Appendix 2B

State of Victoria (Australia) versus State of Georgia (United States)
Comparison Charts for K-12 Mathematics and Science Performance Standards

For

HIGH SCHOOL APPROPRIATE ENGINEERING CONTENT KNOWLEDGE IN THE INFUSION OF ENGINEERING DESIGN INTO K-12 CURRICULUM

(Under the General Topic of "Engineering Design in Secondary Education" and of "Vision and Recommendations for Engineering-Oriented Professional Development")

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NOTES ON THE CREATION OF THE COMPARISON CHARTS (TABLES)

This Appendix contains many tables or "comparison charts" that list the academic performance standards for mathematics and science, which have been established by the Department of Education of the State of Georgia in the United States for K-12 students; and by the Victorian Curriculum and Assessment Authority in Australia for K-10 students. The Georgian standards, called *Georgia Performance Standards*," are extracted from the Department of Education of the State of Georgia's website at https://www.georgiastandards.org/Pages/Default.aspx (*Figure 1* and *Figure 2*). The Victorian standards, called "*Victorian Essential Learning Standards*," are extracted from Victorian Curriculum and Assessment Authority's website at http://vels.vcaa.vic.edu.au/links/standards.html#5, from files that have been downloaded from links named Level 1, Level 2, Level 3, Level 4, Level 5, and Level 6, under the sub-heading of "*Victorian Essential Learning Standards by Level*" (*Figure 3*).

Both sets of standards are listed for comparing government mandates for pre-collegiate mathematics and physics education only, and by no means indicate the actual performance of students in these subjects of learning, either in the State of Georgia, the United States, or in the State of Victoria, Australia. Nevertheless, based on the assumption that average students could meet these standards in their respective states of residence, this comparative study could still serve the purpose of understanding (1) the essential aspects of pre-collegiate mathematics and science education in both states; and (2) the extent to which some pre-calculus level engineering analytic and predictive principles and skills from various subjects (such as statics, dynamics, fluid mechanics, thermodynamics, strength of materials, material science, engineering economics or decision-making, and mechanism design), which traditionally have been taught at lower-division of undergraduate engineering programs, could be included in a potentially viable K-12 engineering curriculum based on a solid foundation of analytic and predictive principles and skills, which could help streamline interested K-12 students' transition to college level engineering programs. Hopefully, such a streamlined process of K-12 through college engineering education could help solve the global problem of shortage of engineering graduates, and thus make a meaningful contribution to an ecologically sustainable, socially ethical, and technically innovative economic growth.

This Appendix is divided into two parts: Part One for Mathematics Education (pp. 6-75); and Part Two for Science Education (pp. 76-156). Both Parts cover academic performance standards from kindergarten to high school. The division of both sets of standards into subject matters in general is different one from the other; thus, for the sake of convenience, some headings are added to divide both sets of standards into similar subject matters; and these headings include:

For Part One (Mathematics Education, Tables 1A, 1B, 1C, 2A, (pp. 7-61), in the left column for Georgia Performance Standards: ***Math Skills***, ***Math Problem-solving Methods***, **Data Analysis, Probabilities & Statistics**, **Measurement & Comparison.**

For Part Two (Science Education), Tables 3, 4A, 4B, 4C, 4D, 4L (pp. 77-128; pp. 142-143), for both left and right columns: Physics-Related Science, Chemistry & Materials Related Science, Scientific Approach, Environmental Science: Chemistry & Materials Related Science, Life Science, Application of Science, Motion and Force, Physics, Energy, Electro-magnetic waves, Relativity & Modern Physics: Classified as "Physics," Chemistry, Classified as "Chemistry," Application of Science, Scientific Approach, Environmental Science. Sometimes, items that are listed under one heading in *Victorian Essential Learning Standards* are divided into separate parts and listed in different tables; in this case, a "(Partial List)" notation is added at the end of the original heading that comes with the standards (an example is **Working Mathematically** (Partial List) in Table 2A). Careful attention has been paid to make the headings as rational and meaningful as possible; however, subjectivity would likely exist.

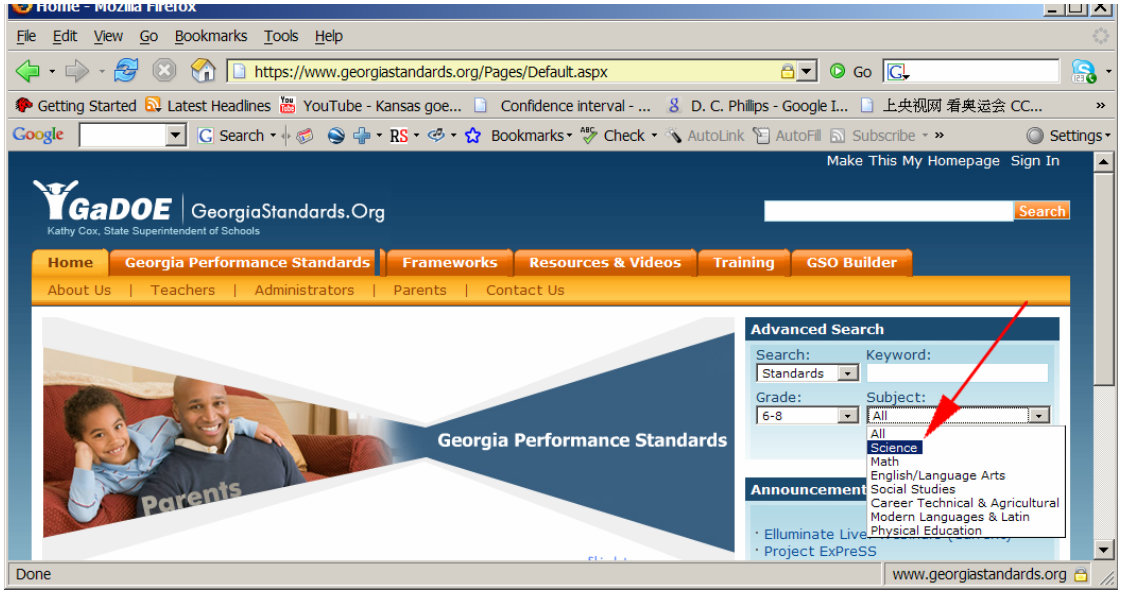

Figure 1. Website of Georgia Performance Standards for Science (Grades K-8) at https://www.georgiastandards.org/Pages/Default.aspx.

Details of comparisons of academic performance standards for pre-collegiate mathematics and science education between Georgia (United States) and Victoria (Australia) are available from Appendix 2 (*Report on the Achievements of K-12 Engineering Education in Australia & its Positive Referential Values for the Evolution of a Potentially Viable K-12 Engineering & Technology Curriculum in the United States*), pages 50-57.

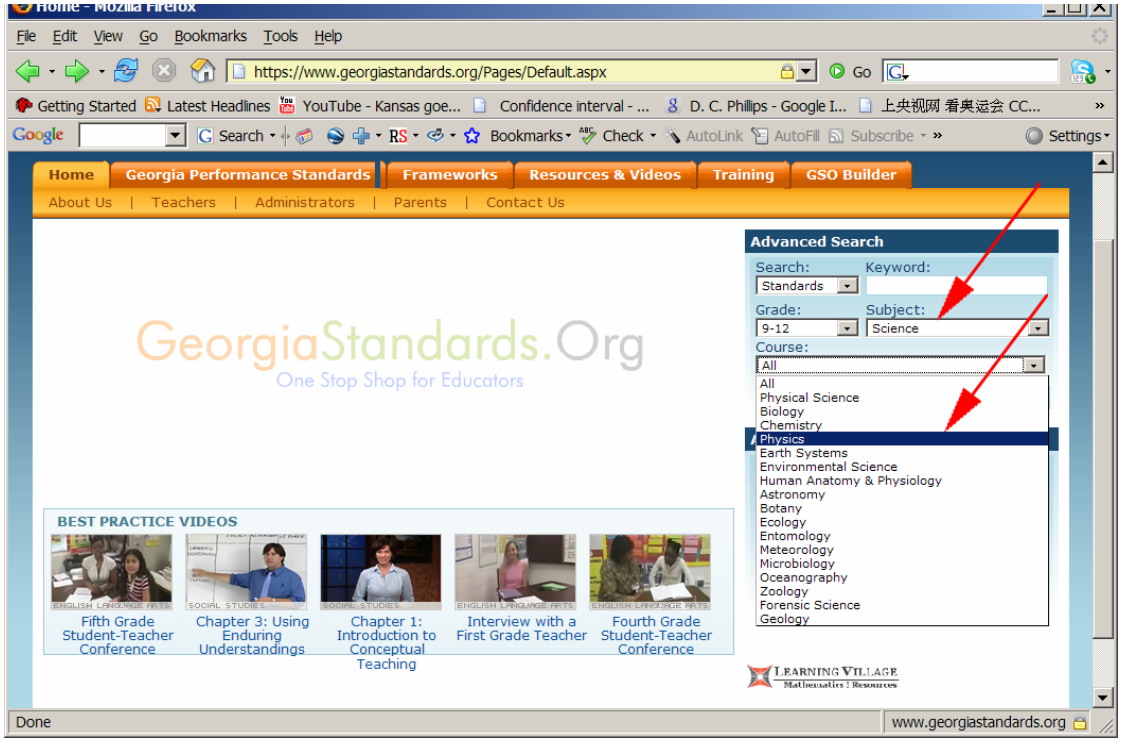

Figure 2. Website of Georgia Performance Standards for Physics and Chemistry (Grades 9-12) at https://www.georgiastandards.org/Pages/Default.aspx.

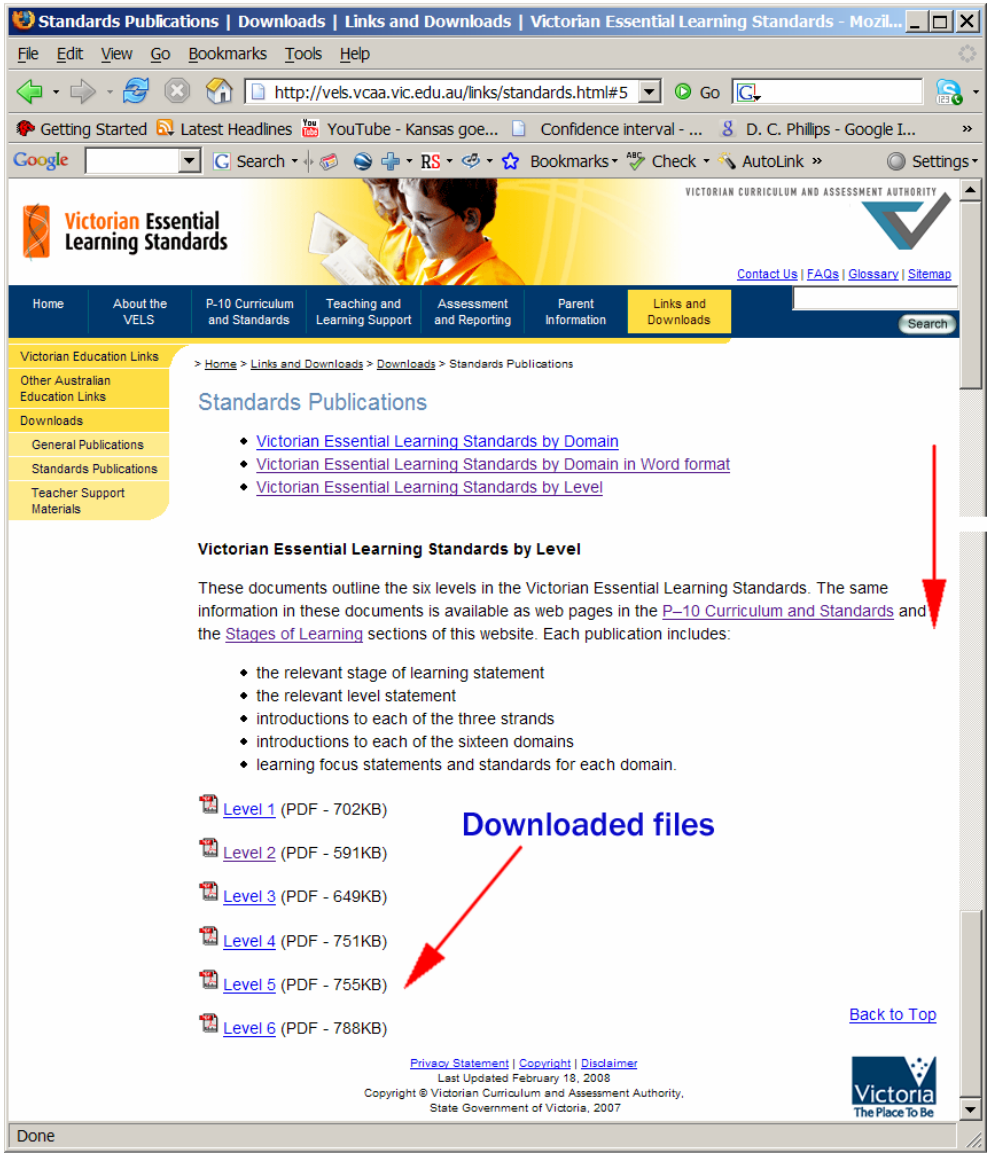

Figure 3. Website of Victorian Essential Learning Standards for Levels 1 through 6 downloadable files at http://vels.vcaa.vic.edu.au/links/standards.html#5

Part One Mathematics Education

Mathematics Subjects for Kindergarten and Middle School

Table 1A
Comparison of Kindergarten to Middle School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subjects: Number, Four Operations and Algebra

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number**
Kindergarten (Grade K)	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (pp. 55-57) → **Years P-K**
Math Skills: **MKN1** Students will connect numerals to the quantities they represent. a. Count a number of objects up to 30. b. Produce models for number words through ten. c. Write numerals through 20 to label sets. d. Sequence and identify using ordinal numbers (1^{st} -10^{th}). e. Compare two or more sets of objects (1-10) and identify which set is equal to, more than, or less than the other. f. Estimate quantities using five and ten as a benchmark. (e.g., 9 is one five and four more. It is closer to two fives or one 10 than it is to one five.). g. Use informal strategies to share objects equally (divide) between two to three people or sets. h. Identify coins by name and value (penny, nickel, dime, and quarter). i. Count out pennies to buy items that together cost less than 30 cents. j. Make fair trades involving combinations of pennies and nickels or pennies and dimes. **MKN2** Students will use representations to model addition and subtraction. a. Use counting strategies to find out how many items are in two sets when they are combined, separated, or compared. b. Build number combinations up to 10 (e.g., 4 and 1, 2 and 3, 3 and 2, 4 and 1 for five) and for doubles to 10 (3 and 3 for six). c. Use objects, pictures, numbers, or words to create, solve, and explain story problems (combining, separating, or comparing) for two numbers that are each less than 10.	***Standards:*** **Number**: o They form small sets of objects from simple descriptions and make simple correspondences between those sets. o They count the size of small sets using the numbers 0 to 20. o They use one-to-one correspondence to identify when two sets are equal in size and when one set is larger than another. o They form collections of sets of equal size. o They use ordinal numbers to describe the position of elements in a set from first to tenth. o They use materials to model addition and subtraction by the aggregation (grouping together) and disaggregation (moving apart) of objects. o They add and subtract by counting forward and backward using the numbers from 0 to 20. **Working Mathematically:** o Students use diagrams and materials to investigate mathematical and real life situations. o They explore patterns in number and space by manipulating objects according to simple rules (for example, turning letters to make patterns like *bqbqbq*, or flipping to make *bdbdbdbd*). o They test simple conjectures such as "nine is four more than five." o They make rough estimates and check their work with respect to computations and constructions in *Number*, *Space*, and *Measurement, chance and data*. They devise and follow ways of recording computations using the digit keys and +, – and = keys on a four function calculator. o They use drawing tools such as simple shape templates and geometry software to draw points, lines, shapes and simple patterns. o They copy a picture of a simple composite shape such as a child's sketch of a house.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number**
Kindergarten (Grade K)	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (pp. 55-57) → **Years P-K**
Math Problem-solving Methods: **MKP1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MKP2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof. **MKP3** Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MKP4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MKP5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena.	***Learning Focus:*** o As students work towards the achievement of Level 1 standards in Mathematics, they manipulate and play with objects to develop links between their immediate environment, everyday language and mathematical activity. **Number:** o Students manipulate and group physical objects and drawings to develop basic understanding of the concepts of number and numerals. o They group objects into sets (collections) and form simple correspondences (relations) between two sets; for example, in sharing pencils among students. o They learn to count the number of objects up to 20 and relate the number counted to the use of a numeral. o They describe and place objects in order such as first, second and third. o They model addition by putting groups of objects together and counting the combined set and they model subtraction by moving apart groups of objects. **Working Mathematically:** o Students undertake activities and play to develop skills in making correspondences (for example, games such as Memory and activities such as matching students with their birth months). o They create and explore number patterns using counters or other objects. o They take risks by making and exploring conjectures relating to numbers, patterns, shapes and measurements (for example, 'the bigger the object the heavier it is' or 'the next shape in a sequence will be …'). o Students work with calculators to check the results of simple addition and subtraction. o They draw and copy simple shapes and patterns by hand and also by using a computer drawing package.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (pp. 58-59) → **Years 1-2**
Math Skills: **M1N1** Students will estimate, model, compare, order, and represent whole numbers up to 100. a. Represent numbers up to 100 using a variety of models, diagrams, and number sentences. Represent numbers larger than 10 in terms of tens and ones using manipulatives and pictures. b. Correctly count and represent the number of objects in a set using numerals. c. Compare small sets using the terms greater than, less than, and equal to (>, <, =). d. Understand the magnitude and order of numbers up to 100 by making ordered sequences and representing them on a number line. e. Exchange equivalent quantities of coins by making fair trades involving combinations of pennies, nickels, dimes, and quarters up to one dollar; count out a combination of coins needed to purchase items up to one dollar. f. Identify bills ($1, $5, $10, $20) by name and value and exchange equivalent quantities by making fair trades involving combinations of bills and count out a combination of bills needed to purchase items that total up to twenty dollars. **M1N2** Understand place value notation for the numbers between 1 and 100. (Discussions may allude to 3-digit numbers to assist in understanding place value.) a. Determine to which ten a given number is nearest using tools such as a sequential number line or chart. b. Represent collections of less than 30 objects with 2-digit numbers and understand the meaning of place value. c. Decompose numbers between 10 and 99 as one ten and the appropriate number of ones.	***Standards:*** **Number:** o Students model the place value of the natural numbers from 0 to 1000. They order numbers and count to 1000 by 1s, 10s and 100s. o Students skip count by 2s, 4s and 5s from 0 to 100 starting from any natural number. o They form patterns and sets of numbers based on simple criteria such as odd and even numbers. o They order money amounts in dollars and cents and carry out simple money calculations. o They describe simple fractions such as one half, one third and one quarter in terms of equal sized parts of a whole object, such as a quarter of a pizza, and subsets such as half of a set of 20 colored pencils. o They add and subtract one- and two-digit numbers by counting on and counting back. o They mentally compute simple addition and subtraction calculations involving one- or two-digit natural numbers, using number facts such as complement to 10, doubles and near doubles. o They describe and calculate simple multiplication as repeated addition, such as 3 × 5 = 5 + 5 + 5; and division as sharing, such as 8 shared between 4. o They use commutative and associative properties of addition and multiplication in mental computation (for example, 3 + 4 = 4 + 3 and 3 + 4 + 5 can be done as 7 + 5 or 3 + 9). **Working Mathematically:** o Students make and test simple conjectures by finding examples, counter-examples and special cases and informally decide whether a conjecture is likely to be true. o They use place value to enter and read displayed numbers on a calculator. o They use a four-function calculator, including use of the constant addition function and × key, to check the accuracy of mental and written estimations and approximations and solutions to simple number sentences and equations.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (pp. 58-59) → **Years 1-2**
M1N3 Students will add and subtract numbers less than 100 as well as understand and use the inverse relationship between addition and subtraction. a. Identify one more than, one less than, 10 more than, and 10 less than a given number. b. Skip-count by 2's, 5's, and 10's forward and backwards – to and from numbers up to 100. c. Compose/decompose numbers up to 10 (e.g. 3+5=8, 8=5+2+1). d. Understand a variety of situations to which subtraction may apply: taking away from a set, comparing two sets, and determining how many more or how many less. e. Understand addition and subtraction number combinations using strategies such as counting on, counting back, doubles, and making tens. f. Know the single-digit addition facts to 18 and corresponding subtraction facts with understanding and fluency. (Use strategies such as relating to facts already known, applying the commutative property, and grouping facts into families.) g. Apply addition and subtraction to 2-digit numbers without regrouping (e.g., 15 + 4, 80-60, 56 + 10, 100-30, 52 + 5). h. Solve and create word problems involving addition and subtraction to 100 without regrouping. Use words, pictures, and concrete models to interpret story problems and reflect the combining of sets as addition and taking away or comparing elements of sets as subtraction. **M1N4** Students will count collections of up to 100 objects by dividing them into equal parts and represent the results using words, pictures, or diagrams. a. Use informal strategies to share objects equally between two to five people. b. Build number patterns, including concepts of even and odd, using various concrete representations. (Examples of concrete representations include a hundreds chart, ten-grid frame, place-value chart, number line, counters, or other objects.) c. Identify, label, and relate fractions (halves, fourths) as equal parts of a whole using pictures and models. d. Understand halves and fourths as representations of equal parts of a whole. ***Math Problem-solving Methods:*** **M1P1:** Same as **MKP1** for Grade K. **M1P2:** Same as **MKP2** for Grade K. **M1P3:** Same as **MKP3** for Grade K. **M1P4:** Same as **MKP4** for Grade K.. **M1P5:** Same as **MKP5** for Grade K.	***Learning Focus:*** **Number**: o Students learn to use base 10 models (units, longs, flats and cubes) and arrays to identify, order and model the counting numbers up to 1000. o They create number patterns mentally, by hand and with the use of the constant addition facility of calculators. o They use models and arrays to support the development of skip counting up to 100. o They recognize patterns created by skip counting (for example, when counting by fours, the pattern of the ones digits is 4, 8, 2, 6, 0, 4, 8). o Students perform simple addition (count on) and subtraction (count back) using numbers up to 100. o They use equal groups of objects and rectangular arrays to model multiplication and equal sharing for division. o Students divide geometric objects including lines, arrays and regular shapes into equal parts to develop the concept of a simple fraction as part of a whole. o They learn to order money amounts in dollars and cents, form different totals using dollars and cents, and carry out simple calculations such as change from small amounts. **Working Mathematically:** o Students learn to use a combination of everyday language and mathematical statements and symbols to describe their manipulation and play with sets of numbers, shapes, objects and patterns. o They model and describe daily activities and familiar events using physical materials, diagrams and maps (for example, use a 1–1 graph to show attendance at class). o Students test the truth of conjectures by attempting to find examples or counter-examples, and exploring special cases. o They develop and consolidate their understanding of the commutative and associative properties for addition and multiplication. o They learn to use a calculator to check estimations, computations and solutions to simple number sentences and equations.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 2	**Level 2** (pp. 58-59) → **Years 1-2**
Math Skills: **M2N2** Students will build fluency with multi-digit addition and subtraction. a. Correctly add and subtract two whole numbers up to three digits each with regrouping. b. Understand and use the inverse relation between addition and subtraction to solve problems and check solutions. c. Use mental math strategies such as benchmark numbers to solve problems. d. Use basic properties of addition (commutative, associative, and identity) to simplify problems (e.g., 98 + 17 by taking two from 17 and adding it to the 98 to make 100 and replacing the original problem by the sum 100 + 15). e. Estimate to determine if solutions are reasonable for addition and subtraction. **M2N3** Students will understand multiplication, multiply numbers, and verify results. a. Understand multiplication as repeated addition. b. Use repeated addition, arrays, and counting by multiples (skip counting) to correctly multiply 1-digit numbers and construct the multiplication table. c. Use the multiplication table (grid) to determine a product of two numbers. d. Use repeated subtraction, equal sharing, and forming equal groups to divide large collections of objects and determine factors for multiplication. **M2N4** Students will understand and compare fractions. a. Model, identify, label, and compare fractions (thirds, sixths, eighths, tenths) as a representation of equal parts of a whole or of a set. b. Know that when all fractional parts are included, such as three thirds, the result is equal to the whole. **M2N1** Students will use multiple representation of numbers to connect symbols to quantities. a. Represent numbers using a variety of models, diagrams, and number sentences (e.g., 4703 represented as 4,000 + 700 + 3, 47 hundreds + 3, or 4,500 + 203). b. Understand the relative magnitudes of numbers using 10 as a unit, 100 as a unit, or 1000 as a unit. Represent 2-digit numbers with drawings of tens and ones and 3-digit numbers with drawings of hundreds, tens, and ones. c. Use money as a medium of exchange. Make change and use decimal notation and the dollar and cent symbols to represent a collection of coins and currency.	↑ **(Previous pages)**

Table 1A (Continued).

Georgia Performance Standards (United States) **For Grades K-8 → Kindergarten to Middle School)**	**Victorian Essential Learning Standards (Australia)** **For Years P-8 → Kindergarten to Middle School)**
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 2	**Level 2** (pp. 58-59) → **Years 1-2**
M2N5 Students will represent and interpret quantities and relationships using mathematical expressions including equality and inequality signs (=, >, a. Include the use of boxes or ___ to represent a missing value. b. Represent problem-solving situations where addition, subtraction, or multiplication may be applied using mathematical expressions. ***Math Problem-solving Methods:*** **M2P1:** Same as **MKP1** for Grade K. **M2P2:** Same as **MKP2** for Grade K. **M2P3:** Same as **MKP3** for Grade K. **M2P4:** Same as **MKP4** for Grade K. **M2P5:** Same as **MKP5** for Grade K.	↑ **(Previous pages)**
↑ Four Operations Basics Completed ↑	
Grade 3	**Level 3** (pp. 60-63) → **Years 3-4**
Math Skills: **M3N2** Students will further develop their skills of addition and subtraction and apply them in problem solving. a. Use the properties of addition and subtraction to compute and verify the results of computation. b. Use mental math and estimation strategies to add and subtract. c. Solve problems requiring addition and subtraction. **M3N3** Students will further develop their understanding of multiplication of whole numbers and develop the ability to apply it in problem solving. a. Describe the relationship between addition and multiplication, i.e., multiplication is defined as repeated addition. b. Know the multiplication facts with understanding and fluency to 10 x 10. c. Use arrays and area models to develop understanding of the distributive property and to determine partial products for multiplication of 2- or 3-digit numbers by a 1-digit number. d. Understand the effect on the product when multiplying by multiples of 10. e. Apply the identity, commutative, and associative properties of multiplication and verify the results. f. Use mental math and estimation strategies to multiply. g. Solve problems requiring multiplication.	***Standards:*** **Number:** o Students use place value (as the idea that "ten of these is one of those") to determine the size and order of whole numbers to tens of thousands, and decimals to hundredths. o They round numbers up and down to the nearest unit, ten, hundred, or thousand. o They develop fraction notation and compare simple common fractions such as 3 > 2 using physical models. o They skip count forwards and backwards, from various starting points using multiples of 2, 3, 4, 5, 10 and 100. o They estimate the results of computations and recognize whether these are likely to be over-estimates or under-estimates. o They compute with numbers up to 30 using all four operations. o They provide automatic recall of multiplication facts up to 10 × 10. o They devise and use written methods for: ➢ whole number problems of addition and subtraction involving numbers up to 999 multiplication by single digits (using recall of multiplication tables) and multiples and powers of ten (for example, 5 × 100, 5 × 70) ➢ division by a single-digit divisor (based on inverse relations in multiplication tables).

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 60-63) → **Years 3-4**
M3N4 Students will understand the meaning of division and develop the ability to apply it in problem solving. a. Understand the relationship between division and multiplication and between division and subtraction. b. Recognize that division may be two situations: the first is determining how many equal parts of a given size or amount may be taken away from the whole as in repeated subtraction, and the second is determining the size of the parts when the whole is separated into a given number of equal parts as in a sharing model. c. Recognize problem-solving situations in which division may be applied and write corresponding mathematical expressions. d. Explain the meaning of a remainder in division in different circumstances. e. Divide a 2 and 3-digit number by a 1-digit divisor. f. Solve problems requiring division. **M3N5** Students will understand the meaning of decimals and common fractions in simple cases and apply them in problem-solving situations. a. Understand a decimal (i.e., 0.1) and a common fraction (i.e., 1/10) represent parts of a whole. b. Understand the fraction *a/b* represents *a* equal sized parts of a whole that is divided into *b* equal sized parts. c. Understand a one place decimal represents tenths, i.e., 0.3 = 3/10. d. Know and use decimals and common fractions to represent the size of parts created by equal divisions of a whole. e. Understand the concept of addition and subtraction of decimals and common fractions with like denominators. f. Model addition and subtraction of decimals and common fractions. g. Solve problems involving fractions.	o They devise and use algorithms for the addition and subtraction of numbers to two decimal places, including situations involving money. They add and subtract simple common fractions with the assistance of physical models. **Structure:** o Students recognize that the sharing of a collection into equal sized parts (division) frequently leaves a remainder. o They investigate sequences of decimal numbers generated using multiplication or division by 10. o They understand the meaning of the "=" in mathematical statements and technology displays (for example, to indicate either the result of a computation or equivalence). o They use number properties in combination to facilitate computations (for example, 7 + 10 + 13 = 10 + 7 + 13 = 10 + 20). o They multiply using the distributive property of multiplication over addition (for example, 13 × 5 = (10 + 3) × 5 = 10 × 5 + 3 × 5). o They list all possible outcomes of a simple chance event. o They use lists, Venn diagrams and grids to show the possible combinations of two attributes. o They recognize samples as subsets of the population under consideration (for example, pets owned by class members as a subset of pets owned by all children). o They construct number sentences with missing numbers and solve them. **Working Mathematically:** o Students apply number skills to everyday contexts such as shopping, with appropriate rounding to the nearest five cents. They recognize the mathematical structure of problems and use appropriate strategies (for example, recognition of sameness, difference and repetition) to find solutions. o Students test the truth of mathematical statements and generalizations. For example, in: ➢ number (which shapes can be easily used to show fractions) ➢ computations (whether products will be odd or even, the patterns of remainders from division) ➢ number patterns (the patterns of ones digits of multiples, terminating or repeating decimals resulting from division) ➢ shape properties (which shapes have symmetry, which solids can be stacked) ➢ transformations (the effects of slides, reflections and turns on a shape) ➢ measurement (the relationship between size and capacity of a container). o Students use calculators to explore number patterns and check the accuracy of estimations. They use a variety of computer software to create diagrams, shapes, tessellations and to organize and present data.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 60-63) → **Years 3-4**
M3A1 Students will use mathematical expressions to represent relationships between quantities and interpret given expressions. a. Describe and extend numeric and geometric patterns. b. Describe and explain a quantitative relationship represented by a formula (such as the perimeter of a geometric figure). c. Use a symbol, such as ϒ and Δ, to represent an unknown and find the value of the unknown in a number sentence. **M3N1** Students will further develop their understanding of whole numbers and ways of representing them. a. Identify place values from tenths through ten thousands. b. Understand the relative sizes of digits in place value notation (10 times, 100 times, 1/10 of a single digit whole number) and ways to represent them. ***Math Problem-solving Methods:*** **M3P1:** Same as **MKP1** for Grade K. **M3P2:** Same as **MKP2** for Grade K. **M3P3:** Same as **MKP3** for Grade K. **M3P4:** Same as **MKP4** for Grade K. **M3P5:** Same as **MKP5** for Grade K.	***Learning Focus:*** o They recognize and explore patterns in numbers and shapes. o They increasingly use mathematical terms and symbols to describe computations, measurements and characteristics of objects. **Number:** o Students use structured materials to explore place value and order of numbers to tens of thousands. o They skip count to create number patterns. o They use materials to develop concepts of decimals to hundredths. o They use suitable fraction material to develop concepts of equivalent fractions and to compare fraction sizes. o They apply number skills to everyday contexts such as shopping. o They extend addition and subtraction computations to three digit numbers. They learn to multiply and divide by single digit numbers. **Structure:** o Students use structured material (in tens, hundreds and thousands) to develop ideas about multiplication by replication and division by sharing. o They recognize the possibility of remainders when dividing. o They learn to use number properties to support computations (for example, they use the commutative and associative properties for adding or multiplying three numbers in any order or combination). o They investigate the distributive property to develop methods of multiplication and division by single digit whole numbers. o They learn to use and describe simple algorithms for computations. o They use simple rules to generate number patterns (for example, 'the next term in the sequence is two more than the previous term'). o They create and complete number sentences using whole numbers, decimals and fractions.
Grade 4	
Math Skills: **M4A1** Students will represent and interpret mathematical relationships in quantitative expressions. a. Understand and apply patterns and rules to describe relationships and solve problems. b. Represent unknowns using symbols, such as □ and Δ. c. Write and evaluate mathematical expressions using symbols and different values. **M4D1** Students will gather, organize, and display data according to the situation and will compare related features. a. Represent data in bar, line, and pictographs. b. Investigate the features and tendencies of graphs. c. Compare different graphical representations for a given set of data. d. Identify missing information and duplications in data.	

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 60-63) → **Years 3-4**
M4N1 Students will further develop their understanding of how whole numbers are represented in the base-ten numeration system. a. Identify place value names and places from hundredths through one million. b. Equate a number's word name, its standard form, and its expanded form. **M4N2** Students will understand and apply the concept of rounding numbers. a. Round numbers to the nearest ten, hundred, or thousand. b. Describe situations in which rounding numbers would be appropriate and determine whether to round to the nearest ten, hundred, or thousand. c. Understand the meaning of rounding a decimal to the nearest whole number. d. Represent the results of computation as a rounded number when appropriate and estimate a sum or difference by rounding numbers. **M4N5** Students will further develop their understanding of the meaning of decimals and use them in computations. a. Understand decimals are a part of the base-ten system. b. Understand the relative size of numbers and order two digit decimals. c. Add and subtract both one and two digit decimals. d. Model multiplication and division of decimals by whole numbers. e. Multiply and divide both one and two digit decimals by whole numbers. **M4N6** Students will further develop their understanding of the meaning of common fractions and use them in computations. a. Understand representations of simple equivalent fractions. b. Add and subtract fractions and mixed numbers with common denominators. (Denominators should not exceed twelve.) c. Convert and use mixed numbers and improper fractions interchangeably. **M4N3** Students will solve problems involving multiplication of 2-3 digit numbers by 1-2 digit numbers.	**Working mathematically:** o Students use mathematical symbols (for example, brackets, division and inequality, the words and, or and not). o Students develop and test ideas (conjectures) across the content of mathematical experience. For example: ➢ in Number, the size and type of numbers resulting from computations ➢ in Space, the effects of transformations of shapes ➢ in Measurement, chance and data, the outcomes of random experiments and inferences from collected samples. o Students learn to recognize practical applications of mathematics in daily life, including shopping, travel and time of day. o They identify the mathematical nature of problems for investigation. o They choose and use learned facts, procedures and strategies to find solutions. o They use a range of tools for mathematical work, including calculators, computer drawing packages and measuring tools.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 60-63) → **Years 3-4**
M4N4 Students will further develop their understanding of division of whole numbers and divide in problem-solving situations without calculators. a. Know the division facts with understanding and fluency. b. Solve problems involving division by a 2-digit number (including those that generate a remainder). c. Understand the relationship between dividend, divisor, quotient, and remainder. d. Understand and explain the effect on the quotient of multiplying or dividing both the divisor and dividend by the same number (2050 ÷ 50 yields the same answer as 205 ÷ 5). **M4N7** Students will explain and use properties of the four arithmetic operations to solve and check problems. Elements: a. Describe situations in which the four operations may be used and the relationships among them. b. Compute using the order of operations, including parentheses. c. Compute using the commutative, associative, and distributive properties. d. Use mental math and estimation strategies to compute. ***Math Problem-solving Methods:*** **M4P1:** Same as **MKP1** for Grade K. **M4P2:** Same as **MKP2** for Grade K. **M4P3:** Same as **MKP3** for Grade K. **M4P4:** Same as **MKP4** for Grade K. **M4P5:** Same as **MKP5** for Grade K.	↑ **(Previous pages)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 79-84) → **Years 5-6**
Math Skills: **M5A1** Students will represent and interpret the relationships between quantities algebraically. a. Use variables, such as *n* or *x*, for unknown quantities in algebraic expressions. b. Investigate simple algebraic expressions by substituting numbers for the unknown. c. Determine that a formula will be reliable regardless of the type of number (whole numbers or decimal fractions) substituted for the variable.	***Standards:*** **Number:** o Students comprehend the size and order of small numbers (to thousandths) and large numbers (to millions). o They model integers (positive and negative whole numbers and zero), common fractions and decimals. o They place integers, decimals and common fractions on a number line. They create sets of number multiples to find the lowest common multiple of the numbers. o They interpret numbers and their factors in terms of the area and Dimension(s)s of rectangular arrays (for example, the factors of 12 can be found by making rectangles of Dimension(s)s 1 × 12, 2 × 6, and 3 x 4). o Students identify square, prime and composite numbers.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 5	**Level 4** (pp. 79-84) → **Years 5-6**
M5N1 Students will further develop their understanding of whole numbers. a. Classify the set of counting numbers into subsets with distinguishing characteristics (odd/even, prime/composite). b. Find multiples and factors. c. Analyze and use divisibility rules. **M5N3** Students will further develop their understanding of the meaning of multiplication and division with decimals and use them. a. Model multiplication and division of decimals by another decimal. b. Explain the process of multiplication and division, including situations in which the multiplier and divisor are both whole numbers and decimals. c. Multiply and divide with decimals including decimals less than one and greater than one. d. Understand that the relationships and rules for multiplication and division of whole numbers also apply to decimals. **M5N4** Students will continue to develop their understanding of the meaning of common fractions and will compute with them. a. Understand division of whole numbers can be represented as a fraction ($a/b = a \div b$). b. Understand the value of a fraction is not changed when both its numerator and denominator are multiplied or divided by the same number because it is the same as multiplying or dividing by one. c. Find equivalent fractions and simplify fractions. d. Model the multiplication and division of common fractions. e. Explore finding common denominators using concrete, pictorial, and computational models. f. Use <, >, or = to compare fractions and justify the comparison. g. Add and subtract common fractions and mixed numbers with unlike denominators. h. Use fractions (proper and improper) and decimals interchangeably. i. Estimate products and quotients. **M5N5** Students will understand the meaning of percentage. a. Model percent on 10 by 10 grids. b. Apply percentage to circle graphs.	o They create factor sets (for example, using factor trees) and identify the highest common factor of two or more numbers. o They recognize and calculate simple powers of whole numbers (for example, 24 = 16). o Students use decimals, ratios and percentages to find equivalent representations of common fractions (for example, ¾ = 9/12 = 0.75 = 75% = 3 : 4 = 6 : 8). o They explain and use mental and written algorithms for the addition, subtraction, multiplication and division of natural numbers (positive whole numbers). o They add, subtract, and multiply fractions and decimals (to two decimal places) and apply these operations in practical contexts, including the use of money. o They use estimates for computations and apply criteria to determine if estimates are reasonable or not. **Structure:** o Students form and specify sets of numbers, shapes and objects according to given criteria and conditions (for example, 6, 12, 18, 24 are the even numbers less than 30 that are also multiples of three). o They use Venn diagrams and karnaugh maps to test the validity of statements using the words none, some or all (for example, test the statement 'all the multiples of 3, less than 30, are even numbers'). o Students construct and use rules for sequences based on the previous term, recursion (for example, the next term is three times the last term plus two), and by formula (for example, a term is three times its position in the sequence plus two). o Students establish equivalence relationships between mathematical expressions using properties such as the distributive property for multiplication over addition (for example, 3 x 26 = 3 x (20 + 6)). o Students identify relationships between variables and describe them with language and words (for example, how hunger varies with time of the day). Students recognize that addition and subtraction, and multiplication and division are inverse operations. They use words and symbols to form simple equations. They solve equations by trial and error. **Working Mathematically:** o Students recognize and investigate the use of mathematics in real (for example, determination of test results as a percentage) and historical situations (for example, the emergence of negative numbers). o Students develop and test conjectures. o They understand that a few successful examples are not sufficient proof and recognize that a single counter-example is sufficient to invalidate a conjecture. For example, in: ➢ number (all numbers can be shown as a rectangular array) ➢ computations (multiplication leads to a larger number) ➢ number patterns (the next number in the sequence 2, 4, 6 … must be 8) ➢ shape properties (all parallelograms are rectangles)

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 5	**Level 4** (pp. 79-84) → **Years 5-6**
M5N2 Students will further develop their understanding of decimals as part of the base-ten number system. a. Understand place value. b. Analyze the effect on the product when a number is multiplied by 10, 100, 1000, 0.1, and 0.01. ***Math Problem-solving Methods:*** **M5P1:** Same as **MKP1** for Grade K. **M5P2:** Same as **MKP2** for Grade K. **M5P3:** Same as **MKP3** for Grade K. **M5P4:** Same as **MKP4** for Grade K. **M5P5:** Same as **MKP1** for Grade K.	➢ chance (a six is harder to roll on die than a one). o Students use the mathematical structure of problems to choose strategies for solutions. They explain their reasoning and procedures and interpret solutions. o They create new problems based on familiar problem structures. o Students engage in investigations involving mathematical modeling. o They use calculators and computers to investigate and implement algorithms (for example, for finding the lowest common multiple of two numbers), explore number facts and puzzles, generate simulations (for example, the gender of children in a family of four children), and transform shapes and solids. ***Learning focus:*** o As students work towards the achievement of Level 4 standards in Mathematics, they describe their investigations with correct mathematical terms, symbols and notations. o They use mathematical procedures to construct and systematically investigate conjectures or hypotheses.
Middle School → For Grades 6-8	
Grade 6	
Math Skills: **M6A1** Students will understand the concept of ratio and use it to represent quantitative relationships. **M6A3** Students will evaluate algebraic expressions, including those with exponents, and solve simple one-step equations using each of the four basic operations. **M6N1** Students will understand the meaning of the four arithmetic operations as related to positive rational numbers and will use these concepts to solve problems. a. Apply factors and multiples. b. Decompose numbers into their prime factorization (Fundamental Theorem of Arithmetic). c. Determine the greatest common factor (GCF) and the least common multiple (LCM) for a set of numbers. d. Add and subtract fractions and mixed numbers with unlike denominators. e. Multiply and divide fractions and mixed numbers. f. Use fractions, decimals, and percents interchangeably. g. Solve problems involving fractions, decimals, and percents. **M6A1** Students will understand the concept of ratio and use it to represent quantitative relationships.	**Number:** o Students extend their understanding of whole numbers, fractions and decimals. o They use patterns and arrays to develop understanding of multiples (including lowest common multiple), factors (including highest common factor), prime and composite numbers. They recognize and use simple powers (for example, $23 = 8$). o Students investigate and use equivalent forms of common fractions. o They order fractions and decimals and locate them on a number line. o They investigate temperature and other contexts to develop the concept of negative numbers. o They explore ideas of ratio (as a comparison) and percentage (comparing to 100). o They use materials to explore decimals, ratios and percentages as equivalent forms of fractions (for example, $\frac{1}{2} = 0.5 = 50\% = 1 : 2$). o Students devise and use mental and written methods (algorithms) to add, subtract, multiply and divide whole numbers. For division they recognize remainders as common fractions or decimals. o They devise and use mental and written methods to add and subtract decimals. o They use materials and number lines to develop understanding of multiplication and division of decimals (to two decimal places) and simple common fractions. o They routinely make estimations and approximations in calculations and make judgments about their accuracy.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 6	**Level 4** (pp. 79-84) → **Years 5-6**
M6A2 Students will consider relationships between varying quantities. a. Analyze and describe patterns arising from mathematical rules, tables, and graphs. b. Use manipulatives or draw pictures to solve problems involving proportional relationships. c. Use proportions (a/b = c/d) to describe relationships and solve problems, including percent problems. d. Describe proportional relationships mathematically using y = kx, where k is the constant of proportionality. e. Graph proportional relationships in the form y = kx and describe characteristics of the graphs. f. In a proportional relationship expressed as y = kx, solve for one quantity given values of the other two. Given quantities may be whole numbers, decimals, or fractions. Solve problems using the relationship y = kx. g. Use proportional reasoning (a/b = c/d and y = kx) to solve problems. ***Math Problem-solving Methods:*** **M6P1:** Same as **MKP1** for Grade K. **M6P2:** Same as **MKP2** for Grade K. **M6P3:** Same as **MKP3** for Grade K. **M6P4:** Same as **MKP4** for Grade K. **M6P5:** Same as **MKP5** for Grade K. **M6RC1** Students will enhance reading in all curriculum areas by: a. Reading in All Curriculum Areas o Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. o Read both informational and fictional texts in a variety of genres and modes of discourse. o Read technical texts related to various subject areas. b. Discussing books o Discuss messages and themes from books in all subject areas. o Respond to a variety of texts in multiple modes of discourse. o Relate messages and themes from one subject area to messages and themes in another area. o Evaluate the merit of texts in every subject discipline. o Examine author's purpose in writing. o Recognize the features of disciplinary texts. c. Building vocabulary knowledge o Demonstrate an understanding of contextual vocabulary in various subjects.	**Structure:** o Students use Venn diagrams and tables (karnaugh maps) to test the validity of statements involving the quantifiers none, some and all. o They develop algorithms involving words, diagrams and mathematical symbols (for example, for testing the divisibility of a number). o Students create number sequences by computing the next term from the previous term or terms (recursion). o They develop function rules for the terms in sequences based on their position in the sequence. o Students recognize that the 'identity' for each operation has no effect: the number 0 for addition and subtraction, and 1 for multiplication and division. o They form and solve equations using words and symbols. **Working Mathematically:** o Students make and test conjectures and generalizations about numbers, shapes and mathematical structure using concrete materials and diagrams. For example: ➢ in Number, the factors of primes and composites ➢ in Space, the properties of shapes ➢ in Measurement, chance and data, the probability of outcomes in games of chance ➢ in Structure, the patterns of remainders formed by division. o Students identify and investigate real life, practical and historical applications of mathematics. o They pose and solve mathematical problems using a range of strategies (for example, make a list, find a pattern, work backwards). o They solve new problems based on familiar problem structures. o Students develop and use estimation procedures to check the results of computations made using technology. o They use technology for complex and extended computations. They use appropriate technology to explore puzzles involving numbers (for example, solve a magic square using a spreadsheet) and to generate drawings of shapes, solids, nets and geometric designs.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 6	**Level 4** (pp. 79-84) → **Years 5-6**
o Use content vocabulary in writing and speaking. o Explore understanding of new words found in subject area texts. d. Establishing context o Explore life experiences related to subject area content. o Discuss in both writing and speaking how certain words are subject area related. o Determine strategies for finding content and contextual meaning for unknown words.	↑ **(Previous pages)**
	Secondary School (Years 7-10)
Grade 7	**Level 5** (pp. 82-92) → **Years 7-8**
Math Skills: **M7A1** Students will represent and evaluate quantities using algebraic expressions. a. Translate verbal phrases to algebraic expressions. b. Simplify and evaluate algebraic expressions, using commutative, associative, and distributive properties as appropriate. c. Add and subtract linear expressions. **M7A2** Students will understand and apply linear equations in one variable. a. Given a problem, define a variable, write an equation, solve the equation, and interpret the solution. b. Use the addition and multiplication properties of equality to solve one- and two-step linear equations. **M7N1** Students will understand the meaning of positive and negative rational numbers and use them in computation. a. Find the absolute value of a number and understand it as the distance from zero on a number line. b. Compare and order rational numbers, including repeating decimals. c. Add, subtract, multiply, and divide positive and negative rational numbers. d. Solve problems using rational numbers. ***Math Problem-solving:*** **M7P1:** Same as **MKP1** for Grade K. **M7P2:** Same as **MKP2** for Grade K. **M7P3:** Same as **MKP3** for Grade K. **M7P4:** Same as **MKP4** for Grade K. **M7P5:** Same as **MKP5** for Grade K. **M7RC1** Same as **M6RC1** for Grade 6.	***Standards:*** **Number:** o At Level 5, students identify complete factor sets for natural numbers and express these natural numbers as products of powers of primes (for example, 36 000 = 2^5 x 3^2 x 5^3). o They write equivalent fractions for a fraction given in simplest form (for example, 2/3 = 4/6 = …) o They know the decimal equivalents for the unit fractions ½, 1/3, ¼, 1/5, 1/8, 1/9 and find equivalent representations of fractions as decimals, ratios and percentages (for example, a subset: set ratio of 4:9 can be expressed equivalently as 4/9 = 0.4444 … ≈ 44.44%). o They write the reciprocal of any fraction and calculate the decimal equivalent to a given degree of accuracy. o Students use knowledge of perfect squares when calculating and estimating squares and square roots of numbers (for example, 20^2 = 400 and 30^2 = 900 so $\sqrt{700}$ is between 20 and 30). o They evaluate natural numbers and simple fractions given in base-exponent form (for example, 5^4 = 625 and $(2/3)^2$ = 4/9). They know simple powers of 2, 3, and 5 (for example, 2^6 = 64, 3^4 = 81, 5^3 = 125). o They calculate squares and square roots of rational numbers that are perfect squares (for example, $\sqrt{.81} = .9$ and $\sqrt{9/16} = 3/4$). o They calculate cubes and cube roots of perfect cubes (for example, $\sqrt[3]{64} = 4$). o Using technology they find square and cube roots of rational numbers to a specified degree of accuracy (for example, $3\sqrt{200} = 5.848$ to three decimal places). o Students express natural numbers base 10 in binary form, (for example, $42_{10} = 1010102$), and add and multiply natural numbers in binary form (for example, $101_2 + 11_2 = 1000_2$ and $101_2 \times 11_2 = 1111_2$).
↑ **Four Operations Completed** ↑	

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years Prep to 4 - Laying the Foundations
Grade 8	**Level 5** (pp. 82-92) → **Years 7-8**
Math Skills: **M8A1** Students will use algebra to represent, analyze, and solve problems. a. Represent a given situation using algebraic expressions or equations in one variable. b. Simplify and evaluate algebraic expressions. c. Solve algebraic equations in one variable, including equations involving absolute values. d. Solve equations involving several variables for one variable in terms of the others. e. Interpret solutions in problem contexts. **M8A5** Students will understand systems of linear equations and inequalities and use them to solve problems. a. Given a problem context, write an appropriate system of linear equations or inequalities. b. Solve systems of equations graphically and algebraically, using technology as appropriate. c. Graph the solution set of a system of linear inequalities in two variables. d. Interpret solutions in problem contexts. **M8D1** Students will apply basic concepts of set theory. a. Demonstrate relationships among sets through use of Venn diagrams. b. Determine subsets, complements, intersection, and union of sets. c. Use set notation to denote elements of a set. **M8D2** Students will determine the number of outcomes related to a given event. a. Use tree diagrams to find the number of outcomes. b. Apply the addition and multiplication principles of counting.	***Standards:*** **Number:** o Students understand ratio as both set: set comparison (for example, number of boys : number of girls) and subset: set comparison (for example, number of girls : number of students), and find integer proportions of these, including percentages (for example, the ratio number of girls: the number of boys is 2 : 3 = 4 : 6 = 40% : 60%). o Students use a range of strategies for approximating the results of computations, such as front-end estimation and rounding (for example, 925 ÷ 34 ≈ 900 ÷ 30 = 30). o Students use efficient mental and/or written methods for arithmetic computation involving rational numbers, including division of integers by two-digit divisors. o They use approximations to π in related measurement calculations (for example, $\pi \times 5^2 = 25\ \pi =$ 78.54 correct to two decimal places). o They use technology for arithmetic computations involving several operations on rational numbers of any size.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years Prep to 4 - Laying the Foundations
Grade 8	**Level 5** (pp. 82-92) → **Years 7-8**
M8N1 Students will understand different representations of numbers including square roots, exponents, and scientific notation. a. Find square roots of perfect squares. b. Recognize the (positive) square root of a number as a length of a side of a square with a given area. c. Recognize square roots as points and as lengths on a number line. d. Understand that the square root of 0 is 0 and that every positive number has two square roots that are opposite in sign. e. Recognize and use the radical symbol to denote the positive square root of a positive number. f. Estimate square roots of positive numbers. g. Simplify, add, subtract, multiply, and divide expressions containing square roots. h. Distinguish between rational and irrational numbers. i. Simplify expressions containing integer exponents. j. Express and use numbers in scientific notation. k. Use appropriate technologies to solve problems involving square roots, exponents, and scientific notation. ***Math Problem-solving Methods:*** **M8P1:** Same as **MKP1** for Grade K. **M8P2:** Same as **MKP2** for Grade K. **M8P3:** Same as **MKP3** for Grade K. **M8P4:** Same as **MKP4** for Grade K. **M8P5:** Same as **MKP5** for Grade K. **M8RC1:** Same as **M6RC1** for Grade 6.	**Structure:** o Students identify collections of numbers as subsets of natural numbers, integers, rational numbers and real numbers. o They use Venn diagrams and tree diagrams to show the relationships of intersection, union, inclusion (subset) and complement between the sets. o They list the elements of the set of all subsets (power set) of a given finite set and comprehend the partial-order relationship between these subsets with respect to inclusion (for example, given the set $\{a, b, c\}$ the corresponding power set is $\{Ø, \{a\}, \{b\}, \{c\},$ o $\{a, b\}, \{b, c\}, \{a, c\}, \{a, b, c\}\}$). o They test the validity of statements formed by the use of the connectives *and*, *or*, *not*, and the quantifiers *none*, *some* and *all*, (for example, "*some* natural numbers can be expressed as the sum of two squares"). o They apply these to the specification of sets defined in terms of one or two attributes, and to searches in data-bases. o Students apply the commutative, associative, and distributive properties in mental and written computation (for example, 24 x 60 can be calculated as 20 x 60 + 4 x 60 or as 12 x 12 x 10). o They use exponent laws for multiplication and division of power terms (for example $2^3 \times 2^5 = 2^8$, $2^0 = 1$, $2^3 \div 2^5 = 2^{-2}$, $(5^2)^3 = 5^6$ and $(3 \times 4)^2 = 3^2 \times 4^2$). o Students generalize from perfect square and difference of two square number patterns (for example, $252 = (20 + 5)^2 = 400 + 2 \times (100) + 25 = 625$. And $35 \times 25 = (30 + 5)(30 – 5) = 900 – 25 = 875$) o Students recognize and apply simple geometric transformations of the plane such as translation, reflection, rotation and dilation and combinations of the above, including their inverses. o They identify the identity element and inverse of rational numbers for the operations of addition and multiplication (for example, ½ + (-1/2) = 0 and 2/2 = 1). o Students use inverses to rearrange simple mensuration formulas, and to find equivalent algebraic expressions (for example, if $P = 2L + 2W$, then $W = P/2 – L$. If $A = \pi r^2$ then $r = \sqrt{A}/\pi$ for $r > 0$). o They solve simple equations (for example, $5x + 7 = 23$, $1.4x – 1.6 = 8.3$, and $4x^2 – 3 = 13$) using tables, graphs and inverse operations. o They recognize and use inequality symbols. They solve simple inequalities such as $y \leq 2x + 4$ and decide whether inequalities such as $x2 > 2y$ are satisfied or not for specific values of x and y. o Students identify a function as a one-to-one correspondence or a many-to one correspondence between two sets. o They represent a function by a table of values, a graph, and by a rule. They describe and specify the independent variable of a function and its domain, and the dependent variable and its range.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years Prep to 4 - Laying the Foundations
Grade 8	**Level 5** (pp. 82-92) → **Years 7-8**
	o They construct tables of values and graphs for linear functions. o They use linear and other functions such as $f(x) = 2x - 4$, $xy = 24$, $y = 2x$ and y = x2 s– 3 to model various situations. **Working Mathematically:** o Students formulate conjectures and follow simple mathematical deductions (for example, if the side length of a cube is doubled, then the surface area increases by a factor of four, and the volume increases by a factor of eight). o Students use variables in general mathematical statements. o They substitute numbers for variables (for example, in equations, inequalities, identities and formulas). o Students explain geometric propositions (for example, by varying the location of key points and/or lines in a construction). o Students develop simple mathematical models for real situations (for example, using constant rates of change for linear models). o They develop generalizations by abstracting the features from situations and expressing these in words and symbols. o They predict using interpolation (working with what is already known) and extrapolation (working beyond what is already known). o They analyze the reasonableness of points of view, procedures and results, according to given criteria, and identify limitations and/or constraints in context. o Students use technology such as graphic calculators, spreadsheets, dynamic geometry software and computer algebra systems for a range of mathematical purposes including numerical computation, graphing, investigation of patterns and relations for algebraic expressions, and the production of geometric drawings. ***Learning Focus*** o As students work towards the achievement of Level 5 standards in Mathematics, they construct mathematical models to explore and describe the physical world. o They recognize the importance of mathematics in a technological society. **Number:** o Students investigate and explore whole numbers and fractions as squares, square roots and other simple powers.

Table 1A (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Number, Four Operations & Algebra**	Dimension(s): **Number + Structure**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years Prep to 4 - Laying the Foundations
Grade 8	**Level 5** (pp. 82-92) → **Years 7-8**
	o They express natural numbers as products of prime number factors. o Students use number lines and materials to compare quantities using ratios, and to form equal ratios using proportion. o They use ratios of number pairs to understand constant rate of change. o They use number lines, graphs, numerical or algebraic means to solve proportion problems and percentage problems as proportion relative to 100. o Students use patterns with division to develop understanding of infinite decimals, and recognize the existence and applications of non-repeating infinite decimals (for example,). Students use mental, written or calculator methods for computations, including multiple operations using rounding and estimation to provide suitable answers for practical situations. They use materials and patterns to understand binary numbers and to add and subtract using this notation. **Structure:** o Students use diagrams to show the relationships between natural, integer, rational and irrational numbers. o They give examples of the use of number properties (commutative, associative and distributive) and use counter-examples to show where they do not apply. o They test logical equivalence of sentences using the quantifiers none, some and all and set operations of complement, intersection and union, by means of diagrams. o Students use the opposite of any integer for addition, and the inverse of any rational number for multiplication (reciprocal) to rearrange formulas and simple algebraic expressions and to solve equations. o They use linear and other simple functions of a single variable, to explore number patterns and provide models for practical situations. o They represent functions by tables of values, ordered pairs, graphs and rules applied over a given domain. o They solve equations and inequalities with a sequence of inverse operations. **Working Mathematically:** o Students determine different but equivalent ways to describe a set, using attributes linked by and, or, not, and by ideas of implication and equivalence. o They generalize from multiple examples and informally justify those generalizations. o They use linear and other simple mathematical models to explore practical situations. o They make and test predictions from these models (including interpolation and extrapolation). o They use technologies such as geometry software, graphics calculators and spreadsheets.
↑ **Basic Algebra Completed** ↑	

Table 1B
Comparison of Kindergarten to Middle School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Geometry

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space**
Kindergarten	**Primary school (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (pp. 56) → **Years P-K**
MKG1 Students will correctly name simple two and three Dimension(s)al figures, and recognize them in the environment. a. Recognize and name the following basic two-Dimension(s)al figures: triangles, quadrilaterals (rectangles, squares), and circles. b. Recognize and name the following three-Dimension(s)al figures: spheres and cubes. c. Observe concrete objects in the environment and represent the objects using basic shapes. d. Combine basic shapes to form other basic and complex figures into basic figures; decompose basic and complex figures into basic shapes. e. Compare geometric shapes and identify similarities and differences of the following two and three-Dimension(s)al shapes: triangles, rectangles, squares, circles, spheres, and cubes. **MKG2** Students will understand basic spatial relationships. a. Identify when an object is beside another object, above another object, or below another object. b. Identify when an object is in front of another object, behind another object, inside another object, or outside it. **MKG3** Students will identify, create, extend, and transfer patterns from one representation to another using actions, objects, and geometric shapes. a. Identify a missing shape within a given pattern. b. Extend a given pattern, and recognize similarities in different patterns. c. Create a pattern in a different context wtih attributes similar to a given pattern.	***Standards:*** o They recognize, copy and draw points, lines and simple freehand curves. o They identify basic two-Dimension(s)al shapes such as triangles, circles and squares and three-Dimension(s)al solids and objects such as boxes and balls. o They recognize the interior and exterior of shapes and objects. o They sort geometric objects according to simple descriptions. o They place and orientate shapes according to simple descriptions such as *next to*, *beside*, *in front of*, *behind*, *over* and *under*. o They develop and follow simple instructions to move and place shapes and objects in familiar situations in relation to what they can see, and to move themselves from one place to another. ***Learning Focus:*** o Students manipulate and investigate the properties of basic two and three-Dimension(s)al shapes. o They use everyday objects and drawings to identify and describe points, lines, edges and surfaces. o They recognize inside and outside. o They participate in activities in which they create and follow simple verbal instructions to locate items in the classroom and immediate environment.

Table 1B (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space Dimension(s)**
Elementary School	**Primary school (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (pp. 58-59) → **Years 1-2**
M1G1 Students will study and create various two and three-Dimension(s)al figures and identify basic figures (squares, circles, triangles, and rectangles) within them. a. Build, draw, name, and describe triangles, rectangles, pentagons, and hexagons. b. Build, represent, name, and describe cylinders, cones, and rectangular prisms. c. Create pictures and designs using shapes, including overlapping shapes. **M1G2** Students will compare, contrast, and/or classify geometric shapes by the common attributes of position, shape, size, number of sides, and number of corners. **M1G3** Students will arrange and describe objects in space by proximity, position, and direction (near, far, below, above, up, down, behind, in front of, next to, and left or right of).	***Standards:*** o Students recognize lines, surfaces and planes, corners and boundaries; familiar two-Dimension(s)al shapes including rectangles, rhombuses and hexagons, and three-Dimension(s)al shapes and objects including pyramids, cones, and cylinders. o They arrange a collection of geometric shapes, such as a set of attribute blocks, into subsets according to simple criteria, and recognize when one set of shapes is a subset of another set of shapes. o They recognize and describe symmetry, asymmetry, and congruence in these shapes and objects. o They accurately draw simple two-Dimension(s)al shapes by hand and construct, copy and combine these shapes using drawing tools and geometry software. o They apply simple transformations to shapes (*flips*, turns, slides and enlargements) and depict both the original and transformed shape together. o They specify location as a relative position, including left and right, and interpret simple networks, diagrams and maps involving a small number of points, objects or locations.
Grade 2	
M2G1 Students will describe and classify plane figures (triangles, squares, rectangles, trapezoids, quadrilaterals, pentagons, hexagons, and irregular polygonal shapes) according to the number of sides and vertices and the sizes of angles (right angle, obtuse, acute). **M2G2** Students will describe and classify solid geometric figures (prisms, pyramids, cylinders, cones, and spheres) according to such things as the number of edges and vertices and the number and shape of faces and angles. a. Recognize the (plane) shapes of the faces of a geometric solid and count the number of faces of each type. b. Recognize the shape of an angle as a right angle, an obtuse angle, or an acute angle. **M2G3** Students will describe the change in attributes as two and three-Dimension(s)al shapes are cut and rearranged.	***Learning Focus:*** o Students participate in activities which focus on identification of key features of shapes and solids. They learn to name familiar two- and three-Dimension(s)al shapes. o They draw simple two-Dimension(s)al shapes, and visualize and describe the effect of transformations (for example, slides, flips and turns). o They use mirrors and folding to investigate symmetry of shapes. o Students learn to construct and follow directions, informal maps, diagrams and routes to locations in the local environment.

Table 1B (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space Dimension(s)**
Elementary School	**Primary school (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 60-61) → **Years 3-4**
M3G1 Students will further develop their understanding of geometric figures by drawing them. They will also state and explain their properties. a. Draw and classify previously learned fundamental geometric figures as well as scalene, isosceles, and equilateral triangles. b. Identify and explain the properties of fundamental geometric figures. c. Examine and compare angles of fundamental geometric figures. d. Identify the center, diameter, and radius of a circle. **M3M3** Students will understand and measure the perimeter of simple geometric figures (squares and rectangles). a. Understand the meaning of the linear unit in measuring perimeter. b. Understand the concept of perimeter as being the boundary of a simple geometric figure. c. Determine the perimeter of a simple geometric figure by measuring and summing the lengths of the sides. **M3M4** Students will understand and measure the area of simple geometric figures (squares and rectangles). a. Understand the meaning of the square unit in measuring area. b. Model (by tiling) the area of a simple geometric figure using square units (square inch, square foot, etc.). c. Determine the area of squares and rectangles by counting, adding, and multiplying with models.	***Standards:*** o Students recognize and describe the directions of lines as vertical, horizontal or diagonal. They recognize angles are the result of rotation of lines with a common end-point. o They recognize and describe polygons. o They recognize and name common three Dimension(s)al shapes such as spheres, prisms and pyramids. They identify edges, vertices and faces. o They use two-Dimension(s)al nets, cross-sections and simple projections to represent simple three-Dimension(s)al shapes. o They follow instructions to produce simple tessellations (for example, with triangles, rectangles, hexagons) and puzzles such as tangrams. o They locate and identify places on maps and diagrams. They give travel directions and describe positions using simple compass directions (for example, N for North) and grid references on a street directory. ***Learning Focus:*** o Students sort lines, shapes and solids according to key features. o They use nets to create three-Dimension(s)al shapes and explore them by counting edges, faces and vertices. o They visualize and draw simple solids as they appear from different positions. o They investigate simple transformations (reflections, slides and turns) to create tessellations and designs. o They explore the concept of angle as turn (for example, using clock hands) and as parts of shapes and objects (for example, at the vertices of polygons). o They use grid references (for example, A5 on a street directory) to specify location and compass bearings to describe directions. o They use local and larger-scale maps to locate places and describe suitable routes between them.
Grade 4	
M4G1 Students will define and identify the characteristics of geometric figures through examination and construction. a. Examine and compare angles in order to classify and identify triangles by their angles. b. Describe parallel and perpendicular lines in plane geometric figures. c. Examine and classify quadrilaterals (including parallelograms, squares, rectangles, trapezoids, and rhombi). d. Compare and contrast the relationships among quadrilaterals.	

Table 1B (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space Dimension(s)**
Elementary School	**Primary school (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 60-61) → **Years 3-4**
M4G2 Students will understand fundamental solid figures. a. Compare and contrast a cube and a rectangular prism in terms of the number and shape of their faces, edges, and vertices. b. Describe parallel and perpendicular lines and planes in connection with rectangular prisms. c. Construct/collect models for solid geometric figures (cubes, prisms, cylinders, etc.) **M4G3** Students will use the coordinate system. a. Understand and apply ordered pairs in the first quadrant of the coordinate system. b. Locate a point in the first quadrant in the coordinate plane and name the ordered pair. c. Graph ordered pairs in the first quadrant.	↑ **(Previous pages)**
↑ **Coordinate System Completed** ↑	
Grade 5	**Years 5 to 8 - Building Breadth and Depth**
	Level 4 (pp. 79-81) → **Years 5-6**
M5G1 Students will understand congruence of geometric figures and the correspondence of their vertices, sides, and angles. **M5G2** Students will understand the relationship of the circumference of a circle, its diameter, and pi ($\pi \approx 3.14$). **M5M1** Students will extend their understanding of area of fundamental geometric plane figures. a. Estimate the area of fundamental geometric plane figures. b. Derive the formula for the area of a parallelogram (e.g., cut the parallelogram apart and rearrange it into a rectangle of the same area). c. Derive the formula for the area of a triangle (e.g. demonstrate and explain its relationship to the area of a rectangle with the same base and height). d. Find the areas of triangles and parallelograms using formulae. e. Estimate the area of a circle through partitioning and tiling and then find the area of a circle with formula (let pi = 3.14). (Discuss square units as they apply to circles.) f. Find the area of a polygon (regular and irregular) by dividing it into squares, rectangles, and/or triangles and finding the sum of the areas of those shapes.	***Standards:*** o Students classify and sort shapes and solids (for example, prisms, pyramids, cylinders and cones) using the properties of lines (orientation and size), angles (less than, equal to, or greater than 90°), and surfaces. o They create two-Dimension(s)al representations of three Dimension(s)al shapes and objects found in the surrounding environment. o They develop and follow instructions to draw shapes and nets of solids using simple scale. o They describe the features of shapes and solids that remain the same (for example, angles) or change (for example, surface area) when a shape is enlarged or reduced. o They apply a range of transformations to shapes and create tessellations using tools (for example, computer software). o Students use the ideas of size, scale, and direction to describe relative location and objects in maps. o They use compass directions, coordinates, scale and distance, and conventional symbols to describe routes between places shown on maps. o Students use network diagrams to show relationships and connectedness such as a family tree and the shortest path between towns on a map.

Table 1B (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space Dimension(s)**
Elementary School	**Primary school (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 79-81) → **Years 5-6**
M5M4 Students will understand and compute the volume of a simple geometric solid. a. Understand a cubic unit (u^3) is represented by a cube in which each edge has the length of 1 unit. b. Identify the units used in computing volume as cubic centimeters (cm^3), cubic meters (m^3), cubic inches (in^3), cubic feet (ft^3), and cubic yards (yd^3). c. Derive the formula for finding the volume of a cube and a rectangular prism using manipulatives. d. Compute the volume of a cube and a rectangular prism using formulae. e. Estimate the volume of a simple geometric solid. f. Understand the similarities and differences between volume and capacity.	***Learning Focus:*** o Students identify and sort shapes by properties such as parallel and perpendicular lines (for example, quadrilaterals). o They use the ideas of angle, size and scale to describe the features of shapes and solids. They identify symmetry by reflection or rotation. o They create and compare pairs of enlarged shapes using simple scale factors. o They describe the features that change (for example, side lengths) and features that remain the same (for example, angles). o They represent solids (for example, prisms, pyramids, cylinders and cones) as two-Dimension(s)al drawings and nets. o They visualize and describe relative location and routes between places shown on a map. They create and interpret simple networks such as a road network to show connectedness between towns.
Middle School → For Grades 6-8	
Grade 6	
M6G1 Students will further develop their understanding of plane figures. a. Determine and use lines of symmetry. b. Investigate rotational symmetry, including degree of rotation. c. Use the concepts of ratio, proportion, and scale factor to demonstrate the relationships between similar plane figures. d. Interpret and sketch simple scale drawings. e. Solve problems involving scale drawings. **M6G2** Students will further develop their understanding of solid figures. a. Compare and contrast right prisms and pyramids. b. Compare and contrast cylinders and cones. c. Interpret and sketch front, back, top, bottom, and side views of solid figures. d. Construct nets for prisms, cylinders, pyramids, and cones. **M6M3** Students will determine the volume of fundamental solid figures (right rectangular prisms, cylinders, pyramids, and cones). a. Determine the formula for finding the volume of fundamental solid figures. b. Compute the volumes of fundamental solid figures, using appropriate units of measure. c. Estimate the volumes of simple geometric solids. d. Solve application problems involving the volume of fundamental solid figures.	

Table 1B (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space Dimension(s)**
Middle School → For Grades 6-8	**Primary school (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 79-81) → **Years 5-6**
M6M4 Students will determine the surface area of solid figures (right rectangular prisms and cylinders). a. Find the surface area of right rectangular prisms and cylinders using manipulatives and constructing nets. b. Compute the surface area of right rectangular prisms and cylinders using formulae. c. Estimate the surface areas of simple geometric solids. d. Solve application problems involving surface area of right rectangular prisms and cylinders.	↑ **(Previous pages)**
	Secondary School (Years 7-10)
Grade 7	**Level 5** (pp. 82-92) → **Years 7-8**
M7G1 Students will construct plane figures that meet given conditions. a. Perform basic constructions using both compass and straight edge, and appropriate technology. Constructions should include copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. b. Recognize that many constructions are based on the creation of congruent triangles. **M7G2** Students will demonstrate understanding of transformations. a. Demonstrate understanding of translations, dilations, rotations, reflections, and relate symmetry to appropriate transformations. b. Given a figure in the coordinate plane, determine the coordinates resulting from a translation, dilation, rotation, or reflection. **M7G3** Students will use the properties of similarity and apply these concepts to geometric figures. a. Understand the meaning of similarity, visually compare geometric figures for similarity, and describe similarities by listing corresponding parts. b. Understand the relationships among scale factors, length ratios, and area ratios between similar figures. Use scale factors, length ratios, and area ratios to determine side lengths and areas of similar geometric figures. c. Understand congruence of geometric figures as a special case of similarity: The figures have the same size and shape.	***Standards:*** o Students construct two-Dimension(s)al and simple three-Dimension(s)al shapes according to specifications of length, angle and adjacency. o They use the properties of parallel lines and transversals of these lines to calculate angles that are supplementary, corresponding, allied (co-interior) and alternate. o They describe and apply the angle properties of regular and irregular polygons, in particular, triangles and quadrilaterals. o They use two-Dimension(s)al nets to construct a simple three-Dimension(s)al object such as a prism or a platonic solid. o They recognize congruence of shapes and solids. o They relate similarity to enlargement from a common fixed point. o They use single-point perspective to make a two-Dimension(s)al representation of a simple three-Dimension(s)al object. o They make tessellations from simple shapes. ***Learning Focus:*** o Students construct shapes and regular polygons to given specifications. o They explore the properties of angles formed by intersecting straight lines. o They use ideas of congruency and similarity to create and describe designs and tessellations. o They use nets and isometric diagrams for common three-Dimension(s)al shapes to construct corresponding geometric objects. o They use perspective to draw three-Dimension(s)al objects on paper.

Table 1B (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **Geometry**	Dimension(s): **Space Dimension(s)**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 82-92) → **Years 7-8**
M7G4 Students will further develop their understanding of three-Dimension(s)al figures. a. Describe three-Dimension(s)al figures formed by translations and rotations of plane figures through space. b. Sketch, model, and describe cross-sections of cones, cylinders, pyramids, and prisms.	o Students interpret and use a range of familiar and common maps of locations from small to large scale, using plans and grids. o They explore the patterns formed by following procedures involving simple transformations or movements around grids. o They use networks to represent relationships in everyday life (for example, a tree diagram for a family tree and a network to show the route used to travel to school).
Grade 8	
M8G1 Students will understand and apply the properties of parallel and perpendicular lines and understand the meaning of congruence. a. Investigate characteristics of parallel and perpendicular lines both algebraically and geometrically. b. Apply properties of angle pairs formed by parallel lines cut by a transversal. c. Understand the properties of the ratio of segments of parallel lines cut by one or more transversals. d. Understand the meaning of congruence: that all corresponding angles are congruent and all corresponding sides are congruent. **M8G2** Students will understand and use the Pythagorean theorem. a. Apply properties of right triangles, including the Pythagorean theorem. b. Recognize and interpret the Pythagorean theorem as a statement about areas of squares on the sides of a right triangle.	**Space:** o Students construct two-Dimension(s)al and simple three-Dimension(s)al shapes according to specifications of length, angle and adjacency. o They use the properties of parallel lines and transversals of these lines to calculate angles that are supplementary, corresponding, allied (co-interior) and alternate. o They describe and apply the angle properties of regular and irregular polygons, in particular, triangles and quadrilaterals. o They use two-Dimension(s)al nets to construct a simple three-Dimension(s)al object such as a prism or a platonic solid. o They recognize congruence of shapes and solids. o They relate similarity to enlargement from a common fixed point. o They use single-point perspective to make a two-Dimension(s)al representation of a simple three-Dimension(s)al object. o They make tessellations from simple shapes. o Students use coordinates to identify position in the plane. o They use lines, grids, contours, isobars, scales and bearings to specify location and direction on plans and maps. o They use network diagrams to specify relationships. They consider the connectedness of a network, such as the ability to travel through a set of roads between towns.
↑ **Basic 2D & 3D Geometric Figure, Areas and Volumes Completed** ↑	

Table 1C
Comparison of Kindergarten to Middle School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Measurement & Comparison, and Data Analysis, Probabilities & Statistics

Georgia Performance Standards (United States) **For Grades K-8 → Kindergarten to Middle School**	**Victorian Essential Learning Standards (Australia)** **For Years P-8 → Kindergarten to Middle School**
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Kindergarten	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (pp. 57) → **Years P-K**
Measurement & Comparison: **MKM1** Students will group objects according to common properties such as longer/shorter, more/less, taller/shorter, and heavier/lighter. a. Compare and order objects on the basis of length. b. Compare and order objects on the basis of capacity. c. Compare and order objects on the basis of height. d. Compare and order objects on the basis of weight. **MKM2** Students will understand the measurement of calendar time. a. Know the names of the days of the week, as well as understand yesterday, today, and tomorrow. b. Know the months of the year. c. Know the four seasons. **MKM3** Students will tell time as it relates to a daily schedule. a. Order daily events. b. Tell the time when daily events occur, such as morning, afternoon, and night. c. Know the name of the day of the week when weekly events occur in class. **Data Analysis, Probabilities & Statistics:** **MKD1** Students will pose questions, collect data, organize, and record results using objects, pictures, and picture graphs.	***Standards:*** o Students compare length, area, capacity and mass of familiar objects using descriptive terms such as *longer*, *taller*, *larger*, *holds more*, and *heavier*. o They make measurements using informal units such as paces for length, handprints for area, glasses for capacity, and bricks for weight. o They recognize the continuity of time and the natural cycles such as day/night and the seasons. They correctly sequence days of the week. They use informal units such as heartbeats and hand claps at regular intervals to measure and describe the passage of time. o They recognize and respond to unpredictability and variability in events, such as getting or not getting a certain number on the roll of a die in a game or the outcome of a coin toss. They collect and display data related to their own activities using simple pictographs. ***Learning Focus:*** o Students learn to compare common objects using terms such as longer, heavier, fuller and hotter. o They begin to make estimates and simple measurements using informal units such as a number of paper clips in a length. o In playing games of chance, students begin to recognize the unpredictability and uncertainty of events such as the roll of a die. o They investigate situations requiring data collection and presentation in simple displays such as a pictogram of family pets.

Table 1C (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (pp. 58-60) → **Years 1-2**
Measurement & Comparison: **M1M1** Students will compare and/or order the length, weight, or capacity of two or more objects by using direct comparison or a nonstandard unit. a. Directly compare nad/or order length, weight, and capacity of concrete objects b. Estimate and measure using a non-standard unit that is smaller than the object to be measured. c. Measure with a tool by creating a "ruled" stick, tape, or container by marking off ten segments of the repeated single unit. **M1M2** Students will develop an understanding of the measurement of time. a. Tell time to the nearest hour and half hour and understand the movement of the minute hand and how it relates to the hour hand. b. Begin to understand the relationship of calendar time by knowing the number of days in a week and months in a year. c. Compare and/or order the sequence or duration of events (e.g., shorter/longer and before/after). **Data Analysis, Probabilities & Statistics:** **M1D1** Students will create simple tables and graphs, and interpret them. a. Interpret tally marks, picture graphs, and bar graphs. b. Pose questions, collect, sort, organize and record data using objects, pictures, tally marks, picture graphs, and bar graphs.	***Standards:*** o Students make, describe and compare measurements of length, area, volume, mass and time using informal units. o They recognize the differences between non-uniform measures, such as hand-spans, to measure length, and uniform measures, such as icy-pole sticks. o They judge relative capacity of familiar objects and containers by eye and make informal comparisons of weight by hefting. o They describe temperature using qualitative terms (for example, cold, warm, hot). o Students use formal units such as hour and minute for time, liter for capacity and the standard units of meters, kilograms and seconds. o Students recognize the key elements of the calendar and place in sequence days, weeks and months. o They describe common and familiar time patterns and such as the time, duration and day of regular sport training and tell the time at hours and half-hours using an analogue clock, and to hours and minutes using a digital clock. o Students predict the outcome of chance events, such as the rolling of a die, using qualitative terms such as certain, likely, unlikely and impossible. o They collect simple categorical and numerical data (count of frequency) and present this data using pictographs and simple bar graphs. ***Learning Focus:*** o Students learn to use both non-uniform (for example, hand-spans) and uniform (for example, pencil length) informal measurement units. o They recognize time units (second, minute, hour, day, week, and month) and investigate basic time patterns and cycles. o They learn to tell the time using analogue and digital clocks. o Students pose and respond to questions leading to data collection. They use pictographs and bar graphs to organize and present data. o They play games of chance to recognize and quantitatively describe the variability of outcomes. o They use terms such as *unlikely* and *almost certain*, *more likely* and *less likely* to describe everyday chance events.
Grade 2	
Measurement & Comparison: **M2M1** Students will know the standard units of inch, foot, yard, and metric units of centimeter and meter and measure length to the nearest inch or centimeter. a. Compare the relationship of one unit to another by measuring objects twice using different units each time. b. Estimate lengths, and then measure to determine if estimations were reasonable. c. Determine an appropriate tool and unit for measuring.	

Table 1C (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 2	**Level 2** (pp. 58-60) → **Years 1-2**
M2M2 Students will tell time to the nearest five minutes and know relationships of time such as the number of seconds in a minute, minutes in an hour and hours in a day. **M2M3** Students will explore temperature. a. Determine a reasonable temperature for a given situation. b. Read a thermometer. **Data Analysis, Probabilities & Statistics:** **M2D1** Students will create simple tables and graphs and interpret their meaning. a. Create, organize and display data using pictographs, Venn diagrams, bar graphs, picture graphs, simple charts, and tables to record results with scales of 1, 2, and 5. b. Know how to interpret picture graphs, Venn diagrams, and bar graphs.	↑ **(Previous pages)**
↑ **Standard Units (Length, Time & Temperature) Completed** ↑	
Grade 3	**Level 3** (pp. 60-63) → **Years 3-4**
Measurement & Comparison: **M3M1** Students will further develop their understanding of the concept of time by determining elapsed time of a full, half, and quarter-hour. **M3M2** Students will measure length choosing appropriate units and tools. a. Use the units kilometer (km) and mile (mi.) to discuss the measure of long distances. b. Measure to the nearest 1/4 inch, 1/2 inch, and millimeter (mm) in addition to the previously learned inch, foot, yard, centimeter, and meter. c. Estimate length and represent it using appropriate units. d. Compare one unit to another within a single system of measurement.	***Standards:*** o Students estimate and measure length, area, volume, capacity, mass and time using appropriate instruments. o They recognize and use different units of measurement including informal (for example, paces), formal (for example, centimeters) and standard metric measures (for example, meter) in appropriate contexts. o They read linear scales (for example, tape measures) and circular scales (for example, bathroom scales) in measurement contexts. o They read digital time displays and analogue clock times at five-minute intervals. o They interpret timetables and calendars in relation to familiar events. o They compare the likelihood of everyday events (for example, the chances of rain and snow). o They describe the fairness of events in qualitative terms. They plan and conduct chance experiments (for example, using colors on a spinner) and display the results of these experiments.

Table 1C (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 60-63) → **Years 3-4**
Data Analysis, Probabilities & Statistics: **M3D1** Students will create and interpret simple tables and graphs. a. Solve problems by organizing and displaying data in bar graphs and tables. b. Construct and interpret bar graphs using scale increments of 1, 2, 5, and 10. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof.	o They recognize different types of data: non-numerical (categories), separate numbers (discrete), or points on an unbroken number line (continuous).They use a column or bar graph to display the results of an experiment (for example, the frequencies of possible categories). ***Learning Focus:*** o Students measure the attributes of everyday objects and events using formal (for example, meters and centimeters) and informal units (for example, pencil lengths). o Students tell the time using analogue and digital clocks and relate familiar activities to the calendar. o Students investigate natural variability in chance events and order them from least likely to most likely. Students conduct experiments and collect data to construct simple frequency graphs. o They use simple two-way tables (karnaugh maps) to sort non-numerical data.
Grade 4	
Measurement & Comparison: **M4M1** Students will understand the concept of weight and how to measure weight. a. Use standard and metric units to measure the weight of objects. b. Know units used to measure weight (gram, kilogram, ounce, pound, and ton). c. Compare one unit to another within a single system of measurement. **M4M2** Grade: 4 Students will understand the concept of angle and how to measure angles. a. Use tools, such as a protractor or angle ruler, and other methods, such as paper folding or drawing a diagonal in a square, to measure angles. b. Understand the meaning and measure of a half rotation (180°) and a full rotation (360°).	
Grade 5	**Years 5 to 8 - Building Breadth and Depth**
	Level 4 (pp. 79-84) → **Years 5-6**
Measurement & Comparison: **M5M3** Students will measure capacity with appropriately chosen units and tools. a. Use milliliters, liters, fluid ounces, cups, pints, quarts, and gallons to measure capacity. b. Compare one unit to another within a single system of measurement (e.g., 1 quart = 2 pints).	***Standards:*** o Students use metric units to estimate and measure length, perimeter, area, surface area, mass, volume, capacity, time and temperature. o They measure angles in degrees. They measure as accurately as needed for the purpose of the activity. They convert between metric units of length, capacity and time (for example, L–mL, sec–min). o Students describe and calculate probabilities using words, and fractions and decimals between 0 and 1. o They calculate probabilities for chance outcomes (for example, using spinners) and use the symmetry properties of equally likely outcomes.

Table 1C (Continued).

Georgia Performance Standards (United States) **For Grades K-8 → Kindergarten to Middle School**	**Victorian Essential Learning Standards (Australia)** **For Years P-8 → Kindergarten to Middle School**
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Elementary School	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 79-84) → **Years 5-6**
Data Analysis, Probabilities & Statistics: **M5D1** Students will analyze graphs. a. Analyze data presented in a graph. b. Compare and contrast multiple graphic representations (circle graphs, line graphs, bar graphs, etc.) for a single set of data and discuss the advantages/disadvantages of each. **M5D2** Students will collect, organize, and display data using the most appropriate graph.	o They simulate chance events (for example, the chance that a family has three girls in a row) and understand that experimental estimates of probabilities converge to the theoretical probability in the long run. o Students recognize and give consideration to different data types in forming questionnaires and sampling. o They distinguish between categorical and numerical data and classify numerical data as discrete (from counting) or continuous (from measurement). o They present data in appropriate displays (for example, a pie chart for eye color data and a histogram for grouped data of student heights). o They calculate and interpret measures of centrality (mean, median, mode) and data spread (range). ***Learning Focus:*** o Students estimate and measure lengths (including perimeter), area (including surface area), volumes, capacity, time (including duration), and temperature in metric units using appropriate instruments and scales. o They determine and use the level of accuracy required for the purpose of the measurement. o They develop simple procedures to determine the perimeter and area of simple shapes (for example, counting squares in a grid to determine area). o Students estimate and describe the chance of random events using words, percentages and fractions or decimals between 0 and 1. o They investigate the sample space (possible outcomes) for simple chance events and calculate theoretical probability. o They explain how symmetry in chance situations (for example, the roll of a die) creates equally likely outcomes. o They create simulations of chance events to estimate probability (for example, randomly selecting a card from a pack without kings to choose a month). o Students plan and conduct questionnaires to collect data for a specific purpose. o They recognize different data types such as categorical and numerical, discrete and continuous. o They organize and present grouped and ungrouped data using displays such as simple frequency tables and histograms. o They calculate and interpret measures of centre (mean, median and mode) and spread (range) for ungrouped data.

Table 1C (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 79-84) → **Years 5-6**
Measurement & Comparison: **M6M1** Students will convert from one unit to another within one system of measurement (customary or metric) by using proportional relationships. **M6M2** Students will use appropriate units of measure for finding length, perimeter, area, and volume and will express each quantity using the appropriate unit. a. Measure length to the nearest half, fourth, eighth, and sixteenth of an inch. b. Select and use units of appropriate size and type to measure length, perimeter, area, and volume. c. Compare and contrast units of measure for perimeter, area, and volume. **Data Analysis, Probabilities & Statistics:** **M6D1** Students will pose questions, collect data, represent and analyze the data, and interpret results. a. Formulate questions that can be answered by data. Students should collect data by using samples from a larger population (surveys), or by conducting experiments. b. Using data, construct frequency distributions, frequency tables, and graphs. c. Choose appropriate graphs to be consistent with the nature of the data (categorical or numerical). Graphs should include pictographs, histograms, bar graphs, line graphs, circle graphs, and line plots. d. Use tables and graphs to examine variation that occurs within a group and variation that occurs between groups. e. Relate the data analysis to the context of the questions posed. **M6D2** Students will use experimental and simple theoretical probability and will understand the nature of sampling. They will also make predictions from investigations. a. Predict the probability of a given event through trials/simulations (experimental probability), and represent the probability as a ratio. b. Determine, and use a ratio to represent, the theoretical probability of a given event. c. Discover that experimental probability approaches theoretical probability when the number of trials is large.	↑ **(Previous pages)**

Table 1C (Continued).

Georgia Performance Standards (United States) **For Grades K-8 → Kindergarten to Middle School**	**Victorian Essential Learning Standards (Australia)** **For Years P-8 → Kindergarten to Middle School**
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 79-84) → **Years 5-6**
M6D1 Students will pose questions, collect data, represent and analyze the data, and interpret results. a. Formulate questions that can be answered by data. Students should collect data by using samples from a larger population (surveys), or by conducting experiments. b. Using data, construct frequency distributions, frequency tables, and graphs. c. Choose appropriate graphs to be consistent with the nature of the data (categorical or numerical). Graphs should include pictographs, histograms, bar graphs, line graphs, circle graphs, and line plots. d. Use tables and graphs to examine variation that occurs within a group and variation that occurs between groups. e. Relate the data analysis to the context of the questions posed. **M6D2** Students will use experimental and simple theoretical probability and will understand the nature of sampling. They will also make predictions from investigations. a. Predict the probability of a given event through trials/simulations (experimental probability), and represent the probability as a ratio. b. Determine, and use a ratio to represent, the theoretical probability of a given event. c. Discover that experimental probability approaches theoretical probability when the number of trials is large.	↑ **(Previous pages)**
↑ **Unit Conversion Completed** ↑	**Secondary School (Years 7-10)**
Grade 7	**Level 5** (pp. 82-92) → **Years 7-8**
Data Analysis, Probabilities & Statistics: **M7A3** Students will understand relationships between two variables. a. Plot points on a coordinate plane. b. Represent, describe, and analyze relations from tables, graphs, and formulas. c. Describe how change in one variable affects the other variable. d. Describe patterns in the graphs of proportional relationships, both direct (y = kx) and inverse (y = k/x).	***Standards:*** o Students measure length, perimeter, area, surface area, mass, volume, capacity, angle, time and temperature using suitable units for these measurements in context. o They interpret and use measurement formulas for the area and perimeter of circles, triangles and parallelograms and simple composite shapes. o They calculate the surface area and volume of prisms and cylinders. o Students estimate the accuracy of measurements and give suitable lower and upper bounds for measurement values. o They calculate absolute percentage error of estimated values. o Students use appropriate technology to generate random numbers in the conduct of simple simulations. o Students identify empirical probability as long-run relative frequency.

Table 1C (Continued).

Georgia Performance Standards (United States) **For Grades K-8 → Kindergarten to Middle School**	**Victorian Essential Learning Standards (Australia)** **For Years P-8 → Kindergarten to Middle School**
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 82-92) → **Years 7-8**
M7D1 Students will pose questions, collect data, represent and analyze the data, and interpret results. a. Formulate questions and collect data from a census of at least 30 objects and from samples of varying sizes. b. Construct frequency distributions. c. Analyze data using measures of central tendency (mean, median, and mode), including recognition of outliers. d. Analyze data with respect to measures of variation (range, quartiles, interquartile range). e. Compare measures of central tendency and variation from samples to those from a census. Observe that sample statistics are more likely to approximate the population parameters as sample size increases. f. Analyze data using appropriate graphs, including pictographs, histograms, bar graphs, line graphs, circle graphs, and line plots introduced earlier, and using box-and-whisker plots and scatter plots. g. Analyze and draw conclusions about data, including a description of the relationship between two variables.	o They calculate theoretical probabilities by dividing the number of possible successful outcomes by the total number of possible outcomes. o They use tree diagrams to investigate the probability of outcomes in simple multiple event trials. o Students organize, tabulate and display discrete and continuous data (grouped and ungrouped) using technology for larger data sets. o They represent univariate data in appropriate graphical forms including dot plots, stem and leaf plots, column graphs, bar charts and histograms. o They calculate summary statistics for measures of centre (mean, median, mode) and spread (range, and mean absolute difference), and make simple inferences based on this data. ***Learning Focus:*** o Students use metric units to estimate and measure length, perimeter, area, surface area, mass, volume, capacity, angle in shapes and solids, time, and temperature. o They convert metric units into smaller or larger units as required. o They judge the accuracy of their estimates by measurement and calculate error. o They use mensuration formulas (for example, for area and perimeter of circles, area and perimeter of triangles and parallelograms, and the surface area and volume of prisms and cylinders). o They solve problems involving simple rates (per unit time or area). o Students estimate probability from simulations involving generation of random numbers and data of long-run frequencies. o They calculate theoretical probabilities involving one- and two-event trials. o Students take samples in order to make inferences and predictions about a population. They learn to present data in appropriate graphical formats. o They calculate and interpret summary statistics (mean, median, mode and range).
Grade 8	
Data Analysis, Probabilities & Statistics: **M8A2** Students will understand and graph inequalities in one variable. a. Represent a given situation using an inequality in one variable. b. Use the properties of inequality to solve inequalities. c. Graph the solution of an inequality on a number line. d. Interpret solutions in problem contexts.	

Table 1C (Continued).

Georgia Performance Standards (United States) **For Grades K-8 → Kindergarten to Middle School**	**Victorian Essential Learning Standards (Australia)** **For Years P-8 → Kindergarten to Middle School**
Subject(s): **Measurement & Comparison + Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
Middle School → For Grades 6-8	**Secondary School (Years 7-10)**
	Years 5 to 8 - Building Breadth and Depth
Grade 8	**Level 5** (pp. 82-92) → **Years 7-8**
M8A3 Students will understand relations and linear functions. a. Recognize a relation as a correspondence between varying quantities. b. Recognize a function as a correspondence between inputs and outputs where the output for each input must be unique. c. Distinguish between relations that are functions and those that are not functions. d. Recognize functions in a variety of representations and a variety of contexts. e. Use tables to describe sequences recursively and with a formula in closed form. f. Understand and recognize arithmetic sequences as linear functions with whole-number input values. h. Interpret the constant difference in an arithmetic sequence as the slope of the associated linear function. i. Identify relations and functions as linear or nonlinear. j. Translate among verbal, tabular, graphic, and algebraic representations of functions. **M8A4** Students will graph and analyze graphs of linear equations and inequalities. Interpret slope as a rate of change. b. Determine the meaning of the slope and y-intercept in a given situation. c. Graph equations of the form y = mx + b. d. Graph equations of the form ax + by = c. e. Graph the solution set of a linear inequality, identifying whether the solution set is an open or a closed half-plane. f. Determine the equation of a line given a graph, numerical information that defines the line, or a context involving a linear relationship. g. Solve problems involving linear relationships. **M8D3** Students will use the basic laws of probability. a. Find the probability of simple independent events. b. Find the probability of compound independent events. **M8D4** Students will organize, interpret, and make inferences from statistical data. a. Gather data that can be modeled with a linear function. b. Estimate and determine a line of best fit from a scatter plot.	↑ **(Previous pages)**

Mathematics Subjects for High School

Table 2A
Comparison of High School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Number, Operations & Functions

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
Math Skills: **MA1N1** Students will represent and operate with complex numbers. a. Write square roots of negative numbers in imaginary form. b. Write complex numbers in the form a + bi. c. Add, subtract, multiply, and divide complex numbers. d. Simplify expressions involving complex numbers. **MA1A1** Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques. a. Represent functions using function notation. b. Graph the basic functions f(x) = x^n, where n = 1 to 3, f(x) = √x, f(x) = |x|, and f(x) = 1/x. c. Graph transformations of basic functions including vertical shifts, stretches, and shrinks, as well as reflections across the x- and y-axes. d. Investigate and explain the characteristics of a function: domain, range, zeros, intercepts, intervals of increase and decrease, maximum and minimum values, and end behavior. e. Relate to a given context the characteristics of a function, and use graphs and tables to investigate its behavior. f. Recognize sequences as functions with domains that are sets of whole numbers. g. Explore rates of change, comparing constant rates of change (i.e., slope) versus variable rates of change. Compare rates of change of linear, quadratic, square root, and other function families. h. Determine graphically and algebraically whether a function has symmetry and whether it is even, odd, or neither.	***Standards*** **Number:** o Students comprehend the set of real numbers containing natural, integer, rational and irrational numbers. o They represent rational numbers in both fractional and decimal (terminating and infinite recurring) forms (for example, $1\frac{4}{25} = 1.16$, $0.\overline{47} = \frac{47}{99}$). o They comprehend that irrational numbers have an infinite non-terminating decimal form. They specify decimal rational approximations for square roots of primes, rational numbers that are not perfect squares, the golden ratio φ, and simple fractions of π correct to a required decimal place accuracy. o Students use the Euclidean division algorithm to find the greatest common divisor (highest common factor) of two natural numbers (for example, the greatest common divisor of 1071 and 1029 is 21 since 1071 = 1029 × 1 + 42, 1029 = 42 × 24 + 21 and 42 = 21 × 2 + 0). o Students carry out arithmetic computations involving natural numbers, integers and finite decimals using mental and/or written algorithms (one- or two-digit divisors in the case of division). o They perform computations involving very large or very small numbers in scientific notation (for example, $0.0045 \times 0.000028 = 4.5 \times 10^{-3} \times 2.8 \times 10^{-5} = 1.26 \times 10^{-7}$). o They carry out exact arithmetic computations involving fractions and irrational numbers such as square roots (for example, $\sqrt{18} = 3\sqrt{2}$, $\sqrt{\frac{3}{2}} = \frac{\sqrt{6}}{2}$) and multiples and fractions of π (example, $\pi + \frac{\pi}{4} = \frac{5\pi}{4}$).

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
i. Understand that any equation in x can be interpreted as the equation f(x) = g(x), and interpret the solutions of the equation as the x-value(s) of the intersection point(s) of the graphs of y = f(x) and y = g(x). j. bach testing... **MA1A2** Students will simplify and operate with radical expressions, polynomials, and rational expressions. a. Simplify algebraic and numeric expressions involving square root. b. Perform operations with square roots. c. Add, subtract, multiply, and divide polynomials. d. Add, subtract, multiply, and divide rational expressions. e. Factor expressions by greatest common factor, grouping, trial and error, and special products limited to the formulas below. $(x + y)^2 = x^2 + 2xy + y^2$ $(x - y)^2 = x^2 - 2xy + y^2$ $(x + y)(x - y) = x^2 - y^2$ $(x + a)(x + b) = x^2 + (a + b)x + ab$ $(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$ $(x - y)^3 = x^3 - 3x^2y + 3xy^2 - y^3$ f. Use area and volume models for polynomial arithmetic. **MA1A3** Students will analyze quadratic functions in the forms $f(x) = ax^2 + bx + c$ and $f(x) = a(x - h)^2 + k$. a. Convert between standard and vertex form. b. Graph quadratic functions as transformations of the function $f(x) = x^2$. c. Investigate and explain characteristics of quadratic functions, including domain, range, vertex, axis of symmetry, zeros, intercepts, extrema, intervals of increase and decrease, and rates of change. d. Explore arithmetic series and various ways of computing their sums. e. Explore sequences of partial sums of arithmetic series as examples of quadratic functions.	o They use appropriate estimates to evaluate the reasonableness of the results of calculations involving rational and irrational numbers, and the decimal approximations for them. They carry out computations to a required accuracy in terms of decimal places and/or significant figures. **Structure:** o Students classify and describe the properties of the real number system and the subsets of rational and irrational numbers. o They identify subsets of these as discrete or continuous, finite or infinite and provide examples of their elements and apply these to functions and relations and the solution of related equations. o Student express relations between sets using membership, $\subseteq$, complement, ‘ , intersection, $\cap$, union, $\cup$, and subset, $\subseteq$, for up to three sets. o They represent a universal set as the disjoint union of intersections of up to three sets and their complements, and illustrate this using a tree diagram, Venn diagram or karnaugh map. o Students form and test mathematical conjectures; for example, ‘What relationship holds between the lengths of the three sides of a triangle?’ o They use irrational numbers such as, π, φ and common surds in calculations in both exact and approximate form. o Students apply the algebraic properties (closure, associative, commutative, identity, inverse and distributive) to computation with number, to rearrange formulas, rearrange and simplify algebraic expressions involving real variables. o They verify the equivalence or otherwise of algebraic expressions (linear, square, cube, exponent, and reciprocal, (for example, o $4x - 8 = 2(2x - 4) = 4(x - 2)$; $(2a - 3)^2 = 4a^2 - 12a + 9$; $(3w)^3 = 27w^3$; o $\frac{x^3y}{xy^2} = x^2y^{-1}$, $\frac{4}{xy} = \frac{2}{x} \times \frac{2}{y}$. o Students identify and represent linear, quadratic and exponential functions by table, rule and graph (all four quadrants of the Cartesian coordinate system) with consideration of independent and dependent variables, domain and range.

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA1A4 Students will solve quadratic equations and inequalities in one variable. a. Solve equations graphically using appropriate technology. b. Find real and complex solutions of equations by factoring, taking square roots, and applying the quadratic formula. c. Analyze the nature of roots using technology and using the discriminant. d. Solve quadratic inequalities both graphically and algebraically, and describe the solutions using linear inequalities. **MA1A5** Students will investigate step and piecewise functions, including greatest integer and absolute value functions. a. Write absolute value functions as piecewise functions. b. Investigate and explain characteristics of a variety of piecewise functions including domain, range, vertex, axis of symmetry, zeros, intercepts, extrema, points of discontinuity, intervals over which the function is constant, intervals of increase and decrease, and rates of change. c. Solve absolute value equations and inequalities analytically, graphically, and by using appropriate technology. **MA1G2** Students will understand and use the language of mathematical argument and justification. a. Use conjecture, inductive reasoning, deductive reasoning, counterexamples, and indirect proof as appropriate. b. Understand and use the relationships among a statement and its converse, inverse, and contrapositive. **MM1A1** Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques. a. Represent functions using function notation. b. Graph the basic functions $f(x) = x(n)$, where n = 1 to 3, f(x) = √x, f(x) = |x|, and f(x) = 1/x. c. Graph transformations of basic functions including vertical shifts, stretches, and shrinks, as well as reflections across the x- and y-axes. d. Investigate and explain the characteristics of a function: domain, range, zeros, intercepts, intervals of increase and decrease, maximum and minimum values, and end behavior.	o They distinguish between these types of functions by testing for constant first difference, constant second difference or constant ratio between consecutive terms (for example, to distinguish between the functions described by the sets of ordered pairs {(1, 2), (2, 4), (3, 6), (4, 8) …}; {(1, 2), (2, 4), (3, 8), (4, 14) …}; and {(1, 2), (2, 4), (3, 8), (4, 16) …}). o They use and interpret the functions in modeling a range of contexts. o They recognize and explain the roles of the relevant constants in the relationships $f(x) = ax + c$, with reference to gradient and y axis intercept, $f(x) = a(x + b)^2 + c$ and $f(x) = ca^x$. o They solve equations of the form $f(x) = k$, where k is a real constant (for example, $x(x + 5) = 100$) and simultaneous linear equations in two variables (for example, $\{2x – 3y = – 4$ and $5x + 6y = 27\}$ using algebraic, numerical (systematic guess, check and refine or bisection) and graphical methods. **Working Mathematically** (Partial List)**:** o Students formulate and test conjectures, generalizations and arguments in natural language and symbolic form (for example, 'if m^2 is even then m is even, and if m^2 is odd then m is odd'). o They follow formal mathematical arguments for the truth of propositions (for example, "the sum of three consecutive natural numbers is divisible by 3"). o They generalize from one situation to another, and investigate it further by changing the initial constraints or other boundary conditions. o They judge the reasonableness of their results based on the context under consideration. **(To be continued in Table 2B).** ***Learning Focus:*** o As students work towards the achievement of Level 6 standards in Mathematics, they extend their use of mathematical models to a wide range of familiar and unfamiliar contexts. They recognize the role of logical argument and proof in establishing mathematical propositions. **Number:** o Students investigate familiar and unfamiliar situations and contexts involving the use of all types of real numbers. o They use irrational numbers such as ø , n, and common surds in calculations in both exact and approximate form. o They apply mental, written or technology-assisted forms of computation as appropriate, using estimation to validate their answers. o They compute using large or small numbers expressed in scientific notation. o They evaluate and use factorials in relevant contexts.

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
e. Relate to a given context the characteristics of a function, and use graphs and tables to investigate its behavior. f. Recognize sequences as functions with domains that are whole numbers. g. Explore rates of change, comparing constant rates of change (i.e., slope) versus variable rates of change. Compare rates of change of linear, quadratic, square root, and other function families. h. Determine graphically and algebraically whether a function has symmetry and whether it is even, odd, or neither. i. Understand that any equation in x can be interpreted as the equation *f(x) = g(x)*, and interpret the solutions of the equation as the x-value(s) of the intersection point(s) of the graphs of *y = f(x) and y = g(x)*. **MM1A2** Students will simplify and operate with radical expressions, polynomials, and rational expressions. a. Simplify algebraic and numeric expressions involving square root. b. Perform operations with square roots. c. Add, subtract, multiply, and divide polynomials. d. Expand binomials using the Binomial Theorem e. Add, subtract, multiply, and divide rational expressions. f. Factor expressions by greatest common factor, grouping, trial and error, and special products limited to the formulas below. (x + y)2 = x2 + 2xy + y2 (x - y)2 = x2 - 2xy + y2 (x + y)(x - y) = x2 - y2 (x + a)(x + b) = x2 + (a + b)x + ab (x + y)3 = x3 + 3 x2y + 3xy2 + y3 (x - y)3 = x3 - 3x2y + 3xy2 - y3 g. Use area and volume models for polynomial arithmetic. **MM1A3** Students will solve simple equations. a. Solve quadratic equations in the form $ax^2 + bx + c = 0$, where a = 1, by using factorization and finding square roots where applicable. b. Solve equations involving radicals such as $\sqrt{x} + b = c$, using algebraic techniques. c. Use a variety of techniques, including technology, tables, and graphs to solve equations resulting from the investigation of $x^2 + bx + c = 0$.	o They apply the concepts of rounding to either a given number of decimal places or significant figures to check the accuracy of computations. **Structure:** o Students learn to categorize natural, integer, rational and irrational numbers in relation to real numbers. o They use the concepts of order, discrete and continuous, and finite and infinite in relation to these sets of numbers. Students apply algebraic properties (for example, closure, associative, commutative, identity, inverse and distributive) to expressions, formulas and equations. o They relate sets with one, two or three attributes, in four ways: ➢ diagrams and grids ➢ the logical connectives *and*, *or*, *not*, *implication* and *equivalence* ➢ the quantifiers none, some and all ➢ the set operations complement, intersection, union and inclusion. o Students work with functions (for example, linear, quadratic, reciprocal, exponential), simple transformations of these functions, their graphs and related algebraic properties. They solve equations of the form *f*(*x*) = *k*, where *k* is a real constant. o They solve simultaneous linear equations using algebraic, numerical and graphical approaches. **Working Mathematically** (Partial List): o Students develop generalizations by abstracting the features from situations, expressing these in words and symbols. o They test propositions, and use formal mathematical arguments to test their truth, modifying them as required. o Students choose, use and develop mathematical models and procedures with attention to assumptions and constraints (for example, they test the suitability of the results of data analysis in terms of the context being modeled). o They solve problems in a wide range of practical, theoretical and historical contexts and communicate the results of these investigations. o They extend their problem solutions by generalizing, or changing the initial constraints of a situation for further investigation. o They describe the major features of mathematical structure, and use of logical argument in mathematical discourse and applications of mathematics. **(To be continued in Table 2B).**

Table 2A (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
d. Solve simple rational equations that result in linear equations or quadratic equations with leading coefficient of 1. **MM2A1** Students will investigate step and piecewise functions, including greatest integer and absolute value functions. a. Write absolute value functions as piecewise functions. b. Investigate and explain characteristics of a variety of piecewise functions including domain, range, vertex, axis of symmetry, zeros, intercepts, extrema, points of discontinuity, intervals over which the function is constant, intervals of increase and decrease, and rates of change. c. Solve absolute value equations and inequalities analytically, graphically, and by using appropriate technology. **MM2A2** Students will explore exponential functions. a. Extend properties of exponents to include all integer exponents. b. Investigate and explain characteristics of exponential functions, including domain and range, asymptotes, zeros, intercepts, intervals of increase and decrease, rates of change, and end behavior. c. Graph functions as transformations of $f(x) = a(x)$. d. Solve simple exponential equations and inequalities analytically, graphically, and by using appropriate technology. e. Understand and use basic exponential functions as models of real phenomena. f. Understand and recognize geometric sequences as exponential functions with domains that are whole numbers. g. Interpret the constant ratio in a geometric sequence as the base of the associated exponential function. **MM2A3** Students will analyze quadratic functions in the forms $f(x) = ax^2 + bx + c$ and $f(x) = a(x – h)^2 + k$. a. Convert between standard and vertex form. b. Graph quadratic functions as transformations of the function $f(x) = x^2$. c. Investigate and explain characteristics of quadratic functions, including domain, range, vertex, axis of symmetry, zeros, intercepts, extrema, intervals of increase and decrease, and rates of change. d. Explore arithmetic series and various ways of computing their sums. e. Explore sequences of partial sums of arithmetic series as examples of quadratic functions.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM2A4 Students will solve quadratic equations and inequalities in one variable. a. Solve equations graphically using appropriate technology. b. Find real and complex solutions of equations by factoring, taking square roots, and applying the quadratic formula. c. Analyze the nature of roots using technology and using the discriminant. d. Solve quadratic inequalities both graphically and algebraically, and describe the solutions using linear inequalities. **MM2A5** Students will explore inverses of functions. a. Discuss the characteristics of functions and their inverses, including one-to-oneness, domain, and range. b. Determine inverses of linear, quadratic, and power functions and functions of the form f(x) = a/x, including the use of restricted domains. c. Explore the graphs of functions and their inverses. d. Use composition to verify that functions are inverses of each other. ***Problem-solving Methods:*** **MA1P1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MA1P2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA1P3 Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MA1P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MA1P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena. **MM1G2** Students will understand and use the language of mathematical argument and justification. a. Use conjecture, inductive reasoning, deductive reasoning, counterexamples, and indirect proof as appropriate. b. Understand and use the relationships among a statement and its converse, inverse, and contrapositive. **MM1P1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM1P2 Students will reason and evaluate mathematical arguments. Elements: a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof. **MM1P3** Students will communicate mathematically. Elements: a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MM1P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MM1P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
Math Skills: **MA2A1** Students will explore exponential functions. a. Extend properties of exponents to include all integer exponents. b. Investigate and explain characteristics of exponential functions, including domain and range, asymptotes, zeros, intercepts, intervals of increase and decrease, rates of change, and end behavior. c. Graph functions as transformations of f(x) = a^x. d. Solve simple exponential equations and inequalities analytically, graphically, and by using appropriate technology. e. Understand and use basic exponential functions as models of real phenomena. f. Understand and recognize geometric sequences as exponential functions with domains that are sets of whole numbers. g. Interpret the constant ratio in a geometric sequence as the base of the associated exponential function. **MA2A2** Students will explore inverses of functions. a. Discuss the characteristics of functions and their inverses, including one-to-oneness, domain, and range. b. Determine inverses of linear, quadratic, and power functions and functions of the form f(x) = a/x, including the use of restricted domains. c. Explore the graphs of functions and their inverses. d. Use composition to verify that functions are inverses of each other. **MA2A3** Students will analyze graphs of polynomial functions of higher degree. a. Graph simple polynomial functions as translations of the function f(x) = ax^n. b. Understand the effects of the following on the graph of a polynomial function: degree, lead coefficient, and multiplicity of real zeros. c. Determine whether a polynomial function has symmetry and whether it is even, odd, or neither. d. Investigate and explain characteristics of polynomial functions, including domain and range, intercepts, zeros, relative and absolute extrema, intervals of increase and decrease, and end behavior.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA2A4 Students will explore logarithmic functions as inverses of exponential functions. a. Define and understand the properties of n^th roots. b. Extend properties of exponents to include rational exponents. c. Define logarithmic functions as inverses of exponential functions. d. Understand and use properties of logarithms by extending laws of exponents. e. Investigate and explain characteristics of exponential and logarithmic functions including domain and range, asymptotes, zeros, intercepts, intervals of increase and decrease, and rate of change. f. Graph functions as transformations of f(x) = a^x, f(x) = logax, f(x) = e^x, f(x) = ln x. g. Explore real phenomena related to exponential and logarithmic functions including half-life and doubling time. **MA2A5** Students will solve a variety of equations and inequalities. a. Find real and complex roots of higher degree polynomial equations using the factor theorem, remainder theorem, rational root theorem, and fundamental theorem of algebra, incorporating complex and radical conjugates. b. Solve polynomial, exponential, and logarithmic equations analytically, graphically, and using appropriate technology. c. Solve polynomial, exponential, and logarithmic inequalities analytically, graphically, and using appropriate technology. Represent solution sets of inequalities using interval notation. d. Solve a variety of types of equations by appropriate means choosing among mental calculation, pencil and paper, or appropriate technology. **MM2N1** Students will represent and operate with complex numbers. a. Write square roots of negative numbers in imaginary form. b. Write complex numbers in the form a + *bi*. c. Add, subtract, multiply, and divide complex numbers. d. Simplify expressions involving complex numbers.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
Math Problem-solving Methods: **MA2P1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MA2P2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof. **MA2P3** Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MA2P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MA2P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM2P1 Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MM2P2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof. **MM2P3** Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MM2P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MM2P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
Math Skills: **MA3A1** Students will explore rational functions. a. Investigate and explain characteristics of rational functions, including domain, range, zeros, points of discontinuity, intervals of increase and decrease, rates of change, local and absolute extrema, symmetry, asymptotes, and end behavior. b. Find inverses of rational functions, discussing domain and range, symmetry, and function composition. c. Solve rational equations and inequalities analytically, graphically, and by using appropriate technology. **MA3A2** Students will use the circle to define the trigonometric functions. a. Define and understand angles measured in degrees and radians, including but not limited to 0°, 30°, 45°, 60°, 90°, their multiples, and equivalences. b. Understand and apply the six trigonometric functions as functions of general angles in standard position. c. Find values of trigonometric functions using points on the terminal sides of angles in the standard position. d. Understand and apply the six trigonometric functions as functions of arc length on the unit circle. e. Find values of trigonometric functions using the unit circle. **MA3A3** Students will investigate and use the graphs of the six trigonometric functions. a. Understand and apply the six basic trigonometric functions as functions of real numbers. b. Determine the characteristics of the graphs of the six basic trigonometric functions. c. Graph transformations of trigonometric functions including changing period, amplitude, phase shift, and vertical shift. d. Apply graphs of trigonometric functions in realistic contexts involving periodic phenomena.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA3A4 Students will investigate functions. a. Compare and contrast properties of functions within and across the following types: linear, quadratic, polynomial, power, rational, exponential, logarithmic, trigonometric, and piecewise. b. Investigate transformations of functions. c. Investigate characteristics of functions built through sum, difference, product, quotient, and composition. **MA3A9** Students will use sequences and series. a. Use and find recursive and explicit formulae for the terms of sequences. b. Recognize and use simple arithmetic and geometric sequences. c. Investigate limits of sequences. d. Use mathematical induction to find and prove formulae for sums of finite series. e. Find and apply the sums of finite and, where appropriate, infinite arithmetic and geometric series. f. Use summation notation to explore series. g. Determine geometric series and their limits. **MA3A11** Students will use complex numbers in trigonometric form. a. Represent complex numbers in trigonometric form. b. Find products, quotients, powers, and roots of complex numbers in trigonometric form. **MA3A12** Students will explore parametric representations of plane curves. Elements: a. Convert between Cartesian and parametric form. b. Graph equations in parametric form showing direction and beginning and ending points where appropriate. **MA3A13** Students will explore polar equations. a. Express coordinates of points in rectangular and polar form. b. Graph and identify characteristics of simple polar equations including lines, circles, cardioids, limaçons, and roses.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA3P1 Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MA3P2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof. **MA3P3** Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MA3P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MA3P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM3A1 Students will analyze graphs of polynomial functions of higher degree. a. Graph simple polynomial functions as translations of the function f(x) = ax^n. b. Understand the effects of the following on the graph of a polynomial function: degree, lead coefficient, and multiplicity of real zeros. c. Determine whether a polynomial function has symmetry and whether it is even, odd, or neither. d. Investigate and explain characteristics of polynomial functions, including domain and range, intercepts, zeros, relative and absolute extrema, intervals of increase and decrease, and end behavior. **MM3A2** Students will explore logarithmic functions as inverses of exponential functions. a. Define and understand the properties of n^th roots. b. Extend properties of exponents to include rational exponents. c. Define logarithmic functions as inverses of exponential functions. d. Understand and use properties of logarithms by extending laws of exponents. e. Investigate and explain characteristics of exponential and logarithmic functions including domain and range, asymptotes, zeros, intercepts, intervals of increase and decrease, and rate of change. f. Graph functions as transformations of f(x) = a^x, f(x) = loga(x), f(x) = e^x, f(x) = ln x. g. Explore real phenomena related to exponential and logarithmic functions including half-life and doubling time. **MM3A3** Students will solve a variety of equations and inequalities. a. Find real and complex roots of higher degree polynomial equations using the factor theorem, remainder theorem, rational root theorem, and fundamental theorem of algebra, incorporating complex and radical conjugates. b. Solve polynomial, exponential, and logarithmic equations analytically, graphically, and using appropriate technology. c. Solve polynomial, exponential, and logarithmic inequalities analytically, graphically, and using appropriate technology. Represent solution sets of inequalities using interval notation. d. Solve a variety of types of equations by appropriate means choosing among mental calculation, pencil and paper, or appropriate technology.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM4A1 Students will explore rational functions. a. Investigate and explain characteristics of rational functions, including domain, range, zeros, points of discontinuity, intervals of increase and decrease, rates of change, local and absolute extrema, symmetry, asymptotes, and end behavior. b. Find inverses of rational functions, discussing domain and range, symmetry, and function composition. c. Solve rational equations and inequalities analytically, graphically, and by using appropriate technology. **MM4A4** Students will investigate functions. a. Compare and contrast properties of functions within and across the following types: linear, quadratic, polynomial, power, rational, exponential, logarithmic, trigonometric, and piecewise. b. Investigate transformations of functions. c. Investigate characteristics of functions built through sum, difference, product, quotient, and composition. ***Math Problem-solving Methods:*** **MA3P1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MA3P2** Students will reason and evaluate mathematical arguments. Elements: a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA3P3 Students will communicate mathematically. Elements: a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MA3P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MA3P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena. **MM3P1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MM3P2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM3P3 Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MM3P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MM3P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena. **MM4P1** Students will solve problems (using appropriate technology). a. Build new mathematical knowledge through problem solving. b. Solve problems that arise in mathematics and in other contexts. c. Apply and adapt a variety of appropriate strategies to solve problems. d. Monitor and reflect on the process of mathematical problem solving. **MM4P2** Students will reason and evaluate mathematical arguments. a. Recognize reasoning and proof as fundamental aspects of mathematics. b. Make and investigate mathematical conjectures. c. Develop and evaluate mathematical arguments and proofs. d. Select and use various types of reasoning and methods of proof.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM4P3 Students will communicate mathematically. a. Organize and consolidate their mathematical thinking through communication. b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. c. Analyze and evaluate the mathematical thinking and strategies of others. d. Use the language of mathematics to express mathematical ideas precisely. **MM4P4** Students will make connections among mathematical ideas and to other disciplines. a. Recognize and use connections among mathematical ideas. b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. c. Recognize and apply mathematics in contexts outside of mathematics. **MM4P5** Students will represent mathematics in multiple ways. a. Create and use representations to organize, record, and communicate mathematical ideas. b. Select, apply, and translate among mathematical representations to solve problems. c. Use representations to model and interpret physical, social, and mathematical phenomena. **MRC** Students will enhance reading in all curriculum areas by: a. Reading in all curriculum areas • Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. • Read both informational and fictional texts in a variety of genres and modes of discourse. • Read technical texts related to various subject areas. b. Discussing books • Discuss messages and themes from books in all subject areas. • Respond to a variety of texts in multiple modes of discourse. • Relate messages and themes from one subject area to messages and themes in another area. • Evaluate the merit of texts in every subject discipline. • Examine author's purpose in writing.	↑ **(Previous pages)**

Table 2A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Number, Operations & Functions**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
• Recognize the features of disciplinary texts. c. Building vocabulary knowledge • Demonstrate an understanding of contextual vocabulary in various subjects. • Use content vocabulary in writing and speaking. • Explore understanding of new words found in subject area texts. d. Establishing context • Explore life experiences related to subject area content. • Discuss in both writing and speaking how certain words are subject area related. Determine strategies for finding content and contextual meaning for unknown words.	

Table 2B
Comparison of High School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Trigonometry & Analytic Geometry

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Trigonometry & Analytic Geometry**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA1G1 Students will investigate properties of geometric figures in the coordinate plane. a. Determine the distance between two points. b. Determine the distance between a point and a line. c. Determine the midpoint of a segment. d. Understand the distance formula as an application of the Pythagorean theorem. e. Use the coordinate plane to investigate properties of and verify conjectures related to triangles and quadrilaterals. **MA1G3** Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons. a. Determine the sum of interior and exterior angles in a polygon. b. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality. c. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL). d. Understand, use, and prove properties of and relationships among special quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite. e. Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid. **MA1G4** Students will understand the properties of circles. a. Understand and use properties of chords, tangents, and secants as an application of triangle similarity. b. Understand and use properties of central, inscribed, and related angles. c. Use the properties of circles to solve problems involving the length of an arc and the area of a sector. d. Justify measurements and relationships in circles using geometric and algebraic properties. **MA1G5** Students will find and compare the measures of spheres. a. Use and apply surface area and volume of a sphere. b. Determine the effect on surface area and volume of changing the radius or diameter of a sphere.	***Standards*** **Space:** o Students represent two- and three-Dimension(s)al shapes using lines, curves, polygons and circles. o They make representations using perspective, isometric drawings, nets and computer-generated images. o They recognize and describe boundaries, surfaces and interiors of common plane and three-Dimension(s)al shapes, including cylinders, spheres, cones, prisms and polyhedra. o They recognize the features of circles (centre, radius, diameter, chord, arc, semi-circle, circumference, segment, sector and tangent) and use associated angle properties. o Students explore the properties of spheres. o Students use the conditions for shapes to be congruent or similar. o They apply isometric and similarity transformations of geometric shapes in the plane. o They identify points that are invariant under a given transformation (for example, the point (2, 0) is invariant under reflection in the x-axis, so the x axis intercept of the graph of $y = 2x - 4$ is also invariant under this transformation). o They determine the effect of changing the scale of one characteristic of two- and three-Dimension(s)al shapes (for example, side length, area, volume and angle measure) on related characteristics. o They use latitude and longitude to locate places on the Earth's surface and measure distances between places using great circles. o Students describe and use the connections between objects/location/events according to defined relationships (networks).

Table 2B (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Trigonometry & Analytic Geometry**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM1G1 Students will investigate properties of geometric figures in the coordinate plane. a. Determine the distance between two points. b. Determine the distance between a point and a line. c. Determine the midpoint of a segment. d. Understand the distance formula as an application of the Pythagorean theorem. e. Use the coordinate plane to investigate properties of and verify conjectures related to triangles and quadrilaterals. **MM1G3** Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons. a. Determine the sum of interior and exterior angles in a polygon. b. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality. c. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL). d. Understand, use, and prove properties of and relationships among special quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite. e. Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.	**Measurement, Chance and Data** (Partial List): o Students estimate and measure length, area, surface area, mass, volume, capacity and angle. o They select and use appropriate units, converting between units as required. o They calculate constant rates such as the density of substances (that is, mass in relation to volume), concentration of fluids, average speed and pollution levels in the atmosphere. Students decide on acceptable or tolerable levels of error in a given situation. o They interpret and use mensuration formulas for calculating the perimeter, surface area and volume of familiar two- and three-Dimension(s)al shapes and simple composites of these shapes. o Students use pythagoras theorem and trigonometric ratios (sine, cosine and tangent) to obtain lengths of sides, angles and the area of right-angled triangles. o They use degrees and radians as units of measurement for angles and convert between units of measurement as appropriate. **(To be continued on Table 2C).** **Working Mathematically** (Partial List)**:** **(Continued from Table 2A).** o Students choose, use and develop mathematical models and procedures to investigate and solve problems set in a wide range of practical, theoretical and historical contexts (for example, exact and approximate measurement formulas for the volumes of various three Dimension(s)al objects such as truncated pyramids). o They select and use technology in various combinations to assist in mathematical inquiry, to manipulate and represent data, to analyze functions and carry out symbolic manipulation. They use geometry software or graphics calculators to create geometric objects and transform them, taking into account invariance under transformation. ***Learning Focus:*** o As students work towards the achievement of Level 6 standards in Mathematics, they extend their use of mathematical models to a wide range of familiar and unfamiliar contexts. They recognize the role of logical argument and proof in establishing mathematical propositions.
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	
MA2G1 Students will identify and use special right triangles. a. Determine the lengths of sides of 30°-60°-90° triangles. b. Determine the lengths of sides of 45°-45°-90° triangles. **MA2G2** Students will define and apply sine, cosine, and tangent ratios to right triangles. a. Discover the relationship of the trigonometric ratios for similar triangles. b. Explain the relationship between the trigonometric ratios of complementary angles. c. Solve application problems using the trigonometric ratios.	

Table 2B (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Trigonometry & Analytic Geometry**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA2G3 Students will investigate the relationships between lines and circles. a. Find equations of circles. b. Graph a circle given an equation in general form. c. Find the equation of a tangent line to a circle at a given point. d. Solve a system of equations involving a circle and a line. e. Solve a system of equations involving two circles. **MA2G4** Students will recognize, analyze, and graph the equations of the conic sections (parabolas, circles, ellipses, and hyperbolas). a. Convert equations of conics by completing the square. b. Graph conic sections, identifying fundamental characteristics. c. Write equations of conic sections given appropriate information. **MA2G5** Students will investigate planes and spheres. a. Plot the point (x, y, z) and understand it as a vertex of a rectangular prism. b. Apply the distance formula in 3-space. c. Recognize and understand equations of planes and spheres. **MM2G1** Students will identify and use special right triangles. a. Determine the lengths of sides of 30°-60°-90° triangles. b. Determine the lengths of sides of 45°-45°-90° triangles. **MM2G2** Students will define and apply sine, cosine, and tangent ratios to right triangles. a. Discover the relationship of the trigonometric ratios for similar triangles. b. Explain the relationship between the trigonometric ratios of complementary angles. c. Solve application problems using the trigonometric ratios.	**Space:** o Students investigate the possible orientation of lines in space. o They investigate the properties of angles formed when lines (including parallel lines) intersect. o They learn how space is enclosed in two and three Dimension(s)s, and systematically investigate the properties of boundaries and regions on surfaces with shapes such as polygons and circles, prisms and polyhedra (including the platonic solids). o They learn to use the concepts of congruency and similarity to compare the size and shape of polygons. They investigate the properties of similar triangles. o Students investigate the relationship between position, length and angle using the pythagorean relationship and trigonometry of right-angled triangles. o They explore simple combinations of rotations, translations and reflections as transformations of geometric shapes in the plane. o They investigate the paths (loci) formed by points, lines and shapes as they move in space according to various rules, conditions and/or constraints involving transformations. o They use symmetry and other properties to create tessellations in two and three Dimension(s)s from regular and composite shapes. o They investigate the effects of changing the scale of one characteristic of a geometric shape (for example, length or angle) on the size of related characteristics (for example, area and volume). o Students use maps and globes to investigate location and distances between places. **Measurement, Chance and Data:** o Students measure and estimate perimeter, area, surface area, mass, volume, capacity, angle, and the rates of speed, density and concentration. o They use and convert units to suit the purpose of the measurements. o They make judgments about errors in measurement. o They use formulas (including trigonometry) to calculate perimeters, areas, angles in shapes, and the surface areas and volumes of solids. o They use degrees and radians, as applicable, for units of measurement of angles. o Students apply probability concepts to aspects of chance and risk in everyday life. **(To be continued on Table 2C).**

Table 2B (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Trigonometry & Analytic Geometry**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM2G3 Students will understand the properties of circles. a. Understand and use properties of chords, tangents, and secants as an application of triangle similarity. b. Understand and use properties of central, inscribed, and related angles. c. Use the properties of circles to solve problems involving the length of an arc and the area of a sector. d. Justify measurements and relationships in circles using geometric and algebraic properties. **MM2G4** Students will find and compare the measures of spheres. a. Use and apply surface area and volume of a sphere. b. Determine the effect on surface area and volume of changing the radius or diameter of a sphere.	**Working Mathematically** (Partial List): **(Continued from Table 2A).** o Students use technology (for example, geometry software, graphics calculators, spreadsheets and computer algebra systems) to develop mathematical ideas and solve problems.
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	
MA3A5 Students will establish the identities below and use them to simplify trigonometric expressions and verify equivalence statements. $\tan\theta = \sin\theta / \cos\theta$ $\cot\theta = \cos\theta / \sin\theta$ $\sec\theta = 1 / \cos\theta$ $\csc\theta = 1 / \sin\theta$ $\sin^2\theta + \cos^2\theta = 1$ $\cot^2\theta + 1 = \csc^2\theta$ $\sin(\propto \pm \beta) = \sin \propto \cos\beta \pm \cos \propto \sin\beta$ $\cos(\propto \pm \beta) = \cos \propto \cos\beta \pm \sin \propto \sin\beta$ $\sin(2\theta) = 2\sin\theta \cos\theta$ $\cos(2\theta) = \cos^2\theta - \sin^2\theta$ **MA3A6** Students will solve trigonometric equations both graphically and algebraically. a. Solve trigonometric equations over a variety of domains, using technology as appropriate. b. Use the coordinates of a point on the terminal side of an angle to express x as $r\cos\theta$ and y as $r\sin\theta$. c. Apply the law of sines and the law of cosines. **MA3A7** Students will verify and apply $\frac{1}{2}ab\sin C$ to find the area of a triangle. **MA3A8** Students will investigate and use inverse sine, inverse cosine, and inverse tangent functions. a. Find values of the above functions using technology as appropriate. b. Determine characteristics of the above functions and their graphs.	

Table 2B (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Trigonometry & Analytic Geometry**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM3G1 Students will investigate the relationships between lines and circles. a. Find equations of circles. b. Graph a circle given an equation in general form. c. Find the equation of a tangent line to a circle at a given point. d. Solve a system of equations involving a circle and a line. e. Solve a system of equations involving two circles. **MM3G2** Students will recognize, analyze, and graph the equations of the conic sections (parabolas, circles, ellipses, and hyperbolas). a. Convert equations of conics by completing the square. b. Graph conic sections, identifying fundamental characteristics. c. Write equations of conic sections given appropriate information. **MM3G3** Students will investigate planes and spheres. a. Plot the point (x, y, z) and understand it as a vertex of a rectangular prism. b. Apply the distance formula in 3-space. c. Recognize and understand equations of planes and spheres. **MM4A2** Students will use the circle to define the trigonometric functions. a. Define and understand angles measured in degrees and radians, including but not limited to 0º, 30º, 45º, 60º, 90º, their multiples, and equivalences. b. Understand and apply the six trigonometric functions as functions of general angles in standard position. c. Find values of trigonometric functions using points on the terminal sides of angles in the standard position. d. Understand and apply the six trigonometric functions as functions of arc length on the unit circle. e. Find values of trigonometric functions using the unit circle.	↑ **(Previous pages)**

Table 2B (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Trigonometry & Analytic Geometry**	Dimension(s): **Number**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM4A3 Students will investigate and use the graphs of the six trigonometric functions. a. Understand and apply the six basic trigonometric functions as functions of real numbers. b. Determine the characteristics of the graphs of the six basic trigonometric functions. c. Graph transformations of trigonometric functions including changing period, amplitude, phase shift, and vertical shift. d. Apply graphs of trigonometric functions in realistic contexts involving periodic phenomena. **MM4A5** Students will establish the identities below and use them to simplify trigonometric expressions and verify equivalence statements. $\tan\theta = \sin\theta / \cos\theta$ $\cot\theta = \cos\theta / \sin\theta$ $\sec\theta = 1 / \cos\theta$ $\csc\theta = 1 / \sin\theta$ $\sin^2\theta + \cos^2\theta = 1$ $\cot^2\theta + 1 = \csc^2\theta$ $\sin(\propto \pm \beta) = \sin \propto \cos\beta \pm \cos \propto \sin\beta$ $\cos(\propto \pm \beta) = \cos \propto \cos\beta \pm \sin \propto \sin\beta$ $\sin(2\theta) = 2\sin\theta\cos\theta$ $\cos(2\theta) = \cos^2\theta - \sin^2\theta$ Elements: **MM4A6** Students will solve trigonometric equations both graphically and algebraically. a. Solve trigonometric equations over a variety of domains, using technology as appropriate. b. Use the coordinates of a point on the terminal side of an angle to express x as $r\cos\theta$ and y as $r\sin\theta$. c. Apply the law of sines and the law of cosines. **MM4A7** Students will verify and apply ½ab sin C to find the area of a triangle. **MM4A8** Students will investigate and use inverse sine, inverse cosine, and inverse tangent functions. a. Find values of the above functions using technology as appropriate. b. Determine characteristics of the above functions and their graphs.	↑ **(Previous pages)**

Table 2C
Comparison of High School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Data Analysis, Probabilities & Statistics

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA1D1 Students will determine the number of outcomes related to a given event. a. Apply the addition and multiplication principles of counting. b. Calculate and use simple permutations and combinations. **MA1D2** Students will use the basic laws of probability. a. Find the probabilities of mutually exclusive events. b. Find the probabilities of dependent events. c. Calculate conditional probabilities. d. Use expected value to predict outcomes. **MA1D3** Students will relate samples to a population. a. Compare summary statistics (mean, median, quartiles, and interquartile range) from one sample data distribution to another sample data distribution in describing center and variability of the data distributions. b. Compare the averages of the summary statistics from a large number of samples to the corresponding population parameters. c. Understand that a random sample is used to improve the chance of selecting a representative sample. **MA1D4** Students will explore variability of data by determining the mean absolute deviation (the average of the absolute values of the deviations). **MA1D5** Students will determine an algebraic model to quantify the association between two quantitative variables. a. Gather and plot data that can be modeled with linear and quadratic functions. b. Examine the issues of curve fitting by finding good linear fits to data using simple methods such as the median-median line and "eyeballing." c. Understand and apply the processes of linear and quadratic regression for curve fitting using appropriate technology.	***Standards*** **Measurement, Chance and Data** (Partial List): **(Continued from Table 2B)** o Students estimate probabilities based on data (experiments, surveys, samples, simulations) and assign and justify subjective probabilities in familiar situations. o They list event spaces (for combinations of up to three events) by lists, grids, tree diagrams, Venn diagrams and karnaugh maps (two-way tables). o They calculate probabilities for complementary, mutually exclusive, and compound events (defined using *and*, *or* and *not*). o They classify events as dependent or independent. o Students comprehend the difference between a population and a sample. o They generate data using surveys, experiments and sampling procedures. o They calculate summary statistics for centrality (mode, median and mean), spread (box plot, inter-quartile range, outliers) and association (by-eye estimation of the line of best fit from a scatter plot). o They distinguish informally between association and causal relationship in bi-variate data, and make predictions based on an estimated line of best fit for scatter-plot data with strong association between two variables.

Table 2C (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 9** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM1D1 Students will determine the number of outcomes related to a given event. a. Apply the addition and multiplication principles of counting. b. Calculate and use simple permutations and combinations. **MM1D2** Students will use the basic laws of probability. Elements: a. Find the probabilities of mutually exclusive events. b. Find the probabilities of dependent events. c. Calculate conditional probabilities. d. Use expected value to predict outcomes. **MM1D3** Students will relate samples to a population. a. Compare summary statistics (mean, median, quartiles, and interquartile range) from one sample data distribution to another sample data distribution in describing center and variability of the data distributions. b. Compare the averages of the summary statistics from a large number of samples to the corresponding population parameters. c. Understand that a random sample is used to improve the chance of selecting a representative sample. **MM1D4** Students will explore variability of data by determining the mean absolute deviation (the average of the absolute values of the deviations).	***Learning Focus:*** o As students work towards the achievement of Level 6 standards in Mathematics, they extend their use of mathematical models to a wide range of familiar and unfamiliar contexts. o They recognize the role of logical argument and proof in establishing mathematical propositions. **Measurement, Chance and Data:** **(Continued from Table 2B)** o They represent event spaces that show the nature of events and their probabilities, and use these representations to assist in the computation of the probabilities of compound, independent and dependent events. o They apply the concept of mathematical expectation to describe expected gain or loss in games of chance. o Students collect and use uni-variate and bi-variate data samples. o They select appropriate representations to display data distributions, centrality, spread, and association between bi-variate data sets.

Table 2C (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MA2D1 Using sample data, students will make informal inferences about population means and standard deviations. a. Pose a question and collect sample data from at least two different populations. b. Understand and calculate the means and standard deviations of sets of data. c. Use means and standard deviations to compare data sets. d. Compare the means and standard deviations of random samples with the corresponding population parameters. Observe that the different sample means vary from one sample to the next. Observe that the distribution of the sample means has less variability than the population distribution. **MA2D2** Students will create probability histograms of discrete random variables, using both experimental and theoretical probabilities. Elements: **MA2D3** Students will solve problems involving probabilities by interpreting a normal distribution as a probability histogram for a continuous random variable (z-scores are used for a general normal distribution). a. Determine intervals about the mean that include a given percent of data. b. Determine the probability that a given value falls within a specified interval. c. Estimate how many items in a population fall within a specified interval. **MA2D4** Students will understand the differences between experimental and observational studies by posing questions and collecting, analyzing, and interpreting data. **MM2D1** Using sample data, students will make informal inferences about population means and standard deviations. a. Pose a question and collect sample data from at least two different populations. b. Understand and calculate the means and standard deviations of sets of data. c. Use means and standard deviations to compare data sets. d. Compare the means and standard deviations of random samples with the corresponding population parameters, including those population parameters for normal distributions. Observe that the different sample means vary from one sample to the next. Observe that the distribution of the sample means has less variability than the population distribution.	↑ **(Previous pages)**

Table 2C (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 2 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM2D2 Students will determine an algebraic model to quantify the association between two quantitative variables. a. Gather and plot data that can be modeled with linear and quadratic functions. b. Examine the issues of curve fitting by finding good linear fits to data using simple methods such as the median-median line and "eyeballing." c. Understand and apply the processes of linear and quadratic regression for curve fitting using appropriate technology. d. Investigate issues that arise when using data to explore the relationship between two variables, including confusion between correlation and causation.	↑ **(Previous pages)**
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	
MA3D1 Using simulation, students will develop the idea of the central limit theorem. **MA3D2** Using student-generated data from random samples of at least 30 members, students will determine the margin of error and confidence interval for a specified level of confidence. **MA3D3** Students will use confidence intervals and margins of error to make inferences from data about a population. Technology is used to evaluate confidence intervals, but students will be aware of the ideas involved. **MM3D1** Students will create probability histograms of discrete random variables, using both experimental and theoretical probabilities. **MM3D2** Students will solve problems involving probabilities by interpreting a normal distribution as a probability histogram for a continuous random variable (z-scores are used for a general normal distribution). a. Determine intervals about the mean that include a given percent of data. b. Determine the probability that a given value falls within a specified interval. c. Estimate how many items in a population fall within a specified interval.	

Table 2C (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Data Analysis, Probabilities & Statistics**	Dimension(s): **Measurement, Chance and Data**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
Accelerated Mathematics 3 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**Level 6** (pp. 82-88) → **Years 9-10**
MM3D3 Students will understand the differences between experimental and observational studies by posing questions and collecting, analyzing, and interpreting data. **MM4A9** Students will use sequences and series. a. Use and find recursive and explicit formulae for the terms of sequences. b. Recognize and use simple arithmetic and geometric sequences. c. Find and apply the sums of finite and, where appropriate, infinite arithmetic and geometric series. d. Use summation notation to explore finite series. **MM4D1** Using simulation, students will develop the idea of the central limit theorem. **MM4D2** Using student-generated data from random samples of at least 30 members, students will determine the margin of error and confidence interval for a specified level of confidence. Elements: **MM4D3** Students will use confidence intervals and margins of error to make inferences from data about a population. Technology is used to evaluate confidence intervals, but students will be aware of the ideas involved.	↑ **(Previous pages)**

Table 2D
Comparison of High School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Linear Algebra

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Linear Algebra**	Dimension(s): **To be determined**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – To be determined
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**To be determined → Years 9-10**
MA2A6 Students will perform basic operations with matrices. a. Add, subtract, multiply, and invert matrices, when possible, choosing appropriate methods, including technology. b. Find the inverses of two-by-two matrices using pencil and paper, and find inverses of larger matrices using technology. c. Examine the properties of matrices, contrasting them with properties of real numbers. **MA2A7** Students will use matrices to formulate and solve problems. a. Represent a system of linear equations as a matrix equation. b. Solve matrix equations using inverse matrices. c. Represent and solve realistic problems using systems of linear equations. **MA2A8** Students will solve linear programming problems in two variables. a. Solve systems of inequalities in two variables, showing the solutions graphically. b. Represent and solve realistic problems using linear programming. **MA2A9** Students will understand and apply matrix representations of vertex-edge graphs. a. Use graphs to represent realistic situations. b. Use matrices to represent graphs, and solve problems that can be represented by graphs. **MM3A4** Students will perform basic operations with matrices. a. Add, subtract, multiply, and invert matrices, when possible, choosing appropriate methods, including technology. b. Find the inverses of two-by-two matrices using pencil and paper, and find inverses of larger matrices using technology. c. Examine the properties of matrices, contrasting them with properties of real numbers.	**N/A**

Table 2D (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Linear Algebra**	Dimension(s): **To be determined**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – To be determined
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 10** under Math Course Sequence Options 2 & 3)	**To be determined → Years 9-10**
MM3A5 Students will use matrices to formulate and solve problems. a. Represent a system of linear equations as a matrix equation. b. Solve matrix equations using inverse matrices. c. Represent and solve realistic problems using systems of linear equations. **MM3A6** Students will solve linear programming problems in two variables. a. Solve systems of inequalities in two variables, showing the solutions graphically. b. Represent and solve realistic problems using linear programming. **MM3A7** Students will understand and apply matrix representations of vertex-edge graphs. a. Use graphs to represent realistic situations. b. Use matrices to represent graphs, and solve problems that can be represented by graphs.	**N/A**

Table 2E
Comparison of High School Mathematics Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Vector Graphics

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 11-12 → Higher School**
Subject(s): **Vector Graphics**	Dimension(s): **To be determined**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – To be determined
Accelerated Mathematics 1 (Grades 9, 10, 11, 12) (To be applied at **Grade 11** under Math Course Sequence Options 2 & 3)	**To be determined → Years 9-10**
MA3A10 Students will understand and use vectors. a. Represent vectors algebraically and geometrically. b. Convert between vectors expressed using rectangular coordinates and vectors expressed using magnitude and direction. c. Add and subtract vectors and compute scalar multiples of vectors. d. Use vectors to solve realistic problems. **MM4A10** Students will understand and use vectors. a. Represent vectors algebraically and geometrically. b. Convert between vectors expressed using rectangular coordinates and expressed using magnitude and direction. c. Add, subtract, and compute scalar multiples of vectors. d. Use vectors to solve realistic problems.	**N/A**

Part Two
Science Education

Science Subjects for Kindergarten and Middle School

Table 3
Comparison of Kindergarten to Middle School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subjects: Science

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Kindergarten (Grade K)	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (p. 62) → **Years P-K**
Physics-Related Science: **SKP2** Students will investigate different types of motion. a. Sort objects into categories according to their motion (straight, zigzag, round and round, back and forth, fast and slow, and motionless). b. Push, pull, and roll common objects and describe their motions. **SKP3** Students will observe and communicate effects of gravity on objects. a. Recognize that some things, such as airplanes and birds, are in the sky, but return to earth. b. Recognize that the sun, moon, and stars are in the sky, but don't come down. c. Explain why a book does not fall down if it is placed on a table, but will fall down if it is dropped. **SKE1** Students will describe time patterns (such as day to night and night to day) and objects (such as sun, moon, stars) in the day and night sky. a. Describe changes that occur in the sky during the day, as day turns into night, during the night, and as night turns into day. b. Classify objects according to those seen in the day sky and those seen in the night sky. c. Recognize that the Sun supplies heat and light to the Earth. Chemistry & Materials Related Science: **SKE2** Students will describe the physical attributes of rocks and soils. a. Use senses to observe and group rocks by physical attributes such as large/small, heavy/light, smooth/rough, dark/light, etc. b. Use senses to observe soils by physical attributes such as smell, texture, color, particle/grain size. c. Recognize earth materials— soil, rocks, water, air, etc.	***Learning Focus:*** o As students work towards the achievement of Level 3 standards in Science, they use their senses to explore the world around them; for example, day and night, the seasons, and living and non-living things. o They describe their activities and observations using both general and science-specific language; for example, *hard*, *soft*, *long*, *short*, *big*, *small*, *strong* and *weak*. ➢ Through sorting objects according to basic criteria such as size, shape, color and weight, they identify and describe the similarities and differences between them. ➢ By participating in very simple investigations involving observation and measurement (for example, making and flying kites, saving water and measuring plant growth) they learn about basic procedures and processes, including collecting and recording data. o They display, and make generalizations from their data. They become aware of using safe procedures in their activities.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Kindergarten (Grade K)	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (p. 62) → **Years P-K**
SKP1 Students will describe objects in terms of the materials they are made of and their physical properties. a. Compare and sort materials of different composition (common materials include clay, cloth, paper, plastic, etc.). b. Use senses to classify common materials, such as buttons or swatches of cloth, according to their physical attributes (color, size, shape, weight, texture, buoyancy, flexibility). **Life Science:** **SKL1** Students will sort living organisms and non-living materials into groups by observable physical attributes. a. Recognize the difference between living organisms and nonliving materials. b. Group animals according to their observable features such as appearance, size, motion, where it lives, etc. (for example: A green frog has four legs and hops. A rabbit also hops.). c. Group plants according to their observable features such as appearance, size, etc. **SKL2** Students will compare the similarities and differences in groups of organisms. a. Explain the similarities and differences in animals (color, size, appearance, etc.). b. Explain the similarities and differences in plants (color, size, appearance, etc.). c. Recognize the similarities and differences between a parent and a baby. d. Match pictures of animal parents and their offspring explaining your reasoning (for example: dog/puppy; cat/kitten; cow/calf; duck/ducklings, etc.). e. Recognize that you are similar to and different from other students (senses, appearance). Teacher note: Be sensitive to the fact that some children have parents who are not their biological parents. Scientific Approach: **SKCS1** Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Raise questions about the world around you and be willing to seek answers to some of the questions by making careful observations (5 senses) and trying things out.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Kindergarten (Grade K)	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade K	**Level 1** (p. 62) → **Years P-K**
SKCS2 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Use whole numbers for counting, identifying, and describing things and experiences. b. Make quantitative estimates of nonstandard measurements (blocks, counters) and check by measuring. **SKCS3** Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities. a. Use ordinary hand tools and instruments to construct, measure (for example: balance scales to determine heavy/light, weather data, nonstandard units for length), and look at objects (for example: magnifiers to look at rocks and soils). b. Make something that can actually be used to perform a task, using paper, cardboard, wood, plastic, metal, or existing objects (for example: paper plate day and night sky models). **SKCS4** Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. a. Use a model - such as a toy or a picture - to describe a feature of the primary thing. b. Describe changes in size, weight, color, or movement, and note which of their other qualities remains the same (for example, playing "Follow the Leader" and noting the changes). c. Compare very different sizes (large/small), ages (parent/baby), speeds (fast/slow), and weights (heavy/light) of both manmade and natural things. **SKCS5** Students will communicate scientific ideas and activities clearly. a. Describe and compare things in terms of number, shape, texture, size, weight, color, and motion. b. Begin to draw pictures that portray features of the thing being described. **SKCS6** Students will understand the important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. In doing science, it is often helpful to work with a team and to share findings with others. b. Tools such as rulers, magnifiers, and balance scales often give more information about things than can be obtained by just observing things without help. c. Much can be learned about plants and animals by observing them closely, but care must be taken to know the needs of living things and how to provide for them (classroom pets).	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (p. 66) → **Years 1-2**
Physics-Related Science: **S1E1** Students will observe, measure, and communicate weather data to see patterns in weather and climate. a. Identify different types of weather and the characteristics of each type. b. Investigate weather by observing, measuring with simple weather instruments (thermometer, wind vane, rain gauge), and recording weather data (temperature, precipitation, sky conditions, and weather events) in a periodic journal or on a calendar seasonally. c. Correlate weather data (temperature, precipitation, sky conditions, and weather events) to seasonal changes. **S1E2** Students will observe and record changes in water as it relates to weather. a. Recognize changes in water when it freezes (ice) and when it melts (water). b. Identify forms of precipitation such as rain, snow, sleet, and hailstones as either solid (ice) or liquid (water). c. Determine that the weight of water before freezing, after freezing, and after melting stays the same. d. Determine that water in an open container disappears into the air over time, but water in a closed container does not. **S1P1** Students will investigate light and sound. a. Recognize sources of light. b. Explain how shadows are made. c. Investigate how vibrations produce sound. d. Differentiate between various sounds in terms of (pitch) high or low and (volume) loud or soft. e. Identify emergency sounds and sounds that help us stay safe. **S1P2** Students will demonstrate effects of magnets and other magnets and other objects. a. Demonstrate how magnets attract and repel. b. Identify common objects that are attracted to a magnet. c. Identify objects and materials (air, water, wood, paper, your hand, etc.) that do not block magnetic force.	***Learning Focus:*** Physics-Related Science: o As students work towards the achievement of Level 3 standards in Science, they observe and describe phenomena; for example, properties of natural and manufactured materials, insect life cycles, phases of the moon, magnets in action, mirrors and seeing around corners, and light and sound from batteries. o Students expand their simple scientific vocabulary by using words and terms for concepts such as *temperature*, *life cycles*, *light* and *reflection*, *sound*, *magnetism* and *fair testing*. Environmental Science: o They investigate ways of reducing waste in their classroom; for example, recycling and composting. Scientific Approach: o Students begin to generate questions about situations and phenomena, and suggest forms of observations and measurements that are appropriate for the investigation of their questions; for example, "Which keeps food fresher, paper or plastic?" and "What makes sounds change?" They continue to practice basic procedures and processes, including those involving safety. o They repeat observations over time to make predictions; for example, collecting data about the weather. o They begin to recognize simple patterns in data and describe them in terms that represent conclusions drawn from the data. o Suitable questions may include: 'Does the size of seeds affect the time taken for them to germinate?', 'Does all chocolate melt at the same temperature?' and 'Are shadows the same size?'

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (p. 66) → **Years 1-2**
S1L1 Students will investigate the characteristics and basic needs of plants and animals. a. Identify the basic needs of a plant. 1. Air 2. Water 3. Light 4. Nutrients b. Identify the basic needs of an animal. 1. Air 2. Water 3. Food 4. Shelter c. Identify the parts of a plant—root, stem, leaf, and flower. d. Compare and describe various animals—appearance, motion, growth, basic needs. Scientific Approach: **S1CS1** Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Raise questions about the world around them and be willing to seek answers to some of the questions by making careful observations and measurements and trying to figure things out. **S1CS2** Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Use whole numbers in ordering, counting, identifying, measuring, and describing things and experiences. b. Readily give the sums and differences of single-digit numbers in ordinary, practical contexts and judge the reasonableness of the answer. c. Give rough estimates of numerical answers to problems before doing them formally. d. Make quantitative estimates of familiar lengths, weights, and time intervals, and check them by measuring.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (p. 66) → **Years 1-2**
S1CS3 Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities. a. Use ordinary hand tools and instruments to construct, measure, and look at objects. b. Make something that can actually be used to perform a task, using paper, cardboard, wood, plastic, metal, or existing objects. c. Identify and practice accepted safety procedures in manipulating science materials and equipment. **S1CS4** Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. a. Use a model - such as a toy or a picture - to describe a feature of the primary thing. b. Describe changes in the size, weight, color, or movement of things, and note which of their other qualities remain the same during a specific change. c. Compare very different sizes, weights, ages (baby/adult), and speeds (fast/slow) of both human made and natural things. **S1CS5** Students will communicate scientific ideas and activities clearly. a. Describe and compare things in terms of number, shape, texture, size, weight, color, and motion. b. Draw pictures (grade level appropriate) that correctly portray features of the thing being described. c. Use simple pictographs and bar graphs to communicate data. **S1CS6** Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that: a. When a science investigation is done the way it was done before, we expect to get a similar result. b. Science involves collecting data and testing hypotheses. c. Scientists often repeat experiments multiple times, and subject their ideas to criticism by other scientists who may disagree with them and do further tests. d. All different kinds of people can be and are scientists.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 1	**Level 2** (p. 66) → **Years 1-2**
S1CS7 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. Scientists use a common language with precise definitions of terms to make it easier to communicate their observations to each other. b. In doing science, it is often helpful to work as a team. All team members should reach individual conclusions and share their understandings with other members of the team in order to develop a consensus. c. Tools such as thermometers, rulers and balances often give more information about things than can be obtained by just observing things without help. d. Much can be learned about plants and animals by observing them closely, but care must be taken to know the needs of living things and how to provide for them. Advantage can be taken of classroom pets.	↑ **(Previous pages)**
Grade 2	
Physics-Related Science: **S2P2** Students will identify sources of energy and how the energy is used. a. Identify sources of light energy, heat energy, and energy of motion. b. Describe how light, heat, and motion energy are used. **S2P3** Students will demonstrate changes in speed and direction using pushes and pulls. a. Demonstrate how pushing and pulling an object affects the motion of the object. b. Demonstrate the effects of changes of speed on an object. **S2E2** Students will investigate the position of sun and moon to show patterns throughout the year. a. Investigate the position of the sun in relation to a fixed object on earth at various times of the day. b. Determine how the shadows change through the day by making a shadow stick or using a sundial. c. Relate the length of the day and night to the change in seasons (for example: Days are longer than the night in the summer.) d. Use observations and charts to record the shape of the moon for a period of time.	

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 2	**Level 2** (p. 66) → **Years 1-2**
Chemistry & Materials Related Science: **S2P1** Students will investigate the properties of matter and changes that occur in objects. a. Identify the three common states of matter as solid, liquid, or gas. b. Investigate changes in objects by tearing, dissolving, melting, squeezing, etc. Life Science: **S2E3** Students will observe and record changes in their surroundings and infer the causes of the changes. a. Recognize effects that occur in a specific area caused by weather, plants, animals, and/or people. **S2L1** Students will investigate the life cycles of different living organisms. Teacher note: Instruct students not to touch wild plants and animals when they observe them. Always wash hands after handling any plants or animals. Caution students not to eat wild plants they find. a. Determine the sequence of the life cycle of common animals in your area: a mammal such as a cat or dog or classroom pet, a bird such as a chicken, an amphibian such as a frog, and an insect such as a butterfly. b. Relate seasonal changes to observations of how a tree changes throughout a school year. c. Investigate the life cycle of a plant by growing a plant from a seed and by recording changes over a period of time. d. Identify fungi (mushrooms) as living organisms. Scientific Approach: **S2CS1** Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Raise questions about the world around them and be willing to seek answers to some of the questions by making careful observations and measurements and trying to figure things out.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 2	**Level 2** (p. 66) → **Years 1-2**
S2CS2 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Use whole numbers in ordering, counting, identifying, measuring, and describing things and experiences. b. Readily give the sums and differences of single-digit numbers in ordinary, practical contexts and judge the reasonableness of the answer. c. Give rough estimates of numerical answers to problems before doing them formally. d. Make quantitative estimates of familiar lengths, weights, and time intervals, and check them by measuring. **S2CS3** Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities. a. Use ordinary hand tools and instruments to construct, measure, and look at objects. b. Assemble, describe, take apart, and reassemble constructions using interlocking blocks, erector sets and other things. c. Make something that can actually be used to perform a task, using paper, cardboard, wood, plastic, metal, or existing objects. **S2CS4** Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. a. Identify the parts of things, such as toys or tools, and identify what things can do when put together that they could not do otherwise. b. Use a model—such as a toy or a picture—to describe a feature of the primary thing. c. Describe changes in the size, weight, color, or movement of things, and note which of their other qualities remain the same during a specific change. d. Compare very different sizes, weights, ages (baby/adult), and speeds (fast/slow) of both human made and natural things. **S2CS5** Students will communicate scientific ideas and activities clearly. a. Describe and compare things in terms of number, shape, texture, size, weight, color, and motion. b. Draw pictures (grade level appropriate) that correctly portray features of the thing being described. c. Use simple pictographs and bar graphs to communicate data.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 2	**Level 2** (p. 66) → **Years 1-2**
S2CS6 Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that: a. When a science investigation is done the way it was done before, we expect to get a similar result. b. Science involves collecting data and testing hypotheses. c. Scientists often repeat experiments multiple times and subject their ideas to criticism by other scientists who may disagree with them and do further tests. d. All different kinds of people can be and are scientists. **S2CS7** Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. Scientists use a common language with precise definitions of terms to make it easier to communicate their observations to each other. b. In doing science, it is often helpful to work as a team. All team members should reach their own individual conclusions and share their understandings with other members of the team in order to develop a consensus. c. Tools such as thermometers, rulers and balances often give more information about things than can be obtained by just observing things without help. d. Much can be learned about plants and animals by observing them closely, but care must be taken to know the needs of living things and how to provide for them. Advantage can be taken of classroom pets. **S2E1** Students will understand that stars have different sizes, brightness, and patterns. a. Describe the physical attributes of stars—size, brightness, and patterns.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 68-70) → **Years 3-4**
Physics-Related Science: **S3P1** Students will investigate how heat is produced and the effects of heating and cooling, and will understand a change in temperature indicates a change in heat. a. Categorize ways to produce heat energy such as burning, rubbing (friction), and mixing one thing with another. b. Investigate how insulation affects heating and cooling. c. Investigate the transfer of heat energy from the sun to various materials. d. Use thermometers to measure the changes in temperatures of water samples (hot, warm, cold) over time. **S3P2** Students will investigate magnets and how they affect other magnets and common objects. a. Investigate to find common objects that are attracted to magnets. b. Investigate how magnets attract and repel each other. Life Science: **S3E2** Students will investigate fossils as evidence of organisms that lived long ago. a. Investigate fossils by observing authentic fossils or models of fossils or view information resources about fossils as evidence of organisms that lived long ago. b. Describe how a fossil is formed. **S3L1** Students will investigate the habitats of different organisms and the dependence of organisms on their habitat. a. Differentiate between habitats of Georgia (mountains, marsh/swamp, coast, Piedmont, Atlantic Ocean) and the organisms that live there. b. Identify features of green plants that allow them to live and thrive in different regions of Georgia. c. Identify features of animals that allow them to live and thrive in different regions of Georgia. d. Explain what will happen to an organism if the habitat is changed.	***Standards:*** **Science Knowledge and Understanding:** Chemistry & Materials-Related Science: o Students classify a range of materials such as solids, liquids and gases according to observable properties, and demonstrate understanding that this system of classification of substances is sometimes problematic. o Students describe examples of reversible and non-reversible changes in substances. Physics-Related Science: o Students identify the actions of forces in everyday situations. o They use the words push and pull in discussing how things can be moved and stopped. o They identify forms of energy and energy transformations in the everyday world. Life Science: o Students identify and describe the structural features of living things, including plants and animals. o They identify how these features operate together to form systems which support living things to survive in their environments. o They distinguish between biotic and abiotic factors in their environment and describe interactions that occur between them. o They describe natural physical and biological conditions, and human influences in the environment, which affect the survival of living things. Environmental Science: o They describe the relationship between day and night and the rotation of the Earth. o Students explain how features of the landscape are altered by processes of weathering and erosion. Scientific Approach: o They use appropriate scientific vocabulary to describe and explain their observations and investigations.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 68-70) → **Years 3-4**
Environmental Science: **S3E1** Students will investigate the physical attributes of rocks and soils. a. Explain the difference between a rock and a mineral. b. Recognize the physical attributes of rocks and minerals using observation (shape, color, texture), measurement, and simple tests (hardness). c. Use observation to compare the similarities and differences of texture, particle size, and color in top soils (such as clay, loam or potting soil, and sand). d. Determine how water and wind can change rocks and soil over time using observation and research. **S3L2** Students will recognize the effects of pollution and humans on the environment. a. Explain the effects of pollution (such as littering) to the habitats of plants and animals. b. Identify ways to protect the environment. o Conservation of resources o Recycling of materials Scientific Approach: **S3CS1** Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Keep records of investigations and observations and do not alter the records later. b. Offer reasons for findings and consider reasons suggested by others. c. Take responsibility for understanding the importance of being safety conscious. **S3CS2** Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator. b. Use commonly encountered fractions – halves, thirds, and fourths (but not sixths, sevenths, and so on) – in scientific calculations. c. Judge whether measurements and computations of quantities, such as length, weight, or time, are reasonable answers to scientific problems by comparing them to typical values.	**Science at Work:** Scientific Approach: o Students plan, design, conduct and report collaboratively on experiments related to their questions about living and non-living things and events. o They select and use simple measuring equipment, use a range of appropriate methods to record observations, and comment on trends. o They describe the concept of a fair test and identify the variables associated with an experiment. o They develop fair tests to make comparisons and explain how they have controlled experimental variables. o Students describe safety requirements and procedures associated with experiments. o They explain how scientific knowledge is used, or could be used, to solve a social issue or problem. o They describe aspects of the work of scientists and how this has contributed to science knowledge. ***Learning Focus:*** Scientific Approach: o As students work towards the achievement of Level 3 standards in Science, they begin to design and conduct experiments to explore contexts drawn from traditional and emerging sciences. o They investigate questions and ideas about the natural world and learn to use scientific vocabulary in place of everyday language to describe and explain their observations and measurements. o They begin to understand that the design of experiments is directly related to their questions about things and events. o They learn to describe evidence in support of simple scientific ideas. o Students investigate changes they observe; for example, day becoming night, using brakes to stop a bicycle hitting a gate, seed germination and plant growth, and the regeneration of forests after a bushfire. o They examine, by referring to energy transformation, the operation of a range of everyday devices; for example, gates, locks, toasters and hot water systems. Physics-Related Science: o They investigate the use of solar energy in cooking or lighting or transport. o Students learn about the actions of forces on objects that affect their motion and shape in everyday situations such as walking, playing ball games, blowing up balloons, playing with moving toys and riding in cars or airplanes. o They explore the relationship between distance and the apparent size of an observed object.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 68-70) → **Years 3-4**
Scientific Approach: **S3CS3** Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities utilizing safe laboratory procedures. a. Choose appropriate common materials for making simple mechanical constructions and repairing things. b. Use computers, cameras and recording devices for capturing information. c. Identify and practice accepted safety procedures in manipulating science materials and equipment. **S3CS4** Students will use ideas of system, model, change, and scale in exploring scientific and technological matters. a. Observe and describe how parts influence one another in things with many parts. b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world. c. Identify ways in which the representations do not match their original counterparts. **S3CS5** Students will communicate scientific ideas and activities clearly. a. Write instructions that others can follow in carrying out a scientific procedure. b. Make sketches to aid in explaining scientific procedures or ideas. c. Use numerical data in describing and comparing objects and events. d. Locate scientific information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases. **S3CS6** Students will question scientific claims and arguments effectively. a. Support statements with facts found in books, articles, and databases, and identify the sources used. **S3CS7** Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that: a. Similar scientific investigations seldom produce exactly the same results, which may differ due to unexpected differences in whatever is being investigated, unrecognized differences in the methods or circumstances of the investigation, or observational uncertainties. b. Some scientific knowledge is very old and yet is still applicable today.	Chemistry-Related Science: o They participate in activities where they learn to classify a variety of materials using states of matter (solids, liquids, gases) and they learn that some materials are difficult to classify; for example, honey, plaster, jelly and carbonated soft drinks. o They explore reversible and non-reversible changes to common substances such as water, vinegar and bicarbonate of soda. Life Science: o They begin to understand how different parts work together in plants and animals to produce change and to aid in survival; for example, growth and movement. o They realize that offspring are similar to their parents. o They learn to classify things that they find in their environment as living (biotic) or nonliving (abiotic). Environmental Science: o They investigate how humans affect the survival of living things and change the environment, and how interactions between living things in the environment change. o They investigate natural processes that change the environment over short periods of time (tsunami, drought, floods) and long periods of time (weathering and erosion). o Students are introduced to the concept of a sustainable environment and their role in contributing to it; for example, involvement in local litter programs and recycling at home and at school. Application of Science: o Students relate scientific ideas to their own experiences, interests and concerns, and to a variety of personal and community uses of science and links with technology; for example, the location of mobile phone towers or clearing local bush land to build new roads. o They examine how scientists work and how science knowledge has developed by visiting scientists at work, listening to guest speakers or conducting research on the Internet. o Students discuss safety considerations and a variety of procedures and processes (including fair tests, variables, ethical considerations relating to observing animals, and selecting and using equipment correctly) that could be used when undertaking experiments.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 3	**Level 3** (pp. 68-70) → **Years 3-4**
S3CS8 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. b. Clear and active communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world. c. Scientists use technology to increase their power to observe things and to measure and compare things accurately. d. Science involves many different kinds of work and engages men and women of all ages and backgrounds.	↑ **(Previous pages)**
Grade 4	
Physics-Related Science: **S4P1** Students will investigate the nature of light using tools such as mirrors, lenses, and prisms. a. Identify materials that are transparent, opaque, and translucent. b. Investigate the reflection of light using a mirror and a light source. c. Identify the physical attributes of a convex lens, a concave lens, and a prism and where each is used. **S4P2** Students will demonstrate how sound is produced by vibrating objects and how sound can be varied by changing the rate of vibration. a. Investigate how sound is produced. b. Recognize the conditions that cause pitch to vary.	

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 68-70) → **Years 3-4**
S4P3 Students will demonstrate the relationship between the application of a force and the resulting change in position and motion on an object. a. Identify simple machines and explain their uses (lever, pulley, wedge, inclined plane, screw, wheel and axle). b. Using different size objects, observe how force affects speed and motion. c. Explain what happens to the speed or direction of an object when a greater force than the initial one is applied. d. Demonstrate the effect of gravitational force on the motion of an object. Teacher note: The use of mathematical formulas is not recommended in S4P3. Fourth grade students should carry out investigations to provide a foundation of concrete experience for the abstract understandings of physical science in upper grades. **S4E1** Students will compare and contrast the physical attributes of stars, star patterns, and planets. a. Recognize the physical attributes of stars in the night sky such as number, size, color and patterns. b. Compare the similarities and differences of planets to the stars in appearance, position, and number in the night sky. c. Explain why the pattern of stars in a constellation stays the same, but a planet can be seen in different locations at different times. d. Identify how technology is used to observe distant objects in the sky. **S4E2** Students will model the position and motion of the earth in the solar system and will explain the role of relative position and motion in determining sequence of the phases of the moon. a. Explain the day/night cycle of the earth using a model. b. Explain the sequence of the phases of the moon. c. Demonstrate the revolution of the earth around the sun and the earth's tilt to explain the seasonal changes. d. Demonstrate the relative size and order from the sun of the planets in the solar system.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 68-70) → **Years 3-4**
S4E4 Students will analyze weather charts/maps and collect weather data to predict weather events and infer patterns and seasonal changes. a. Identify weather instruments and explain how each is used in gathering weather data and making forecasts (thermometer, rain gauge, barometer, wind vane, anemometer). b. Using a weather map, identify the fronts, temperature, and precipitation and use the information to interpret the weather conditions. c. Use observations and records of weather conditions to predict weather patterns throughout the year. d. Differentiate between weather and climate. Chemistry & Materials Related Science: **S4E3** Students will differentiate between the states of water and how they relate to the water cycle and weather. a. Demonstrate how water changes states from solid (ice) to liquid (water) to gas (water vapor/steam) and changes from gas to liquid to solid. b. Identify the temperatures at which water becomes a solid and at which water becomes a gas. c. Investigate how clouds are formed. d. Explain the water cycle (evaporation, condensation, and precipitation). e. Investigate different forms of precipitation and sky conditions (rain, snow, sleet, hail, clouds, and fog). Life Science: **S4L1** Students will describe the roles of organisms and the flow of energy within an ecosystem. a. Identify the roles of producers, consumers, and decomposers in a community. b. Demonstrate the flow of energy through a food web/food chain beginning with sunlight and including producers, consumers, and decomposers. c. Predict how changes in the environment would affect a community (ecosystem) of organisms. d. Predict effects on a population if some of the plants or animals in the community are scarce or if there are too many.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 68-70) → **Years 3-4**
S4L2 Students will identify factors that affect the survival or extinction of organisms such as adaptation, variation of behaviors (hibernation), and external features (camouflage and protection). a. Identify external features of organisms that allow them to survive or reproduce better than organisms that do not have these features (for example: camouflage, use of hibernation, protection, etc.). b. Identify factors that may have led to the extinction of some organisms. Scientific Approach: **S4CS1** Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Keep records of investigations and observations and do not alter the records later. b. Carefully distinguish observations from ideas and speculation about those observations. c. Offer reasons for findings and consider reasons suggested by others. d. Take responsibility for understanding the importance of being safety conscious. **S4CS2** Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator. b. Use fractions and decimals, and translate between decimals and commonly encountered fractions – halves, thirds, fourths, fifths, tenths, and hundredths (but not sixths, sevenths, and so on) – in scientific calculations. c. Judge whether measurements and computations of quantities, such as length, area, volume, weight, or time, are reasonable answers to scientific problems by comparing them to typical values. **S4CS3** Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities utilizing safe laboratory procedures. a. Choose appropriate common materials for making simple mechanical constructions and repairing things. b. Measure and mix dry and liquid materials in prescribed amounts, exercising reasonable safety. c. Use computers, cameras and recording devices for capturing information. d. Identify and practice accepted safety procedures in manipulating science materials and equipment.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 68-70) → **Years 3-4**
S4CS4 Students will use ideas of system, model, change, and scale in exploring scientific and technological matters. a. Observe and describe how parts influence one another in things with many parts. b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world. Identify ways in which the representations do not match their original counterparts. c. Identify patterns of change in things—such as steady, repetitive, or irregular change - using records, tables, or graphs of measurements where appropriate. **S4CS5** Students will communicate scientific ideas and activities clearly. a. Write instructions that others can follow in carrying out a scientific procedure. b. Make sketches to aid in explaining scientific procedures or ideas. c. Use numerical data in describing and comparing objects and events. d. Locate scientific information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases. **S4CS6** Students will question scientific claims and arguments effectively. a. Support statements with facts found in books, articles, and databases, and identify the sources used. b. Identify when comparisons might not be fair because some conditions are different. **S4CS7** Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that: a. Similar scientific investigations seldom produce exactly the same results, which may differ due to unexpected differences in whatever is being investigated, unrecognized differences in the methods or circumstances of the investigation, or observational uncertainties. b. Some scientific knowledge is very old and yet is still applicable today.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years Prep to 4 - Laying the Foundations
Grade 4	**Level 3** (pp. 68-70) → **Years 3-4**
S4CS8 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. b. Clear and active communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world. c. Scientists use technology to increase their power to observe things and to measure and compare things accurately. d. Science involves many different kinds of work and engages men and women of all ages and backgrounds.	↑ **(Previous pages)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 89-91) → **Years 5-6**
Physics-Related Science: **S5P3** Students will investigate the electricity, magnetism and their relationship. a. Investigate static electricity. b. Determine the necessary components for completing an electric circuit. c. Investigate common materials to determine if they are insulators or conductors of electricity. d. Compare a bar magnet to an electromagnet. Chemistry & Materials Related Science: **S5P2** Students will explain the difference between a physical change and a chemical change. a. Investigate physical changes by separating mixtures and manipulating (cutting, tearing, folding) paper to demonstrate examples of physical change. b. Recognize that the changes in state of water (water vapor/steam, liquid, ice) are due to temperature differences and are examples of physical change. c. Investigate the properties of a substance before, during, and after a chemical reaction to find evidence of change.	***Standards:*** **Science Knowledge and Understanding:** Chemistry & Materials-Related Science: o At Level 4, students explain change in terms of cause and effect. They identify the characteristics of physical and chemical changes. o They describe how substances change during reactions. o They identify and compare the properties of the new or changed material/s with those of the original material/s. o Students explain the role of chemical change in the production of new materials. Physics-Related Science: o They qualitatively describe changes in motion in terms of the forces present. Life Science: o They identify and explain the connections between systems in the human body and their various functions. o They identify and explain the relationships that exist within and between food chains in the environment.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 89-91) → **Years 5-6**
Life Science: **S5L1** Students will classify organisms into groups and relate how they determined the groups with how and why scientists use classification. a. Demonstrate how animals are sorted into groups (vertebrate and invertebrate) and how vertebrates are sorted into groups (fish, amphibian, reptile, bird, and mammal). b. Demonstrate how plants are sorted into groups. **S5L2** Students will recognize that offspring can resemble parents in inherited traits and learned behaviors. a. Compare and contrast the characteristics of learned behaviors and of inherited traits. b. Discuss what a gene is and the role genes play in the transfer of traits. Teacher note: Be sensitive to this topic since biological parents may be unavailable. **S5L3** Students will diagram and label parts of various cells (plant, animal, single-celled, multi-celled). a. Use magnifiers such as microscopes or hand lenses to observe cells and their structure. b. Identify parts of a plant cell (membrane, wall, cytoplasm, nucleus, chloroplasts) and of an animal cell (membrane, cytoplasm, and nucleus) and determine the function of the parts. c. Explain how cells in multi-celled organisms are similar and different in structure and function to single-celled organisms. **S5L4** Students will relate how microorganisms benefit or harm larger organisms. a. Identify beneficial microorganisms and explain why they are beneficial. b. Identify harmful microorganisms and explain why they are harmful.	Environmental Science: o Students use everyday examples to illustrate the transforming and transferring of energy. o They explain how the Earth and the Moon operate as a simple system within the larger solar system. o They describe the composition of layers within the Earth. o They explain the function of the layers of the Earth's atmosphere. Application of Science: o Students apply the terms relationships, models and systems appropriately as ways of representing complex structures. **Science at Work:** Environmental Science: o They explain how sustainable practices have been developed and/or are applied in their local environment. They describe the contributions Australian scientists have made to improve and/or change science knowledge. Scientific Approach: o Students design their own simple experiments to collect data and draw conclusions. o They describe the purpose of experiments they undertake, including a statement of ethical considerations, and relate this purpose to the nature of the data that is collected. o They design and build simple models and write an account of the science that is central to explanation of the model. o They use diagrams and symbols to explain procedures used when reporting on their investigations. o Students approach data collection systematically, and analyze data qualitatively in terms of errors of measurement. o They use a range of simple measuring instruments and materials, and demonstrate understanding of their personal responsibility in using them. o They identify and describe safety requirements and procedures associated with experiments and the use of standard equipment. Students use the terms relationships and cause and effect when discussing and drawing conclusions from the data they collect.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 89-91) → **Years 5-6**
Environment Science: **S5E1** Students will identify surface features of the Earth caused by constructive and destructive processes. a. Identify surface features caused by constructive processes. o Deposition (deltas, sand dunes, etc.) o Earthquakes o Volcanoes o Faults b. Identify and find examples of surface features caused by destructive processes. o Erosion (water—rivers and oceans, wind) o Weathering o Impact of organisms o Earthquake o Volcano c. Relate the role of technology and human intervention in the control of constructive and destructive processes. Examples include, but are not limited to o Seismological studies o Flood control (dams, levees, storm drain management, etc.) o Beach reclamation (Georgia coastal islands) Scientific Approach: **S5CS1** Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Keep records of investigations and observations and do not alter the records later. b. Carefully distinguish observations from ideas and speculation about those observations. c. Offer reasons for findings and consider reasons suggested by others. d. Take responsibility for understanding the importance of being safety conscious.	Application of Science: o At Level 4, students analyze a range of science-related local issues and describe the relevance of science to their own and other people's lives. ***Learning Focus:*** Scientific Approach: o As students work towards the achievement of Level 4 standards in Science, they develop a more systematic knowledge of science and science concepts drawn from traditional and emerging sciences. o They reflect on the variety of ways collected data can be represented; for example, graphs, tables or digital images, and on changes they may make to the design of their investigation. o They complete reports on their investigations and model-building, explaining the science involved using symbols, diagrams and simple equations. o They use this understanding to consider the appropriateness of the inferences and solutions drawn from the evidence and data, and to consider their own responsibilities and safety requirements when working with a variety of instruments and materials. Life Science: o They group living things on the basis of observable characteristics. o They explore the concept of relationship; for example, food chains and energy flow along food chains in terrestrial and aquatic environments. o They contemplate how systems operate; for example, the human body as a large system consisting of smaller separate systems (circulatory, respiratory, digestive, skeletal, reproductive and nervous) working together, and life cycles as systems for survival. Central to this is their understanding that some questions are open to investigation while others require reasoning and discussion, and that science knowledge is improved and changed by the outcomes of new investigations and explorations.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 89-91) → **Years 5-6**
S5CS2 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator. b. Use fractions and decimals, and translate between decimals and commonly encountered fractions – halves, thirds, fourths, fifths, tenths, and hundredths (but not sixths, sevenths, and so on) – in scientific calculations. c. Judge whether measurements and computations of quantities, such as length, area, volume, weight, or time, are reasonable answers to scientific problems by comparing them to typical values. **S5CS3** Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities. a. Choose appropriate common materials for making simple mechanical constructions and repairing things. b. Measure and mix dry and liquid materials in prescribed amounts, exercising reasonable safety. c. Use computers, cameras and recording devices for capturing information. d. Identify and practice accepted safety procedures in manipulating science materials and equipment. **S5CS4** Students will use ideas of system, model, change, and scale in exploring scientific and technological matters. a. Observe and describe how parts influence one another in things with many parts. b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world. Identify ways in which the representations do not match their original counterparts. c. Identify patterns of change in things—such as steady, repetitive, or irregular change—using records, tables, or graphs of measurements where appropriate. d. Identify the biggest and the smallest possible values of something. **S5CS5** Students will communicate scientific ideas and activities clearly. a. Write instructions that others can follow in carrying out a scientific procedure. b. Make sketches to aid in explaining scientific procedures or ideas. c. Use numerical data in describing and comparing objects and events. d. Locate scientific information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.	Physics-Related Science: o They link cause and effect (for example, how physical and chemical changes impact on substances) and how using force produces motion (for example, how objects are affected by gravity, how the magnitude of a force affects the motion and the shape of an object, and how forces such as magnetism may act at a distance). o They describe how products or tools have been developed. o They consider how models are used to explain structures; for example, the arrangement of planets in the solar system, and the layers within the Earth and in the Earth's atmosphere. o They begin to design and build models to demonstrate the application of science concepts; for example, energy transformation and energy transfer in a solar barbecue, the reflection of light in periscopes, the desalination of water, and the double-pump action of the human heart. o Students use a variety of measuring instruments, including alcohol and digital thermometers, to develop an understanding of error in measurement, relating to both the instrument and instrument use. Application of Science: o They examine the work of Australian scientists to show how science knowledge has developed. o Students practice framing and investigating questions that interest them and are drawn from locally based issues; for example, sustainability of farming practices, comparative efficiencies of alternative forms and sources of energy used in the community, effectiveness of school recycling programs or the use of new technology. Environmental Science: o They develop skills in identifying the forms of evidence or data that are needed for drawing conclusions and proposing solutions to the particular scientific questions they generate. Chemistry & Materials-Related Science: They use hand lenses to examine the smaller visible parts that make up materials.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Elementary School	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 5	**Level 4** (pp. 89-91) → **Years 5-6**
Scientific Approach: **S5CS6** Students will question scientific claims and arguments effectively. a. Support statements with facts found in books, articles, and databases, and identify the sources used. b. Identify when comparisons might not be fair because some conditions are different. **S5CS7** Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that: a. Similar scientific investigations seldom produce exactly the same results, which may differ due to unexpected differences in whatever is being investigated, unrecognized differences in the methods or circumstances of the investigation, or observational uncertainties. b. Some scientific knowledge is very old and yet is still applicable today. **S5CS8** Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. b. Clear and active communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world. c. Scientists use technology to increase their power to observe things and to measure and compare things accurately. d. Science involves many different kinds of work and engages men and women of all ages and backgrounds. **S5P1** Students will verify that an object is the sum of its parts. a. Demonstrate that the mass of an object is equal to the sum of its parts by manipulating and measuring different objects made of various parts. b. Investigate how common items have parts that are too small to be seen without magnification.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 89-91) → **Years 5-6**
Scientific Approach: **S6E1** Students will explore current scientific views of the universe and how those views evolved. a. Relate the Nature of Science to the progression of basic historical scientific theories (geocentric and heliocentric) as they describe our solar system, and the Big Bang as it describes the formation b. Describe the position of the solar system in the Milky Way galaxy and the universe. c. Compare and contrast the planets in terms of o Size relative to the earth o Surface and atmospheric features o Relative distance from the sun o Ability to support life d. Explain the motion of objects in the day/night sky in terms of relative position. e. Explain that gravity is the force that governs the motion in the solar system. f. Describe the characteristics of comets, asteroids, and meteors. **S6E2** Students will understand the effects of the relative positions of the earth, moon and sun. a. Demonstrate the phases of the moon by showing the alignment of the earth, moon, and sun. b. Explain the alignment of the earth, moon, and sun during solar and lunar eclipses. c. Relate the tilt of the earth to the distribution of sunlight throughout the year and its effect on climate. **S6E6** Students will describe various sources of energy, and with their uses, and conservation. a. Explain the role of the sun as the major source of energy and the sun's relationship to wind and water energy. b. Identify renewable and nonrenewable resources. Chemistry & Materials Related Science: **S6E3** Students will recognize the significant role of water in earth processes. a. Explain that a large portion of the Earth's surface is water, consisting of oceans, rivers, lakes, underground water, and ice. b. Relate various atmospheric conditions to stages of the water cycle. c. Describe the composition, location, and subsurface topography of the world's oceans. d. Explain the causes of waves, currents, and tides.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 89-91) → **Years 5-6**
Chemistry & Materials Related Science: **S6E4** Students will understand how the distribution of land and oceans affects climate and weather. a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns. b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms. c. Relate how moisture evaporating from the oceans affects the weather patterns and the weather events such as hurricanes. **S6E5** Students will investigate the scientific view of how the earth's surface is formed. a. Compare and contrast the Earth's crust, mantle, and core including temperature, density, and composition. b. Investigate the composition of rocks in terms of minerals. c. Classify rocks by their process of formation. d. Describe processes that change rocks and the surface of the earth. e. Recognize that lithospheric plates constantly move and cause major geological events on the earth's surface. f. Explain the effects of physical processes (plate tectonics, erosion, deposition, volcanic eruption, gravity) on geological features including oceans (composition, currents, and tides). g. Describe how fossils show evidence of the changing surface and climate of the Earth. h. Describe soil as consisting of weathered rocks and decomposed organic material. i. Explain the effects of human activity on the erosion of the earth's surface. j. Describe methods for conserving natural resources such as water, soil, and air. Scientific Approach: **S6CS1** Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Understand the importance of—and keep—honest, clear, and accurate records in science. b. Understand that hypotheses are valuable if they lead to fruitful investigations, even if the hypotheses turn out not to be completely accurate descriptions.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 89-91) → **Years 5-6**
Scientific Approach: **S6CS10** Students will enhance reading in all curriculum areas by: a. Reading in All Curriculum Areas o Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. o Read both informational and fictional texts in a variety of genres and modes of discourse. o Read technical texts related to various subject areas. o b. Discussing books o Discuss messages and themes from books in all subject areas. o Respond to a variety of texts in multiple modes of discourse. o Relate messages and themes from one subject area to messages and themes in another area. o Evaluate the merit of texts in every subject discipline. o Examine author's purpose in writing. o Recognize the features of disciplinary texts. o c. Building vocabulary knowledge o Demonstrate an understanding of contextual vocabulary in various subjects. o Use content vocabulary in writing and speaking. o Explore understanding of new words found in subject area texts. o d. Establishing context o Explore life experiences related to subject area content. o Discuss in both writing and speaking how certain words are subject area related. o Determine strategies for finding content and contextual meaning for unknown words. **S6CS2** Students will use standard safety practices for all classroom laboratory and field investigations. a. Follow correct procedures for use of scientific apparatus. b. Demonstrate appropriate techniques in all laboratory situations. c. Follow correct protocol for identifying and reporting safety problems and violations.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 89-91) → **Years 5-6**
Scientific Approach: **S6CS3** Students will use computation and estimation skills necessary for analyzing data and following scientific explanations. a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers and decimals. b. Use metric input units (such as seconds, meters, or grams per milliliter) of scientific calculations to determine the proper unit for expressing the answer c. Address the relationship between accuracy and precision and the importance of each. d. Draw conclusions based on analyzed data. **S6CS4** Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities. a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. b. Estimate the effect of making a change in one part of a system on the system as a whole. c. Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, and temperature, and choose appropriate units for reporting various quantities. **S6CS5** Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. a. Observe and explain how parts are related to other parts in systems such as weather systems, solar systems, and ocean systems including how the output from one part of a system (in the form of material, energy, or information) can become the input to other parts (e.g., El Nino's effect on weather). b. Identify several different models (such as physical replicas, pictures, and analogies) that could be used to represent the same thing, and evaluate their usefulness, taking into account such things as the model's purpose and complexity. **S6CS6** Students will communicate scientific ideas and activities clearly. a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Primary School (Years PK-6)**
	Years 5 to 8 - Building Breadth and Depth
Grade 6	**Level 4** (pp. 89-91) → **Years 5-6**
b. Understand and describe how writing for scientific purposes is different from writing for literary purposes. c. Organize scientific information using appropriate tables, charts, and graphs, and identify relationships they reveal. **S6CS7** Students will question scientific claims and arguments effectively. a Question claims based on vague attributions (such as "Leading doctors say...") or on statements made by people outside the area of their particular expertise. b. Recognize that there may be more than one way to interpret a given set of findings. **S6CS8** Students will investigate the characteristics of scientific knowledge and how it is achieved. a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful. b. When new experimental results are inconsistent with an existing, well-established theory, scientists may require further experimentation to decide whether the results are flawed or the theory requires modification. c. As prevailing theories are challenged by new information, scientific knowledge may change and grow. **S6CS9** Students will investigate the features of the process of scientific inquiry. a. Scientific investigations are conducted for different reasons. They usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations. b. Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions. c. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. d. Scientists use technology and mathematics to enhance the process of scientific inquiry. e. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 93-95) → **Years 7-8**
Life Science: **S7L1** Students will investigate the diversity of living organisms and how they can be compared scientifically. a. Demonstrate the process for the development of a dichotomous key. b. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system (archaebacteria, eubacteria, protists, fungi, plants, and animals). **S7L2** Students will describe the structure and function of cells, tissues, organs, and organ systems. a. Explain that cells take in nutrients in order to grow and divide and to make needed materials. b. Relate cell structures (cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria) to basic cell functions. c. Explain that cells are organized into tissues, tissues into organs, organs into systems, and systems into organisms. d. Explain that tissues, organs, and organ systems serve the needs cells have for oxygen, food, and waste removal. e. Explain the purpose of the major organ systems in the human body (i.e., digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease). **S7L3** Students will recognize how biological traits are passed on to successive generations. a. Explain the role of genes and chromosomes in the process of inheriting a specific trait. b. Compare and contrast sexual and asexual reproduction in organisms (bacteria, protists, fungi, plants & animals). c. Recognize that selective breeding can produce plants or animals with desired traits. **S7L4** Students will examine the dependence of organisms on one another and their environments. a. Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments. b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism. c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species. d. Categorize relationships between organisms that are competitive or mutually beneficial.	***Standards*** **Science Knowledge and Understanding:** Chemistry & Materials-Related Science: o At Level 5, students use the particle model to explain structure and properties of matter, chemical reactions and factors that influence rate. Life Science: o They explain the structure and function of cells and how different cells work together. o Students explain the relationships, past and present, in living and non-living systems, in particular ecosystems, and human impact on these systems. o They analyze what is needed for living things to survive, thrive or adapt, now and in the future. o They explain how the observed characteristics of living things are used to establish a classification system. Physics-Related Science: o Students use everyday examples of machines, tools and appliances to show how the thermodynamic model describes energy and change, and force and motion. o They use time scales to explain the changing Earth and its place in space. o Students distinguish ideas about the Universe that have a scientific basis from those that do not. o They use physical and theoretical models to investigate geological processes. **Science at Work:** Chemistry & Materials-Related Science: o At Level 5, students demonstrate safe, technical uses of a range of instruments and chemicals, and of procedures for preparation and separation. Scientific Approach: o They design investigations that include measurement, using standard laboratory instruments and equipment and methods to improve accuracy in measurement. o They make systematic observations and interpret recorded data appropriately, according to the aims of the study. o Students justify their choice of instruments and the accuracy of their measurements, commenting on the reliability of the procedures, the measurements used, and the conclusions drawn against the prediction or hypothesis investigated. o They use appropriate diagrams and symbols when reporting on their investigations. o Students make and use models and images from computer software to interpret and explain observations.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 93-95) → **Years 7-8**
e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine). **S7L5** Students will examine the evolution of living organisms through inherited characteristics that promote survival of organisms and the survival of successive generations of their offspring. a. Explain that physical characteristics of organisms have changed over successive generations (e.g. Darwin's finches and peppered moths of Manchester). b. Describe ways in which species on earth have evolved due to natural selection. c. Explain how the fossil record found in sedimentary rock provides evidence for the long history of changing life forms. Scientific Approach: **S7CS1** Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Understand the importance of—and keep—honest, clear, and accurate records in science. b. Understand that hypotheses can be valuable, even if they turn out not to be completely accurate. **S7CS10** Students will enhance reading in all curriculum areas by: a. Reading in All Curriculum Areas o Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. o Read both informational and fictional texts in a variety of genres and modes of discourse. o Read technical texts related to various subject areas. b. Discussing books o Discuss messages and themes from books in all subject areas. o Respond to a variety of texts in multiple modes of discourse. o Relate messages and themes from one subject area to messages and themes in another area. o Evaluate the merit of texts in every subject discipline. o Examine author's purpose in writing. o Recognize the features of disciplinary texts. o c. Building vocabulary knowledge o Demonstrate an understanding of contextual vocabulary in various subjects.	o In field work, they demonstrate use of basic sampling procedures and represent relationships in ecosystems graphically. o Students use simulations to predict the effect of changes in an ecosystem. o They work effectively in a group to use science ideas to make operating models of devices. o Students identify, analyze and ask their own questions in relation to scientific ideas or issues of interest. ***Learning Focus:*** Physics-Related Science: o As students work towards the achievement of Level 5 standards in Science, they develop their understanding of The Law of Conservation of Energy and The Law of Conservation of Mass and apply these laws to familiar and new situations. o They construct simple electric circuits which include batteries. Scientific Approach: o They expand their knowledge of science to include abstract concepts, theories, principles and models drawn from traditional and emerging sciences. o They apply these to particular situations. Examples include: changing the rates of chemical reactions; using gear systems to demonstrate the relationship between force and energy; investigating the formation of rocks and minerals, including fossil fuels; modeling earthquakes as examples of geological processes; explaining tidal patterns; using data to compare the gravitational attraction between objects in space; expanding their ideas of space science to include meteors, comets, stars, galaxies and the Universe; and relating sustainability to the requirements for species survival and the management of resources. o They learn that the nature of scientific thinking is not static and relies upon knowledge, cultural perspectives, understanding and skills that are built up over time, shared and reflected upon, while incorporating new ideas, thinking and experimental evidence. o Students develop their understanding through the use of science ideas (theories, laws, principles and models) applied in particular situations; for example, testing formal understandings in controlled studies using appropriate experimental tools. o They discuss and elaborate particular theoretical knowledge or ways of working in areas of personal or public concern, interest or career, including researching scientific ideas expressed in science magazines and science fiction texts. o They develop confidence in justifying their selection of equipment and procedures, the type of data collected, and its relationship to the question under investigation.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 93-95) → **Years 7-8**
o Use content vocabulary in writing and speaking. o Explore understanding of new words found in subject area texts. d. Establishing context o Explore life experiences related to subject area content. o Discuss in both writing and speaking how certain words are subject area related. o Determine strategies for finding content and contextual meaning for unknown words. **S7CS2** Students will use standard safety practices for all classroom laboratory and field investigations. a. Follow correct procedures for use of scientific apparatus. b. Demonstrate appropriate techniques in all laboratory situations. c. Follow correct protocol for identifying and reporting safety problems and violations. **S7CS3** Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers, fractions, decimals, and percents. b. Use the mean, median, and mode to analyze a set of scientific data. c. Apply the metric system to a scientific investigation that includes metric to metric conversion. (i.e. centimeters to meters). d. Draw conclusions based on analyzed data. e. Decide what degree of precision is adequate, and round off appropriately. f. Address the relationship between accuracy and precision and the importance of each. **S7CS4** Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities. a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. b. Use appropriate tools for measuring objects and/or substances. c. Learn and use on a regular basis standard safety practices for scientific investigations.	o They use a range of tools (for example, their own or others' computer models, images and simulations) to explain and interpret observations. o They learn to present data in appropriate spreadsheet and graphical form. o They prepare and present reports of their investigations in a variety of formats, using diagrams and symbols to summarize their procedures. o Students practice safe, responsible and ethical behavior when conducting investigations using standard equipment and chemicals including acids and bases, electric circuit components and metals and non-metals. Life Science: o They develop an understanding of themselves as organisms composed of different cells and systems working together. o They explore the relationship between system failure and disease, in humans. o They investigate disease at the cellular, tissue and human body levels. o Students explore how scientific work has led to the discovery of new knowledge and understanding about the natural world and changed our understanding of ourselves and our future. Examples include the use of fossils and other information to construct a time scale for the history of Earth; the development of a classification system for living things, past and present; and the use of the particle model of matter to explain the behavior of materials. Environmental Science: o They compare the use of reusable, renewable and non-renewable resources, including energy. They investigate the effects of forces supporting or opposing each other; for example, floating and sinking, and speeding up and slowing down. Chemistry & Materials-Related Science: o Students develop skills in measuring mass, volume and density. o They learn to use appropriate units of measurement. o They participate in activities in which they identify, prepare and separate mixtures and solutions. o They learn to use basic sampling procedures when conducting fieldwork. o They design and perform controlled experiments. o They develop ideas about the responsible use and disposal of materials using Material Safety Data Sheets (MSDS). o They begin to write balanced chemical equations using symbols.

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 93-95) → **Years 7-8**
Scientific Approach: **S7CS5** Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. a. Observe and explain how parts can be related to other parts in a system such as predator/prey relationships in a community/ecosystem. b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing. **S7CS6** Students will communicate scientific ideas and activities clearly. a. Write clear, step-by-step instructions for conducting particular scientific investigations, operating a piece of equipment, or following a procedure. b. Write for scientific purposes incorporating data from circle, bar, and line graphs, two-way data tables, diagrams, and symbols. c. Organize scientific information using appropriate simple tables, charts, and graphs, and identify relationships they reveal. **S7CS7** Students will question scientific claims and arguments effectively. a. Question claims based on vague attributions (such as "Leading doctors say...") or on statements made by people outside the area of their particular expertise. b. Identify the flaws of reasoning that are based on poorly designed research (i.e., facts intermingled with opinion, conclusions based on insufficient evidence). c. Question the value of arguments based on small samples of data, biased samples, or samples for which there was no control. d. Recognize that there may be more than one way to interpret a given set of findings.	↑ **(Previous pages)**

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Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
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Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 7	**Level 5** (pp. 93-95) → **Years 7-8**
S7CS8 Students will investigate the characteristics of scientific knowledge and how that knowledge is achieved. a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful b. When new experimental results are inconsistent with an existing, well established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification. c. As prevailing theories are challenged by new information, scientific knowledge may change. **S7CS9** Students will investigate the features of the process of scientific inquiry. a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing competing theories. b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence. c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant. d. Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions. e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. f. Scientists use technology and mathematics to enhance the process of scientific inquiry. g. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
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Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 8	**Level 5** (pp. 93-95) → **Years 7-8**
Physics-Related Science: **S8P2** Students will be familiar with the forms and transformations of energy. a. Explain energy transformation in terms of the Law of Conservation of Energy. b. Explain the relationship between potential and kinetic energy. c. Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, sound) and their characteristics. d. Describe how heat can be transferred through matter by the collisions of atoms (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection). **S8P3** Students will investigate relationship between force, mass, and the motion of objects. a. Determine the relationship between velocity and acceleration. b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction. c. Demonstrate the effect of simple machines (lever, inclined plane, pulley, wedge, screw, and wheel and axle) on work. **S8P4** Students will explore the wave nature of sound and electromagnetic radiation. a. Identify the characteristics of electromagnetic and mechanical waves. b. Describe how the behavior of light waves is manipulated causing reflection, refraction diffraction, and absorption. c. Explain how the human eye sees objects and colors in terms of wavelengths. d. Describe how the behavior of waves is affected by medium (such as air, water, solids). e. Relate the properties of sound to everyday experiences. f. Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch. **S8P5** Students will recognize characteristics of gravity, electricity, and magnetism as major kinds of forces acting in nature. a. Recognize that every object exerts gravitational force on every other object and that the force exerted depends on how much mass the objects have and how far apart they are. b. Demonstrate the advantages and disadvantages of series and parallel circuits and how they transfer energy. c. Investigate and explain that electric currents and magnets can exert force on each other.	↑ **(Previous pages)**

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Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
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Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 8	**Level 5** (pp. 93-95) → **Years 7-8**
Chemistry & Materials Related Science: **S8P1** Students will examine the scientific view of the nature of matter. a. Distinguish between atoms and molecules. b. Describe the difference between pure substances (elements and compounds) and mixtures. c. Describe the movement of particles in solids, liquids, gases, and plasma states. d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility). e. Distinguish between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change in color). f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements. g. Identify and demonstrate the Law of Conservation of Matter. Scientific Approach: **S8CS1** Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Understand the importance of - and keep - honest, clear, and accurate records in science. b. Understand that hypotheses can be valuable even if they turn out not to be completely accurate. **S8CS10** Students will enhance reading in all curriculum areas by: a. Reading in All Curriculum Areas Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. Read both informational and fictional texts in a variety of genres and modes of discourse. Read technical texts related to various subject areas. b. Discussing books Discuss messages and themes from books in all subject areas. Respond to a variety of texts in multiple modes of discourse. Relate messages and themes from one subject area to messages and themes in another area. Evaluate the merit of texts in every subject discipline. Examine author's purpose in writing. Recognize the features of disciplinary texts.	↑ **(Previous pages)**

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	Years 5 to 8 - Building Breadth and Depth
Grade 8	**Level 5** (pp. 93-95) → **Years 7-8**
c. Building vocabulary knowledge o Demonstrate an understanding of contextual vocabulary in various subjects. o Use content vocabulary in writing and speaking. o Explore understanding of new words found in subject area texts. d. Establishing context o Explore life experiences related to subject area content. o Discuss in both writing and speaking how certain words are subject area related. o Determine strategies for finding content and contextual meaning for unknown words. **S8CS2** Students will use standard safety practices for all classroom laboratory and field investigations. a. Follow correct procedures for use of scientific apparatus. b. Demonstrate appropriate techniques in all laboratory situations. c. Follow correct protocol for identifying and reporting safety problems and violations. **S8CS3** Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations. a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers, fractions, decimals, and percents. b. Find the mean, median, and mode and use them to analyze a set of scientific data. c. Apply the metric system to scientific investigations that include metric to metric conversions (i.e., centimeters to meters). d. Decide what degree of precision is adequate, and round off appropriately. e. Address the relationship between accuracy and precision. f. Use ratios and proportions, including constant rates, in appropriate problems. **S8CS4** Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures. a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. b. Use appropriate tools and units for measuring objects and/or substances. c. Learn and use standard safety practices when conducting scientific investigations.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 8	**Level 5** (pp. 93-95) → **Years 7-8**
S8CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. a. Observe and explain how parts can be related to other parts in a system such as the role of simple machines in complex machines. b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing. **S8CS6** Students will communicate scientific ideas and activities clearly. a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure. b. Write for scientific purposes incorporating information from a circle, bar, or line graph, data tables, diagrams, and symbols. c. Organize scientific information in appropriate tables, charts, and graphs, and identify relationships they reveal. **S8CS7** Students will question scientific claims and arguments effectively. a. Question claims based on vague attributions (such as "Leading doctors say...") or on statements made by people outside the area of their particular expertise. b. Identify the flaws of reasoning in arguments that are based on poorly designed research (e.g., facts intermingled with opinion, conclusions based on insufficient evidence). c. Question the value of arguments based on small samples of data, biased samples, or samples for which there was no control. d. Recognize that there may be more than one way to interpret a given set of findings. **S8CS8** Students will be familiar with the characteristics of scientific knowledge and how it is achieved. a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful. b. When new experimental results are inconsistent with an existing, well established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification. c. As prevailing theories are challenged by new information, scientific knowledge may change.	↑ **(Previous pages)**

Table 3 (Continued).

Georgia Performance Standards (United States) For Grades K-8 → Kindergarten to Middle School)	**Victorian Essential Learning Standards (Australia)** For Years P-8 → Kindergarten to Middle School)
Subject(s): **K-8 Science**	Dimension(s): **Science**
Middle School → For Grades 6-8	**Secondary School (Years 7-8)**
	Years 5 to 8 - Building Breadth and Depth
Grade 8	**Level 5** (pp. 93-95) → **Years 7-8**
Scientific Approach: **S8CS9** Students will understand the features of the process of scientific inquiry. a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing different theories. b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence. c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant. d. Scientists often collaborate to design research. To prevent this bias, scientists conduct independent studies of the same questions. e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. f. Scientists use technology and mathematics to enhance the process of scientific inquiry. g. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.	↑ **(Previous pages)**

"Essential" Science Subjects for High School (Physics, Chemistry and Scientific Approach)

Table 4A
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Physics

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Physics**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
Motion and Force: **SP1** Students will analyze the relationships between force, mass, gravity, and the motion of objects. a. Calculate average velocity, instantaneous velocity, and acceleration in a given frame of reference. b. Compare and contrast scalar and vector quantities. c. Compare graphically and algebraically the relationships among position, velocity, acceleration, and time. d. Measure and calculate the magnitude of frictional forces and Newton's three Laws of Motion. e. Measure and calculate the magnitude of gravitational forces. f. Measure and calculate two-Dimension(s)al motion (projectile and circular) by using component vectors. g. Measure and calculate centripetal force. h. Determine the conditions required to maintain a body in a state of static equilibrium. **SPS8** Students will determine relationships among force, mass, and motion. a. Calculate velocity and acceleration. b. Apply Newton's three laws to everyday situations by explaining the following: o Inertia o Relationship between force, mass and acceleration o Equal and opposite forces c. Relate falling objects to gravitational force d. Explain the difference in mass and weight. e. Calculate amounts of work and mechanical advantage using simple machines.	***Standards:*** **Science knowledge and understanding:** Physics: o Students explain change in terms of energy in a range of biological, chemical and physical contexts. o They give both qualitative and quantitative explanations of the relationships between force, mass and movement. ***Learning Focus:*** Physics: o Students develop a qualitative and quantitative understanding of the relationships between force, mass and movement. o Students develop an understanding of the constancy of the 'big' ideas of science (matter, energy, time and space) and science methodologies across different areas and contexts.

Table 4A (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Physics**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
Energy: **SP2** Students will evaluate the significance of energy in understanding the structure of matter and the universe. Elements: a. Relate the energy produced through fission and fusion by stars as a driving force in the universe. b. Explain how the instability of radioactive isotopes results in spontaneous nuclear reactions. **SP3** Students will evaluate the forms and transformations of energy. a. Analyze, evaluate, and apply the principle of conservation of energy and measure the components of work-energy theorem by describing total energy in a closed system. o identifying different types of potential energy. o calculating kinetic energy given mass and velocity. o relating transformations between potential and kinetic energy. b. Explain the relationship between matter and energy. c. Measure and calculate the vector nature of momentum. d. Compare and contrast elastic and inelastic collisions. e. Demonstrate the factors required to produce a change in momentum. f. Analyze the relationship between temperature, internal energy, and work done in a physical system. g. Analyze and measure power. **SPS7** Students will relate transformations and flow of energy within a system. a. Identify energy transformations within a system (e.g. lighting of a match). b. Investigate molecular motion as it relates to thermal energy changes in terms of conduction, convection, and radiation. c. Determine the heat capacity of a substance using mass, specific heat, and temperature. d. Explain the flow of energy in phase changes through the use of a phase diagram.	↑ **(Previous pages)**

Table 4A (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Physics**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
Electro-magnetic waves: **SPS9** Students will investigate the properties of waves. a. Recognize that all waves transfer energy. b. Relate frequency and wavelength to the energy of different types of electromagnetic waves and mechanical waves. c. Compare and contrast the characteristics of electromagnetic and mechanical (sound) waves. d. Investigate the phenomena of reflection, refraction, interference, and diffraction. e. Relate the speed of sound to different mediums. f. Explain the Doppler Effect in terms of everyday interactions. **SP4** Students will analyze the properties and applications of waves. a. Explain the processes that results in the production and energy transfer of electromagnetic waves. b. Experimentally determine the behavior of waves in various media in terms of reflection, refraction, and diffraction of waves. c. Explain the relationship between the phenomena of interference and the principle of superposition. d. Demonstrate the transfer of energy through different mediums by mechanical waves. e. Determine the location and nature of images formed by the reflection or refraction of light. **SP5** Students will evaluate relationships between electrical and magnetic forces. a. Describe the transformation of mechanical energy into electrical energy and the transmission of electrical energy. b. Determine the relationship among potential difference, current, and resistance in a direct current circuit. c. Determine equivalent resistances in series and parallel circuits. d. Determine the relationship between moving electric charges and magnetic fields. **SPS10** Students will investigate the properties of electricity and magnetism. a. Investigate static electricity in terms of o friction o induction o conduction	↑ **(Previous pages)**

Table 4A (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Physics**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
b. Explain the flow of electrons in terms of o alternating and direct current. o the relationship among voltage, resistance and current. o simple series and parallel circuits. c. Investigate applications of magnetism and/or its relationship to the movement of electrical charge as it relates to o electromagnets o simple motors o permanent magnets Relativity & Modern Physics: **SP6** The student will describe the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large. a. Explain matter as a particle and as a wave. b. Describe the Uncertainty Principle. c. Explain the differences in time, space, and mass measurements by two observers when one is in a frame of reference moving at constant velocity parallel to one of the coordinate axes of the other observer's frame of reference if the constant velocity is greater than one tenth the speed of light. d. Describe the gravitational field surrounding a large mass and its effect on a ray of light. **SPS3** Students will distinguish the characteristics and components of radioactivity. a. Differentiate between alpha and beta particles and gamma radiation. b. Differentiate between fission and fusion. c. Explain the process half-life as related to radioactive decay. d. Describe nuclear energy, its practical application as an alternative energy source, and its potential problems. **SPS5** Students will compare and contrast the phases of matter as they relate to atomic and molecular motion. a. Compare and contrast the atomic/molecular motion of solids, liquids, gases and plasmas. b. Relate temperature, pressure, and volume of gases to the behavior of gases.	↑ **(Previous pages)**

Table 4B
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Chemistry

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Chemistry**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
Classified as "Physics:" **SPS1** Students will investigate our current understanding of the atom. a. Examine the structure of the atom in terms of o proton, electron, and neutron locations. o atomic mass and atomic number. o atoms with different numbers of neutrons (isotopes). o explain the relationship of the proton number to the element's identity. b. Compare and contrast ionic and covalent bonds in terms of electron position. **SPS2** Students will explore the nature of matter, its classifications, and the system for naming types of matter. a. Calculate density when given a means to determine a substance's mass and volume. b. Predict formulas for stable binary ionic compounds based on balance of charges. c. Use IUPAC nomenclature for transition between chemical names and chemical formulas of o binary ionic compounds (containing representative elements). o binary covalent compounds (i.e. carbon dioxide, carbon tetrachloride). d. Demonstrate the Law of Conservation of Matter in a chemical reaction. e. Apply the Law of Conservation of Matter by balancing the following types of chemical equations: o Synthesis o Decomposition o Single Replacement o Double Replacement	***Standards:*** **Science knowledge and understanding:** Chemistry: o Students explain the behavior and properties of materials in terms of their constituent particles and the forces holding them together. o They explain how similarities in the chemical behavior of elements and their compounds and their atomic structures are represented in the way the periodic table has been constructed. o They use the periodic table to write electronic configurations for a range of elements representative of the major groups and periods in the periodic table. o They use atomic symbols and balanced chemical equations to summarize chemical reactions, including neutralization, precipitation and combustion. **Science at work:** Chemistry: o They use chemicals (including biomaterials), equipment, electronic components and instruments responsibly and safely.

Table 4B (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Chemistry**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SPS4 Students will investigate the arrangement of the Periodic Table. a. Determine the trends of the following: o Number of valence electrons o Types of ions formed by representative elements o Location of metals, nonmetals, and metalloids o Phases at room temperature b. Use the Periodic Table to predict the above properties for representative elements. **SPS6** Students will investigate the properties of solutions. a. Describe solutions in terms of o solute/solvent o conductivity o concentration b. Observe factors affecting the rate a solute dissolves in a specific solvent. c. Demonstrate that solubility is related to temperature by constructing a solubility curve. d. Compare and contrast the components and properties of acids and bases. e. Determine whether common household substances are acidic, basic, or neutral. Classified as "Chemistry:" **SC1** Students will analyze the nature of matter and its classifications. a. Relate the role of nuclear fusion in producing essentially all elements heavier than hydrogen. b. Identify substances based on chemical and physical properties. c. Predict formulas for stable ionic compounds (binary and tertiary) based on balance of charges. d. Use IUPAC nomenclature for both chemical names and formulas: o Ionic compounds (Binary and tertiary) o Covalent compounds (Binary and tertiary) o Acidic compoupounds (Binary and tertiary)	↑ **(Previous pages)**

Table 4B (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Chemistry**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SC2 Students will relate how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions. a. Identify and balance the following types of chemical equations: o Synthesis o Decomposition o Single Replacement o Double Replacement o Combustion b. Experimentally determine indicators of a chemical reaction specifically precipitation, gas evolution, water production, and changes in energy to the system. c. Apply concepts of the mole and Avogadro's number to conceptualize and calculate o Empirical/molecular formulas, o Mass, moles and molecules relationships, o Molar volumes of gases. d. Identify and solve different types of stoichiometry problems, specifically relating mass to moles and mass to mass. e. Demonstrate the conceptual principle of limiting reactants. f. Explain the role of equilibrium in chemical reactions. **SC3** Students will use the modern atomic theory to explain the characteristics of atoms. a. Discriminate between the relative size, charge, and position of protons, neutrons, and electrons in the atom. b. Use the orbital configuration of neutral atoms to explain its effect on the atom's chemical properties. c. Explain the relationship of the proton number to the element's identity. d. Explain the relationship of isotopes to the relative abundance of atoms of a particular element. e. Compare and contrast types of chemical bonds (i.e. ionic, covalent). f. Relate light emission and the movement of electrons to element identification.	↑ **(Previous pages)**

Table 4B (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Chemistry**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SC4 Students will use the organization of the Periodic Table to predict properties of elements. a. Use the Periodic Table to predict periodic trends including atomic radii, ionic radii, ionization energy, and electronegativity of various elements. b. Compare and contrast trends in the chemical and physical properties of elements and their placement on the Periodic Table. **SC5** Students will understand that the rate at which a chemical reaction occurs can be affected by changing concentration, temperature, or pressure and the addition of a catalyst. a. Demonstrate the effects of changing concentration, temperature, and pressure on chemical reactions. b. Investigate the effects of a catalyst on chemical reactions and apply it to everyday examples. c. Explain the role of activation energy and degree of randomness in chemical reactions. **SC6** Students will understand the effects motion of atoms and molecules in chemical and physical processes. a. Compare and contrast atomic/molecular motion in solids, liquids, gases, and plasmas. b. Collect data and calculate the amount of heat given off or taken in by chemical or physical processes. c. Analyzing (both conceptually and quantitatively) flow of energy during change of state (phase). Teacher Note: The use of Gas Laws to achieve this standard is permissible, but not mandated. **SC7** Students will characterize the properties that describe solutions and the nature of acids and bases. a. Explain the process of dissolving in terms of solute/solvent interactions: o Observe factors that effect the rate at which a solute dissolves in a specific solvent o Express concentrations as molarities, o Prepare and properly label solutions of specified molar concentration, o Relate molality to colligative properties. b. Compare, contrast, and evaluate the nature of acids and bases: o Arrhenius, Bronsted-Lowry Acid/Bases o Strong vs. weak acids/bases in terms of percent dissociation o Hydronium ion concentration o pH Acid-Base neutralization	↑ **(Previous pages)**

Table 4C
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Scientific Approach

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Scientific Approach**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SCSh1 Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science. a. Exhibit the above traits in their own scientific activities. b. Recognize that different explanations often can be given for the same evidence. c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations. **SCSh2** Students will use standard safety practices for all classroom laboratory and field investigations. a. Follow correct procedures for use of scientific apparatus. b. Demonstrate appropriate techniques in all laboratory situations. c. Follow correct protocol for identifying and reporting safety problems and violations. **SCSh3** Students will identify and investigate problems scientifically. a. Suggest reasonable hypotheses for identified problems. b. Develop procedures for solving scientific problems. c. Collect, organize and record appropriate data. d. Graphically compare and analyze data points and/or summary statistics. e. Develop reasonable conclusions based on data collected. f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information. **SCSh4** Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials. a. Develop and use systematic procedures for recording and organizing information. b. Use technology to produce tables and graphs. c. Use technology to develop, test, and revise experimental or mathematical models.	***Standards:*** **Science at work:** Application of Science: o Students describe the science base of science-related occupations in their local community. o They use the relevant science concepts and relationships as one Dimension(s) of debating contentious and/or ethically based science-related issues of broad community concern. o They demonstrate an awareness of the ways in which scientific vocabulary is used incorrectly in the mass media, distinguishing between the intended meaning of such terms and their meaning in non-scientific contexts. o They provide two examples of the work of scientists that demonstrate different approaches to developing scientific knowledge or solving a scientific problem. Scientific Approach: o Students formulate their own hypotheses and plan and conduct investigations in order to prove or disprove them. o They select appropriate equipment and measurement procedures that will ensure a high degree of reliability in data collected and enable valid conclusions to be drawn. o They construct working models and visual aids that demonstrate scientific ideas. o They present experimental results using appropriate data presentation formats, and comment on the nature of experimental errors. o They use Material Safety Data Sheets (MSDS) and risk assessment to evaluate the safety of their investigations. o They evaluate the appropriateness of the experimental design and methodology used to investigate their predictions.

Table 4C (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Scientific Approach**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SCSh5 Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations. a. Trace the source on any large disparity between estimated and calculated answers to problems. b. Consider possible effects of measurement errors on calculations. c. Recognize the relationship between accuracy and precision. d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate. e. Solve scientific problems by substituting quantitative values, using Dimension(s)al analysis and/or simple algebraic formulas as appropriate. **SCSh6** Students will communicate scientific investigations and information clearly. a. Write clear, coherent laboratory reports related to scientific investigations. b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data. c. Use data as evidence to support scientific arguments and claims in written or oral presentations. d. Participate in group discussions of scientific investigation and current scientific issues. **SCSh7** Students will analyze how scientific knowledge is developed. Students will recognize that: a. The universe is a vast single system in which the basic principles are the same everywhere. b. Universal principles are discovered through observation and experimental verification. c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group. d. Hypotheses often cause scientists to develop new experiments that produce additional data. e. Testing, revising, and occasionally rejecting new and old theories never ends. **SCSh8** Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices: a. Scientific investigators control the conditions of their experiments in order to produce valuable data.	***Learning Focus:*** Scientific Approach: o As students work towards the achievement of Level 6 standards in Science, they extend their concept of science as a way of knowing to include an understanding of how scientific theories and models drawn from traditional and emerging sciences are based on evidence that may initially be tentative and limited. Examples include atomic structure, natural selection and evolution, development of medicines, genetic inheritance, and the genesis of the Universe. o They explore the ways in which scientific theories are both powerful (in guiding thinking and investigation) and tentative (in being open to change) at the same time. o They understand that the features of science as a way of knowing lead to it being: empirical and non-empirical, creative and methodical, and speculative and logical. o They appreciate that people of diverse cultures have contributed to and shaped the development of science. o Students develop a qualitative and quantitative understanding of the relationships between force, mass and movement. o Students learn that scientific theories are both powerful and never final, that clarity is always assumed to be a significant attribute of science theories, and that the use of a theory to successfully predict the consequences of changes to situations is important in the validation of the theory. o Students design and conduct scientific investigations of their choice in ways that lead to the collection, interpretation and presentation of valid data. o They explain trends and patterns in data, identify discrepancies in experimental results and suggest improvements to their investigations. o They learn to use correct units of measurement when recording quantities. o They use Material Safety Data Sheets (MSDS). when appropriate. o Using a variety of formats, students prepare investigation reports learning to use symbols and diagrams extensively to illustrate procedures and data analysis, and support the conclusions drawn and presented. o Students develop an understanding of the constancy of the 'big' ideas of science (matter, energy, time and space) and science methodologies across different areas and contexts.

Table 4C (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Scientific Approach**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations. c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting. d. The merit of a new theory is judged by how well scientific data are explained by the new theory. e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases. f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought. **SCSh9** Students will enhance reading in all curriculum areas by: a. Reading in All Curriculum Areas o Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. o Read both informational and fictional texts in a variety of genres and modes of discourse. o Read technical texts related to various subject areas. b. Discussing books o Discuss messages and themes from books in all subject areas. o Respond to a variety of texts in multiple modes of discourse. o Relate messages and themes from one subject area to messages and themes in another area. o Evaluate the merit of texts in every subject discipline. o Examine author's purpose in writing. o Recognize the features of disciplinary texts. c. Building vocabulary knowledge o Demonstrate an understanding of contextual vocabulary in various subjects. o Use content vocabulary in writing and speaking. o Explore understanding of new words found in subject area texts. d. Establishing context o Explore life experiences related to subject area content. o Discuss in both writing and speaking how certain words are subject area related. Determine strategies for finding content and contextual meaning for unknown words.	Application of Science: o They investigate, create and produce a range of strategies and products that explore, encourage and communicate the responsible use and management of natural and processed resources. o Students make links across related areas of science; for example, biotechnology (biology and chemistry); communication satellites (physics and astronomy); neuroscience (psychology, biology and chemistry); synchrotron science (biology, chemistry and physics); resource management and green chemistry (chemistry and earth and environmental science); and habitat renewal (earth and environmental sciences and biology). o They explore the opportunities for employment in science-related occupations and industries in their community, and consider the dynamic and collaborative nature of these roles. o They debate, from the basis of scientific knowledge, the merits and problems of science-related issues that are reported in the popular media, particularly those that embrace a clear ethical Dimension(s). o They also explore the ways in which science concepts, language and perspectives can be misunderstood and misrepresented. Students cite instances in which social priorities have had an impact on or have been influenced by society. o This involves students applying their conceptual understandings to the consideration of issues significant to themselves as individuals and to the broader society in which they live; for example, stem cell research, ecotourism, tourism in space, personal safety, a clean and healthy environment, energy use, ecological footprints, electronic gadgets, robotics, the history and philosophy of science, ethics and science research.

High School Science Subjects Related to Natural Environment & Physical Universe

Table 4D
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Environmental Science

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Environmental Science**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEV1 Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society. a. Interpret biogeochemical cycles including hydrologic, nitrogen, phosphorus, oxygen, and carbon cycles. Recognize that energy is not recycled in ecosystems. b. Relate energy changes to food chains, food webs, and to trophic levels in a generalized ecosystem, recognizing that entropy is a primary factor in the loss of usable food energy during movement up the trophic levels. c. Relate food production and quality of nutrition to population growth and the trophic levels. d. Relate the cycling of matter and the flow of energy to the Laws of Conservation of matter and energy. Identify the role and importance of decomposers in the recycling process. e. Distinguish between abiotic and biotic factors in an ecosystem and describe how matter and energy move between these. **SEV2** Students will demonstrate an understanding that the Earth is one interconnected system. a. Describe how the abiotic components (water, air, and energy) affect the biosphere. b. Recognize and give examples of the hierarchy of the biological entities of the biosphere (organisms, populations, communities, ecosystems, and biosphere). c. Characterize the components that define a Biome. Abiotic Factors - to include precipitation, temperature and soils. Biotic Factors - plant and animal adaptations that create success in that biome. d. Characterize the components that define fresh-water and marine systems. Abiotic Factors - to include light, dissolved oxygen, phosphorus, nitrogen, pH and substrate. Biotic Factors - plant and animal adaptations characteristic to that system.	***Standards:*** **Science knowledge and understanding:** Environmental Science: o They identify and classify the sources of wastes generated, and describe their management, within the community and in industry. o They use a specific example to explain the sustainable management of a resource. ***Learning Focus:*** Environmental Science: o Students investigate sources of waste generated within the community and consider waste treatment and management options. o They learn how wastes are generated in the processing of natural materials (for example, oil, water, brown coal and ores), and how the procedures used to manage these wastes contribute to environmental sustainability.

Table 4D (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Environmental Science**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEV3 Students will describe stability and change in ecosystems. a. Describe interconnections between abiotic and biotic factors, including normal cyclic fluctuations and changes associated with climatic change (i.e. ice ages). b. Explain succession in terms of changes in communities through time to include changes in biomass, diversity, and complexity. c. Explain how succession may be altered by traumatic events. d. Explain how biotic and abiotic factors influence populations. e. Describe interactions between individuals (i.e. mutualism, commensalisms, parasitism, predation, and competition). **SEV4** Students will understand and describe availability, allocation and conservation of energy and other resources. a. Differentiate between renewable and nonrenewable resources including how different resources are produced, rates of use, renewal rates, and limitations of sources. Distinguish between natural and produced resources. b. Describe how technology is increasing the efficiency of utilization and accessibility of resources. c. Describe how energy and other resource utilization impact the environment and recognize that individuals as well as larger entities (businesses, governments, etc.) have impact on energy efficiency. d. Describe the relationship of energy consumption and the living standards of societies. e. Describe the commonly used fuels (e.g. fossil fuels, nuclear fuels, etc.) and some alternative fuels (e.g. wind, solar, ethanol, etc.) including the required technology, availability, pollution problems and implementation problems. Recognize the origin of fossil fuels and the problems associated with our dependence on this energy source. f. Describe the need for informed decision making of resource utilization. (i.e. energy and water usage allocation, conservation, food and land, and long-term depletion)	↑ **(Previous pages)**

Table 4D (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Environmental Science**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEV5 Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems. a. Describe factors affecting population growth of all organisms, including humans. Relate these to factors affecting growth rates and carrying capacity of the environment. b. Describe the effects of population growth, demographic transitions, cultural differences, emergent diseases, etc. on societal stability. c. Explain how human activities affect global and local sustainability. d. Describe the actual and potential effects of habitat destruction, erosion, and depletion of soil fertility associated with human activities. e. Describe the effects and potential implications of pollution and resource depletion on the environment at the local and global levels (e.g. air and water pollution, solid waste disposal, depletion of the stratospheric ozone, global warming, and land uses). f. Describe how political, legal, social, and economic decisions may affect global and local ecosystems.	↑ **(Previous pages)**

Table 4E
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Ecology

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Ecology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEC1 Students will investigate how biotic and abiotic factors interact to affect the distribution of species and the diversity of life on Earth. a. Characterize the biotic and abiotic components that define various biomes and aquatic life zones. b. Explore how global climate patterns and biogeography affect the distribution and abundance of species on Earth. c. Investigate factors that lead to the species richness of an ecosystem and describe the importance of biodiversity. d. Relate the role of natural selection to organismal adaptations that are specific to their habitats and describe some examples of coevolution. **SEC2** Students will describe factors influencing population density, dispersion, and demographics. a. Explore factors that regulate population growth. b. Investigate models that predict population growth. c. Explore the role of intraspecific competition in population growth and population density d. Describe the different life history and reproductive strategies that have evolved in organisms. e. Relate the rapid growth of human population to environmental problems. **SEC3** Students will explore and analyze community interactions. a. Identify examples of species interactions (e.g. predation, parasitism, mutualism, commensalism, and competition) and adaptations that have evolved in response to interspecific selective pressures. b. Explore ecological niches and resource partitioning. c. Identify dominant, keystone, and foundation species and their roles in ecosystems and communities. d. Analyze species diversity as it relates to the stability of ecosystems and communities. e. Describe ecological succession in terms of changes in communities over time and the impact of disturbance on community composition.	↑ **(Previous Table 4D)**

Table 4E (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Ecology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEC4 Students will investigate biogeochemical cycles and the flow of energy in ecosystems. a. Interpret the carbon, water, oxygen, phosphorous, nitrogen, and sulfur cycles, describing their flow through biotic and abiotic pools, including human influences. b. Relate the first and second laws of thermodynamics to the flow of energy in ecosystems. c. Investigate the flow of energy in the living world by constructing food chains, webs and pyramids for various ecosystems. d. Investigate the role of decomposers in food webs and relate their role to the law of conservation of matter. e. Explore the importance of primary productivity in ecosystems. **SEC5** Students will assess the impact of human activities on the natural world and explore how ecological theory and research can address current issues facing our society. a. Describe the sources, environmental impacts, and mitigation measures for major primary and secondary pollutants b. Assess the ecological impact of non-sustainable use of resources, including soil, timber, fish and wild game, mineral resources, and nonrenewable energy. c. Describe and differentiate between causes and impacts on ecosystems of natural, cyclic climate change and anthropogenic climate change d. Explain the consequences of habitat fragmentation and habitat loss on biodiversity in relation to island biogeography, and apply island biogeography theory to the design of parks and nature preserves e. Describe the history and importance of agriculture to humans and society, including major milestones in agricultural development (agricultural revolution, industrial revolution, green revolution, and gene revolution). f. Analyze the benefits and imbalances associated with integrated pest management.	↑ **(Previous Table 4D)**

Table 4F
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Earth System

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Earth System**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SES1 Students will investigate the composition and formation of Earth systems, including the Earth's relationship to the solar system. a. Describe the early evolution of the Earth and solar system, including the formation of Earth's solid layers (core, mantle, crust), the distribution of major elements, the origin of internal heat sources, and the mechanism by which heat transfer drives plate tectonics. b. Explain how the composition of the Earth's crust, mantle and core is determined and compare it to that of other solar system objects. c. Describe how the decay of radioactive isotopes is used to determine the age of rocks, Earth, and solar system. d. Describe how the Earth acquired its initial oceans and atmosphere. e. Identify the transformations and major reservoirs that make up the rock cycle, hydrologic cycle, carbon cycle, and other important geochemical cycles. **SES2** Students will understand how plate tectonics creates certain geologic features, materials, and hazards. a. Distinguish among types of plate tectonic settings produced by plates diverging, converging, and sliding past each other. b. Relate modern and ancient geologic features to each kind of plate tectonic setting. c. Relate certain geologic hazards to specific plate tectonic settings. d. Associate specific plate tectonic settings with the production of particular groups of igneous and metamorphic rocks and mineral resources. e. Explain how plate tectonics creates and destroys sedimentary basins through time.	↑ **(Previous Table 4D)**

Table 4F (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Earth System**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SES3 Students will explore the actions of water, wind, ice, and gravity that create landforms and systems of landforms (landscapes). a. Describe how surface water and groundwater act as the major agents of physical and chemical weathering. b. Explain how soil results from weathering and biological processes acting on parent rock.c. Describe the processes and hazards associated with both sudden and gradual mass wasting. d. Relate the past and present actions of ice, wind, and water to landform distribution and landscape evolution. e. Explain the processes that transport and deposit material in terrestrial and marine sedimentary basins, which result, over time, in sedimentary rock. **SES4** Students will understand how rock relationships and fossils are used to reconstruct the Earth's past. a. Describe and apply principles of relative age (superposition, original horizontality, cross-cutting relations, and original lateral continuity) and describe how unconformities form. b. Interpret the geologic history of a succession of rocks and unconformities. c. Apply the principle of uniformitarianism to relate sedimentary rock associations and their fossils to the environments in which the rocks were deposited. d. Explain how sedimentary rock units are correlated within and across regions by a variety of methods (e.g., geologic map relationships, the principle of fossil succession, radiometric dating, and paleomagnetism). e. Use geologic maps and stratigraphic relationships to interpret major events in Earth history (e.g., mass extinction, major climatic change, tectonic events). **SES5** Students will investigate the interaction of insolation and Earth systems to produce weather and climate. a. Explain how latitudinal variations in solar heating create atmospheric and ocean currents that redistribute heat globally. b. Explain the relationship between air masses and the surfaces over which they form. c. Relate weather patterns to interactions among ocean currents, air masses, and topography. d. Describe how temperature and precipitation produce the pattern of climate regions (classes) on Earth. e. Describe the hazards associated with extreme weather events and climate change (e.g., hurricanes, tornadoes, El Niño/La Niña, global warming).	↑ **(Previous Table 4D)**

Table 4F (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Earth System**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SES6 Students will explain how life on Earth responds to and shapes Earth systems. a. Relate the nature and distribution of life on Earth, including humans, to the chemistry and availability of water. b. Relate the distribution of biomes (terrestrial, freshwater, and marine) to climate regions through time. c. Explain how geological and ecological processes interact through time to cycle matter and energy, and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion). d. Describe how fossils provide a record of shared ancestry, evolution, and extinction that is best explained by the mechanism of natural selection. e. Identify the evolutionary innovations that most profoundly shaped Earth systems: photosynthetic prokaryotes and the atmosphere; multicellular animals and marine environments; land plants and terrestrial environments.	↑ **(Previous Table 4D)**

Table 4G
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Geology

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Geology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SG1 Students will interpret the geologic history of the Earth. a. Describe the formation and evolution of the Earth including the lithosphere, hydrosphere, and atmosphere as driven by internal/external energy sources (i.e. solar, radioactive, gravitational). b. Use fossils, radiometric dating and stratigraphic relationships and geologic maps (e.g. cross cutting, superposition, uniformitarianism) to interpret Earth?s history. c. Explain how catastrophic and long-term events have impacted the evolution of life on Earth. d. Relate the geologic history of Georgia to that of surrounding regions. **SG2** Students will interpret the geologic conditions and processes that form different rocks and minerals. a. Describe how minerals form under diverse geological conditions. b. Distinguish between the processes that form plutonic (intrusive) and volcanic (extrusive) igneous rocks of differing compositions, including magmatic differentiation. c. Differentiate between processes that form various types of sedimentary rocks. d. Interpret the changes in common sedimentary and igneous rocks under a variety of metamorphic conditions. **SG3** Students will investigate the evidence for plate tectonics; evaluate the importance of Earth's internal processes and assess the relationship between plate tectonic boundary type and certain disasters such as earthquakes and volcanic eruptions. a. Analyze the mechanisms that drive plate motion, the different types of plate boundaries, and how boundary type relates to mountain building, earthquakes, volcanism, and features such as island arcs, hot spots, and mid ocean ridges. b. Compare and contrast folded, fault-block, and volcanic mountains and analyze their relationship to plate tectonic setting. c. Analyze cross-sectional diagrams to differentiate between types of folds and faults and the landforms they produce.	↑ **(Previous Table 4D)**

Table 4G (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Geology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
d. Classify volcanoes, using their interior/exterior features, magma composition and their plate tectonic settings and assess current volcanic hazards in the United States. e. Research current technology that improves our ability to predict natural disasters and mitigate their effects. f. Evaluate the differences in seismic activity at plate margins versus mid-plate areas and assess the degree of seismic risk in different parts of the United States including Georgia. **SG4** Students will evaluate how climate systems affect landforms on the surface of the Earth. a. Analyze the effects of climate on weathering processes and soil formation. b. Characterize the geologic processes and resulting landforms of desert and glacial areas. c. Distinguish specific landforms and geologic features on topographic maps. d. Examine the features of various coastal systems in different areas; erosion and depositional features, barrier islands, coastal management, and tides as an energy resource. e. Investigate the characteristics, geologic processes, and human impacts associated with surface and groundwater as a natural resource in Georgia. f. Discuss how changes in greenhouse gases have affected Earth's climate history. **SG5** Students will apply geologic knowledge to the use of resources in the Earth and the control of human impacts on Earth's systems. a. Investigate the geologic origin, distribution, limitations, and economic importance of mineral resources, including those obtained in Georgia. b. Compare and contrast the types and origins of gemstones and their occurrence in Georgia. c. Research current controversies regarding the extraction and use of geologic resources (e.g. causes of global warming, drilling for oil, safety and environmental impact of mining). d. Compare and contrast the impacts of using energy resources obtained from the Earth, with those of energy alternatives.	↑ **(Previous Table 4D)**

Table 4H
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Oceanography

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Oceanography**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SO1 Students will identify characteristics, physical features, and boundaries of the oceans. a. Trace the development of the theory of plate tectonics. b. Explain how the dynamic events at plate boundaries influence oceans and continents. c. Differentiate between features of the continental margins and the deep ocean basins. d. Identify the sources of the main types of marine sediments and describe how marine sediments are used in paleoceanography. **SO2** Students will relate how the oceans are integral to all life on earth and how biogeochemical processes in the oceans influence the entire planet. a. Explain how the hydrologic cycle integrates the oceans and the land. b. Identify the role of the oceans in global biogeochemical cycles. c. Distinguish between photosynthesis and chemosynthesis in ocean flora. d. Analyze the flow of energy in marine ecosystems. e. Describe the limiting factors that influence the primary productivity of the oceans. **SO3** Students will analyze how weather and climate are influenced by the oceans. a. Identify general global patterns of atmospheric and oceanic circulation including variations such as El Nino and monsoons. b. Explain the influence of the Coriolis Effect on winds, ocean currents, and on weather and climate. c. Describe the effects of tilt of the earth, solar energy inputs, and heat capacity of land and oceans on the resulting patterns of weather and climate. d. Explain relationships between climate change, the greenhouse effect, and the consequences of global warming on the ocean.	**N/A**

Table 4H (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Oceanography**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SO4 Students will investigate waves and tides and analyze their influence on coastal processes. a. Explain how waves are generated. b. Explain the role of the moon and the sun in the formation of tides and tide patterns. c. Describe the role of waves, tides, and sea level change on the physical structure of the coast. d. Investigate the relationship of tides and waves on the distribution and diversity of organisms in shallow water communities such as rocky intertidal zones and estuaries. e. Identify natural hazards (e.g., tsunamis, hurricanes, and sea level change) and their impact on coastal communities. **SO5** Students will analyze how the unique attributes of seawater determine the types of marine organisms and the ecology of marine food webs a. Compare and contrast the physical and chemical structure of pure water and seawater. b. Identify adaptations of marine organisms that allow them to live in seawater rather than on land. c. Describe patterns and relationships between biotic and abiotic factors among marine ecosystems, including estuaries, coral reefs, open waters, and the deep ocean. d. Explain the relationship between productivity, the flow of energy, and the structure of marine food webs. **SO6** Students will identify how humans use the oceans for food, commerce, and energy and will evaluate the potential for abuse in the absence of responsible stewardship. a. Describe how physical, geological, and biological resources are extracted from the oceans, and assess the consequences for marine ecosystems. b. Identify how the oceans are used as sources of alternative energy. c. Explain how the oceans are used for recreation and transportation, and evaluate their impacts on marine ecosystems. d. Analyze issues, policies, and laws that promote responsible stewardship of the oceans, including trade, fisheries, transportation, and resources.	**N/A**

Table 4J
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Meteorology

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Meteorology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SME1 Students will relate the formation, structure and composition of Earth's atmosphere to the processes that cause weather. a. Describe how atmospheric activity such as meteor bombardment, led to the formation of Earth's early atmosphere. b. Examine the chemical composition, location and characteristics of the layers of Earth's present day atmosphere. c. Analyze the effect insulation has on the relative amount of heat energy in the atmosphere and how temperature differences give rise to phenomena such as Hadley cells and Ferrel cells. d. Analyze the influence that the Coriolis Effect has on the movement of Earth's air masses. e. Compare the amount of water vapor in the atmosphere to characteristic atmospheric conditions. **SME2** Students will investigate energy transfer to types of clouds formed, precipitation, and air masses. a. Explain the relationship between air masses and the areas over which they form. b. Differentiate the four types of fronts, their structure, and the clouds and precipitation associated with each front. c. Relate weather events to the energy transfer within the Earth's atmosphere. d. Examine the role of energy transfer in the development of global weather patterns. **SME3** Students will explore the science of weather forecasting. a. Analyze a surface weather map. b. Predict weather for a specific location using knowledge of air mass, frontal, and cyclone movement. c. Investigate and describe the formation of severe weather including severe thunderstorms, hurricane, tornadoes and their role in energy transfer. d. Describe the role of technological advancements on weather forecasting and relate that to the improvement of weather watch/warning issuance.	**N/A**

Table 4J (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Meteorology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SME4 Students will analyze the relationship of weather and society. a. Analyze the implications of severe weather events (droughts, floods, thunderstorms, tornadoes, winter weather, hurricanes, etc.) on local, national, and global economies. b. Interpret the relationship between weather and pollution (smog, ground level ozone, acid rain, etc) and the impact of pollution on the economy, health, and the environment. c. Analyze the concept of the urban heat island and its effects on weather and society. d. Compare and contrast the reasons for decreasing stratospheric ozone and its implications to humans. e. Evaluate political, social, and economic decisions and their relationship to the development and/or reduction of acid rain, smog, and the urban heat island effect. **SME5** Students will differentiate the climates of Earth, how climate changes through time, and the theories regarding current climate change. a. Compare and contrast the various climates found on Earth. b. Demonstrate knowledge of the reasons for continual climate change. c. Evaluate the effects of El Nino-Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO) on climate. d. Analyze current methods of climate prediction. (Predictions of ENSO, NAO, long-range outlooks, etc.) e. Explore radiative equilibrium and demonstrate the differences between the greenhouse effect and global warming. f. Judge the current theories explaining global warming and argue the potential implications of global warming on global weather patterns and severe weather events.	**N/A**

Table 4K
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Astronomy

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Astronomy**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SAST1 Students will be able to explain the tools used by astronomers to study electromagnetic radiation to determine composition, motions, and other physical attributes of astronomical objects. a. Explain the challenges faced by astronomers due to the properties of light and the vast distances in the cosmos. b. Evaluate the types of telescopes used by astronomers for examining different frequencies of electromagnetic radiation and compare and contrast the uses and advantages of each. c. Mathematically apply Newtonian gravity to celestial bodies to determine their masses and explain their motion. d. Discuss how spectroscopy provides information about the inherent properties and motions of objects. e. Quantitatively analyze data from telescopes and/or other astronomical sources (e.g. tide tables, sky charts). **SAST2** Students will describe the scientific view of the origin of the universe, the evolution of matter and the development of resulting celestial objects. a. Outline the main arguments and evidence in support of the standard cosmological model. (e.g. elements, solar systems, and universe) b. Describe the life cycle of a star and explain the role gravity and mass play in the brightness, life span, and end-stages of stars. c. Compare and contrast the major properties of the components of our solar system. **SAST3** Students will be able to describe and explain the celestial sphere and astronomical observations made from the point of reference of the Earth. a. Evaluate the effects of the relative positions of the Earth, moon, and sun on observable phenomena, e.g. phases of the moon, eclipses, seasons, and diurnal cycles. b. Describe how latitude and time of the year affect visibility of constellations. c. Predict visibility of planets (major and minor) in the solar system based on relative orbital motion.	**N/A**

Table 4K (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Astronomy**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SAST4 Students will be able to analyze the dynamic nature of astronomy by comparing and contrasting evidence supporting current views of the universe with historical views. a. Evaluate the impact that technological advances, as an agent of change, have had on our modern view of the solar system and universe. b. Explain the relevance of experimental contributions of scientists to the advancement of the field of astronomy. **SAST5** Students will evaluate the significance of energy transfers and energy transformations in understanding the universe. a. Relate nuclear fusion reactions and mass-energy equivalence to the life cycle of stars. b. Explain the relationship between the energy produced by fusion in stars to the luminosity. c. Analyze the energy relationships between the mass, power output, and life span of stars. d. Describe energy transfers and transformations associated with the motion and interactions of celestial bodies.	**N/A**

High School Science Subjects Related to Living Organisms

Table 4L
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Biology

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Biology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SB1 Students will analyze the nature of the relationships between structures and functions in living cells. a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction. b. Explain how enzymes function as catalysts. c. Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids). d. Explain the impact of water on life processes (i.e., osmosis, diffusion). **SB2** Students will analyze how biological traits are passed on to successive generations. a. Distinguish between DNA and RNA. b. Explain the role of DNA in storing and transmitting cellular information. c. Using Mendel's laws, explain the role of meiosis in reproductive variability. d. Describe the relationships between changes in DNA and potential appearance of new traits including • Alterations during replication. o Insertions o Deletions o Substitutions • Mutagenic factors that can alter DNA. o High energy radiation (x-rays and ultraviolet) o Chemical e. Compare the advantages of sexual reproduction and asexual reproduction in different situations. f. Examine the use of DNA technology in forensics, medicine, and agriculture.	***Standards:*** **Science knowledge and understanding:** Life Science: o They demonstrate the link between natural selection and evolution. o They explain the role of DNA and genes in cell division and genetic inheritance. o They explain how the coordination and regulatory functions within plants and animals assist them to survive in their environments. o They explain how the action of micro-organisms can be both beneficial and detrimental to society. o Students apply concepts of geological time to elaborate their explanations of both natural selection and evolution, and the origin and evolution of the Universe. ***Learning Focus:*** Life Science: o They consider how coordination and regulation of functions occurs in plants and animals. They investigate the adaptive behaviors which enable plants and animals to survive in their environments, and consider possible adaptive behaviors which may be needed for future survival. o They explore the role of DNA and genes in determining patterns of inheritance. o They investigate how energy may be responsible for the changes observed in biological, chemical and physical processes and applications. Examples include electromagnetism; polarization of light; the operation of electronic systems; endothermic and exothermic reactions; rate of reaction; production of new materials; photosynthesis and respiration; cell division (mitosis and meiosis); action of micro-organisms; global atmospheric changes; plate tectonics; optics; photonics; transmission of nerve impulses; energy flow through ecosystems; population dynamics; and the cycling of matter (including water, carbon and minerals) in ecosystems.

Table 4L (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Biology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SB3 Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems. a. Explain the cycling of energy through the processes of photosynthesis and respiration. b. Compare how structures and function vary between the six kingdoms c. Examine the evolutionary basis of modern classification systems (archaebacteria, eubacteria, protists, fungi, plants, and animals). d. Compare and contrast viruses with living organisms. **SB4** Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems. a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes. b. Explain the flow of matter and energy through ecosystems by • Arranging components of a food chain according to energy flow. • Comparing the quantity of energy in the steps of an energy pyramid • Explaining the need for cycling of major nutrients (C, O, H, N, P). c. Relate environmental conditions to successional changes in ecosystems. d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption. e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions. f. Relate animal adaptations, including behaviors, to the ability to survive stressful environmental conditions. **SB5** Students will evaluate the role of natural selection in the development of the theory of evolution. a. Trace the history of the theory. b. Explain the history of life in terms of biodiversity, ancestry, and the rates of evolution. c. Explain how fossil and biochemical evidence support the theory. d. Relate natural selection to changes in organisms. e. Recognize the role of evolution to biological resistance (pesticide and antibiotic resistance).	↑ **(Previous pages)**

Table 4M
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Human Anatomy & Physiology

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Human Anatomy & Physiology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SAP1 Students will analyze anatomical structures in relationship to their physiological functions. a. Apply correct terminology when explaining the orientation of body parts and regions. b. Investigate the interdependence of the various body systems to each other and to the body as a whole. c. Explain the role of homeostasis and its mechanisms as these relate to the body as a whole and predict the consequences of the failure to maintain homeostasis. d. Relate cellular metabolism and transport to homeostasis and cellular reproduction. e. Describe how structure and function are related in terms of cell and tissue types. **SAP2** Students will analyze the interdependence of the integumentary, skeletal, and muscular systems as these relate to the protection, support and movement of the human body. a. Relate the structure of the integumentary system to its functional role in protecting the body and maintaining homeostasis. b. Explain how the skeletal structures provide support and protection for tissues, and function together with the muscular system to make movements possible. **SAP3** Students will assess the integration and coordination of body functions and their dependence on the endocrine and nervous systems to regulate physiological activities. a. Interpret interactions among hormones, senses, and nerves which make possible the coordination of functions of the body. b. Investigate the physiology of electrochemical impulses and neural integration and trace the pathway of an impulse, relating biochemical changes involved in the conduction of the impulse. c. Describe how the body perceives internal and external stimuli and responds to maintain a stable internal environment, as it relates to biofeedback.	**N/A**

Table 4M (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Human Anatomy & Physiology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SAP4 Students will analyze the physical, chemical, and biological properties of process systems as these relate to transportation, absorption and excretion, including the cardiovascular, respiratory, digestive, excretory and immune systems. a. Describe the chemical and physical mechanisms of digestion, elimination, transportation, and absorption within the body to change food and derive energy. b. Analyze, and explain the relationships between the respiratory and cardiovascular systems as they obtain oxygen needed for the oxidation of nutrients and removal of carbon dioxide. c. Relate the role of the urinary system to regulation of body wastes (i.e. water-electrolyte balance, volume of body fluids). d. Examine various conditions that change normal body functions (e.g. tissue rejection, allergies, injury, diseases and disorders) and how the body responds. e. Describe the effects of aging on body systems. **SAP5** Students will analyze the role of the reproductive system as it pertains to the growth and development of humans. a. Explain how the functions of the reproductive organs are regulated by hormonal interactions. b. Describe the stages of human embryology and gestation including investigation of gestational and congenital disorders (e.g. ectopic pregnancy, miscarriage, cleft palate, hydrocephaly, fetal alcohol syndrome). c. Describe the stages of development from birth to adulthood (i.e. neonatal period, infancy, childhood, adolescence and puberty, and maturity).	**N/A**

Table 4N
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Botany

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Botany**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SBO1 Students will use current plant phylogenetic principles and describe the structural changes used to delineate the plant divisions. a. Describe the structures and evolutionary changes of major organs, tissues, cells, and organelles types in nonvascular/seedless and vascular/seed plants. b. Identify and evaluate plant structures in relation to their functions. c. Use, compare, and contrast the methods and purposes of plant classification. **SBO2** Students will be able to identify and describe Georgia?s major physiographic provinces and their natural plant communities. a. Identify and describe four major physiographic (mountain, piedmont, coastal plain, salt marsh) provinces, the aquatic [freshwater and marine]) systems, and their natural plant (oak-hickory-pine, oak-pine, long leaf pine-wire grass, cord grass, algal) communities of Georgia. b. Use taxonomic keys to identify local flora and recognize major groups representative of the southeast. c. Explore the effects of nonnative invasive plants on natural communities. d. Investigate the causes of plants becoming endangered and the effects extinction has on natural communities. **SBO3** Students will explore the plant processes necessary for the survival of plants and other organisms including flowering plant and animal co-evolution. a. Describe and relate plant structures (organs, tissues, cells, organelles) to plant processes (photosynthesis, respiration, transport, growth, reproduction, dispersal). b. Explore how plants and animals have co-evolved in pollination, which confers genetic and evolutionary advantages. c. Explore how fruit and seed adaptations help promote dispersal, which prevents competition between plants and helps in colonization. d. Explain the role of plant processes in the biosphere.	**N/A**

Table 4N (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Botany**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SBO4 Students will explore the defense systems of plants and recognize the impact of plant diseases on the biosphere. a. Identify plant diseases and management strategies. b. Examine how plant diseases affect humans and animals. c. Examine how plants respond to diseases caused by pathogens (i.e. insects, fungi, bacteria, viruses, etc.) and insects and attempt to protect themselves from those disease causing agents. d. Examine the economic and social impact of plant diseases. **SBO5** Students will analyze the diversity of plant adaptations and responses to environmental extremes. a. Describe the diversity of plants and their adaptations in relation to differing ecosystems and changing environments, both long term (climate) and short term (seasonal and diurnal). b. Examine plant growth and development in relation to plant hormones and responses to external signals such as light, gravity, and touch. c. Describe and relate adaptations to the ability to survive stressful environments d. Examine the changes in plants when exposed to: 1)Water extremes. 2)Saline environment. 3)Extreme temperature e. Investigate how human activities impact plants and the sustainability of plant communities. **SBO6** Students will explore the economic and ecological importance of plants in society. a. Explain the uses and values of plants in different societies (agriculture, horticulture, industry, medicine, biotechnology). b. Explain how plants impact the environment providing diverse habitats for birds, beneficial insects, and other wildlife in ecosystems.	**N/A**

Table 4P
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Entomology

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Entomology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEN1 Students will identify and analyze how insects provide environmental services to humans. a. Demonstrate how insects provide protein vital for the diets of many species, including birds and fish. b. Illustrate the important function(s) of insects in diverse terrestrial and freshwater food webs (i.e., as herbivores, predators, and decomposers). c. Explain the role of insects in various niches. d. Compare species diversity and biomass in different terrestrial habitats and evaluate why insects are the dominant organisms worldwide by either measure. e. Analyze the numerous ways that insects provide critical ecosystem services (e.g., plant pollination, decomposers/recyclers of carrion and manure, nutrition for wildlife). f. Discuss the importance of coevolution/coadaptation relationships between various insects and plants; specifically, describe examples of how insects serve as pollen vectors for plants and explain why these are examples of coadaptation/coevolution between organisms. g. Cite specific examples where insects can serve as environmental indicators because they are sensitive to habitat change (e.g., water quality indicators). **SEN2** Students will investigate the diversity of insects in relation to other arthropods, their morphology, and their value as research organisms. a. Compare and contrast the relationship of insects to other arthropods (Arachnida, Chilopoda, Crustacea, and Diplopoda). b. Classify insect orders based on morphological characteristics (e.g., mouthpart types, wing/leg modifications). c. Compare and contrast how insect structure and function are integrated and reflect evolved adaptations to different lifestyles. d. Justify why insects are valuable research organisms.	**N/A**

Table 4P (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Entomology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEN3 Students will investigate the aesthetic value and economic impact of insects. a. Provide supporting evidence that insects have inherent value as living organisms and are complex animals (e.g., butterfly scales, electron micrographs of minute insects). b. Identify examples of commercially valuable products produced by insects (e.g., silk, honey, lacquer, and dyes). c. Evaluate the benefits of insects to ecosystem functioning for food production (e.g., pollinators of agricultural crops). d. Evaluate the costs of insects as pests of crops, stored food, and housing (e.g., termites). e. Analyze the economic impact that insects can have on livestock and pets (e.g., dog heartworm is transmitted by mosquitoes, and fleas are irritating pests). **SEN4** Students will investigate the impact of insects on human health and history. a. Relate the impact of insects that transmit serious human diseases (e.g., malaria, yellow fever, plague, dengue fever, and West Nile virus) on public health. b. Illustrate how insect-carried diseases have changed the course of human history (e.g., the Black Plague during the Middle Ages, and yellow fever and malaria during the construction of the Panama Canal). c. Research environmentally-friendly ways that humans can prevent or avoid many insect-transmitted diseases (e.g., repellents and traps). d. Analyze why people sometimes have allergic reactions to insects (e.g., wasp stings, cockroach droppings).	**N/A**

Table 4P (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Entomology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SEN5 Students will evaluate the risks and benefits of various methods used to control insect pests of humans and agriculture. a. Infer the importance of accurate insect identification before choosing a control method. b. Compare and contrast the beneficial and detrimental aspects of alternative methods of insect control. c. Discuss the harmful aspects of using toxic substances to control insects to human and environmental health. d. Explain how biological control of crop pests and plants is achieved through the use of natural enemies (e.g., insect parasitoids, predators, and herbivores). e. Evaluate the benefits and risks of using genetically modified crops to manage pests. f. Compare and contrast Integrated Pest Management (IPM) strategies with more traditional techniques to control pest numbers. g. Justify and predict why by using multiple pest control options, IPM limits evolution of insect resistance to chemical and other control means.	**N/A**

Table 4Q
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Microbiology

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Microbiology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SM1 Students will analyze different types of microorganisms and their defining characteristics. a. Distinguish between different kinds of microorganisms based on cellular structure, molecular biology and biochemical composition. b. Explain differences between prokaryotes and eukaryotes. c. Describe how viruses differ from other parasitic microorganisms. d. Compare relative sizes of microorganisms, different types of cell shapes, and various methods used to visualize microorganisms. **SM2** Students will examine structural components of microbes and their functions. a. Investigate structural properties of microbial membranes and functions associated with these membranes. b. Compare structures of prokaryotic cell envelope (e.g., cell membrane, wall and capsule and S-layers) and virus envelopes and their functions in providing support and protection. c. Examine intracellular organization in microbes and explain how these structures play roles in energy generation, transcription, translation, DNA replication and cellular locomotion. **SM3** Students will examine different ways in which microbial cells generate energy for growth and reproduction. a. Explain different types of energy generation used by microbes, including respiration, photosynthesis, and lithotrophy. b. Describe how microorganisms differ with respect to their nutritional requirements for growth. **SM4** Students will investigate molecular mechanisms involved in gene expression in microbes. a. Investigate molecular basis for transcription, translation, and DNA replication in prokaryotes and eukaryotes. b. Examine how DNA rearrangements occur in bacteria. c. Describe how genetic information is transferred between cells. d. Describe how genetic transfer impacts microbial evolution and how it can be utilized in biotechnological applications.	**N/A**

Table 4Q (Continued).

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Microbiology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SM5 Students will compare and contrast parameters affecting microbial growth, ways of controlling growth of microorganisms, and examine the effects that physicochemical factors can have on microbes. a. Explain different growth phases of microbial in a batch cultures and the factors that influence these phases. b. Describe environmental factors that influence microbial growth and how these factors vary for different species. c. Compare various physical and chemical methods used to control or prevent microbial growth. d. Explain the various modes of action of specific antibiotics in preventing the growth of microorganisms. e. Describe how exposure to certain chemicals or radiation increase rates of heritable mutations in microorganisms. f. Examine the evolution and spread of antibiotic resistant pathogens. **SM6** Students will analyze the impact of microorganisms in the environment and the use of microbes in biotechnology, agriculture, and industry. a. Explain the prevalence and diversity of microbes in various environments (e.g., hot springs, arctic ice, hypersaline environments, alkaline soils, acid mine drainage.) b. Relate biotic and abiotic factors to the development of microbial populations and diversity. c. Describe the importance of microorganisms in global nutrient cycling within both soil, freshwater, and marine habitats. d. Describe applications of microbes in industry, biotechnology and food processing. e. Relate water and soil quality to microbial contamination and its impact on human populations. **SM7** Students will analyze symbiotic and pathogenic relationships in host-microbe interactions. a. Relate Koch?s postulates to identifying disease-causing microbes. b. Describe examples of pathogenic microorganisms and how they cause disease in plants and animals. c. Compare mechanisms of how communicable diseases are spread among individuals within a population and how genetic changes in pathogenic microbes (such as influenza virus) result in new outbreaks of disease. d. Explain animal host defense mechanisms for combating microbial invaders, including both adaptive and innate immune systems. e. Describe plant-host defense mechanisms in response to microbial invasion. f. Describe symbiotic relationships between plants or animals and microorganisms and the importance of these relationships to both partners.	**N/A**

Table 4R
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Zoology

Georgia Performance Standards (United States) For Grades 9-12 → High School	**Victorian Essential Learning Standards (Australia)** For Years 9-10 → High School
Subject(s): **Zoology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SZ1 Students will derive the phylogeny of living (extant) animal taxa (monophyletic clades in a cladogram) using informative characteristics. a. Define characteristics of animals b. Construct a classification of representative animal taxa including: Porifera, Cnidaria, Platyhelminthes, Nematoda, Annelida, Rotifera, Mollusca, Arthropoda (Mandibulata, Chelicerata, and Crustacea), Bryozoa, Brachiopoda, Echinodermata, Hemichordata, Urochordata, Cephalochordata, and Vertebrata. c. Construct and use a dichotomous key to identify taxa. **SZ2** Students will explain the evolutionary history of animals over the geological history of Earth. d. Recognize types of data used to test hypotheses of relationships e. Describe the fossil record of the animals including discussing the Cambrian Explosion and major extinction events **SZ3** Students will compare form and function relationships within animal groups (clades) and across key taxa. a. Explain the similarities and differences among major body plans (e.g., radial and bilateral symmetry) b. Compare & contrast taxa based on morphological characters c. Relate important structural changes to key functional transitions d. Dissect representative taxa and describe their internal anatomy and the function of major organs **SZ4** Students will assess how animals interact with their environment including key adaptations found within animal taxa. a. Discuss morphological & physiological adaptations relative to ecological roles b. Relate animal adaptations, including behaviors, to the ecological roles played by animals c. Explain various life cycles found among animals (e.g., polyp and medusa in cnidarians; multiple hosts and stages in platyhelminthes life cycle; arthropod metamorphosis; egg, tadpole, adult stages in amphibian life history).	**N/A**

Table 4R (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Zoology**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SZ5 Students will evaluate the relationships between humans and other animals. a. Describe the effects of human activities on animal biodiversity through actions such as habitat destruction, over hunting, introduced species, and pollution. b. Explain the importance of species diversity to the biological resources needed by human populations including food, medicine, and natural aesthetics c. Describe the role of humans in the survival of species in natural settings through actions such as habitat conservation, research, legislation, and management of genetic diversity at local and global levels. d. Explain how humans can preserve animal diversity in captive environments with regard to habitat creation, research, animal enrichment, diet, medical, and captive breeding programs. e. Investigate how moral, legal, societal, political, and economic decisions impact animal diversity with short-term & long-term effects.	**N/A**

Table 4S
Comparison of High School Science Education
(Between the State of Georgia in the United States and the State of Victoria in Australia)
Subject: Forensic Science

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Forensic Science**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SFS1 Students will recognize and classify various types of evidence in relation to the definition and scope of Forensic Science a. Compare and contrast the history of scientific forensic techniques used in collecting and submitting evidence for admissibility in court (e.g. Locard?s Exchange Principle, Frye standard, Daubert ruling). b. Distinguish and categorize physical and trace evidence (e.g. ballistics, drugs, fibers, fingerprints, glass, hair, metal, lip prints, soil, and toxins). c. Determine the proper techniques to search, isolate and record evidence. d. Recognize possible evidence at the site of an investigation, evaluate the relevance of the evidence to the investigation, and illustrate the proper techniques for the collection of physical and trace evidence. e. Organize relevant information to accurately develop and submit both scene and analysis reports. **SFS2** Students will use various scientific techniques to analyze physical and trace evidence. a. Identify and utilize appropriate techniques used to lift and evaluate readable, latent, plastic and visible fingerprints. b. Analyze the morphology and types of hair, fibers, soil and glass. c. Evaluate how post mortem changes are used to determine probable time of death: 1)Rigor mortis 2)Livor mortis 3)Algor mortis 4)Gastric contents d. Identify methods used for the evaluation of handwriting and document evidence. e. Determine the appropriate uses of chromatography and spectroscopy in evidence analysis.	**N/A**

Table 4S (Continued).

Georgia Performance Standards (United States) **For Grades 9-12 → High School**	**Victorian Essential Learning Standards (Australia)** **For Years 9-10 → High School**
Subject(s): **Forensic Science**	Dimension(s): **Science**
High School → For **Grades 9-12**	**Secondary School (Years 7-10)**
	Years 9 to 10 – Developing Pathways
	Level 6 (pp. 93-96) → **Years 9-10**
SFS3 Students will assess how the analysis of DNA, toxicology, serology, and illicit drugs are used for forensic investigations a. Classify toxins and their effects on the body. b. Compare the effects of alcohol on blood alcohol levels with regard to gender, and according to the law. c. Evaluate forensic techniques used to isolate toxins in the body. d. Differentiate the forensic techniques used to distinguish human and animal blood e. Analyze the physics of blood stain patterns. f. Compare short tandem repeat patterns (STR) and relate to identifying the DNA of an individual. g. Understand the use of the DNA database for DNA profiling. **SFS4** Students evaluate the role of ballistics, tool marks and arson in forensic investigation. a. Identify firearm lab tests used to distinguish the characteristics of ballistics and cartridge cases. b. Analyze the physics of ballistic trajectory to predict range of firing. c. Recognize the forensic significance of tool marks, footwear and tire impressions in an investigation. d. Evaluate possible indicators of arson and criminal bombing. **SFS5** Students will evaluate the role of Forensics as it pertains to Medicolegal Death Investigation a. Identify the various causes of death (blunt force trauma, heart attack, bleeding, etc.). b. Analyze evidence that pertains to the manner of death (natural, homicide, suicide, accidental, or undetermined). c. Interpret various modes of death.	**N/A**

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