STATE STANDARDS ANALYSIS

COLORADO

Colorado
9–12 Model Content Standards
Reading and Writing, Mathematics, and Science

and

ACT®
College Readiness Standards

February 2008

Executive Summary

How well are Colorado's Model Content Standards preparing students to be college-ready?

1. Are ACT's College Readiness Standards present in Colorado's Model Content Standards?
2. What information can the ACT provide about students' achievement of Colorado's state standards?

ANALYSIS 1

POSSIBLE GAPS HAVE BEEN IDENTIFIED IN COLORADO'S MODEL CONTENT STANDARDS WITH RESPECT TO PREPARING STUDENTS FOR ENTRY-LEVEL POSTSECONDARY COURSES (SEE SECTION A FOR DETAILS).

- **READING AND WRITING RESULTS:** Many Colorado Model Content Standards map to ACT College Readiness Standards in Reading, English, and Writing. However, two entire strands of the ACT Writing College Readiness Standards have **no** Colorado statements matched to them (specifically, the Organization and Focus strands). Also, many ACT standards at the more complex, higher levels of proficiency and achievement appear to be absent from the Colorado standards. With respect to measuring student achievement of Colorado standards, the ACT English, Reading, and Writing tests measure 5 out of 6 Colorado Model Content Standards in Reading and Writing (including 29 of 57 descriptors)

- **MATHEMATICS RESULTS:** Colorado Model Content Standards for mathematics are present in all strands of the ACT College Readiness Standards for mathematics. However, of the Colorado standards that were present in the ACT standards, only 3 Colorado standards were worded specifically enough to be matched to a single specific ACT standard. With respect to measuring student achievement of Colorado standards, the ACT Mathematics Test measures 6 out of 6 Colorado Model Content Standards in Mathematics (including 45 of 49 descriptors).

ANALYSIS 2

THE ACT MEASURES NEARLY ALL COLORADO MODEL CONTENT STANDARDS IN READING AND WRITING, MATHEMATICS, AND SCIENCE (SEE SECTION B FOR DETAILS).

- **SCIENCE RESULTS:** Some Colorado Model Science standards were present in ACT's College Readiness Standards in Science. However, 2 out of 3 ACT Science College Readiness Standards **strands** did not contain Colorado statements through benchmark level (indicating Colorado may be at risk for not preparing students for postsecondary success in science). With respect to measuring student achievement of Colorado standards, the ACT Science Test measures 5 out of 6 Colorado Model Content Standard in Science (including 14 of 21 process descriptors & 47 of 52 content topics)

Most exceptions arise from the language or wording of a content standard and the ability of an instrument to measure that outcome.

Colorado's Content Standards in civics, dance, economics, foreign language, geography, history, music, physical education, theater, and visual arts are not measured by ACT's tests and are not included in this report.

ACT has the only empirically-derived definition of College Readiness

Various groups claim to describe what students truly need to know and be able to do for college and/or workplace readiness. Such groups typically ask individual experts in education to gather and discuss what they feel is important for students to understand. Not surprisingly, the answers vary. In contrast, ACT defines college readiness through a unique and rigorous empirical process:

ACT BUILDS ITS DEFINITION OF COLLEGE READINESS ON AN EMPIRICAL BASE:

1. **THE ACT NATIONAL CURRICULUM SURVEY**
2. **ACT'S COLLEGE READINESS BENCHMARK SCORES**
3. **ACT'S COLLEGE READINESS STANDARDS™**

- **The knowledge and skills necessary for students to be ready for college-level work are empirically identified via the ACT National Curriculum Survey®.**

  ACT surveys thousands of secondary and postsecondary instructors across the nation to determine which skills and knowledge are most important at each course level and for college and work readiness. The responses drive the test specifications for EXPLORE, PLAN, and the ACT.

- **The empirically derived performance levels necessary for students to be ready to succeed in college-level work are defined in ACT's College Readiness Benchmark Scores.**

  ACT analyzed thousands of student records to identify ACT's test scores associated with success in postsecondary coursework (i.e., a 50% chance of earning a B or better in credit-bearing first-year college courses): 18 for English, 22 for Math, 21 for Reading, and 24 for Science.

- **Skills and knowledge a student currently has and areas for improvement can be identified by the empirically derived ACT College Readiness Standards.**

  Using thousands of student records and responses, content and measurement experts developed data-driven, empirically derived statements of what students typically know and are able to do in various score ranges on the ACT English, Reading, Writing, Mathematics, and Science tests. These statements provide specific details about students' college readiness and can be used to identify next steps for improvement.

In sum, the ACT provides specific and abundant data relevant to Colorado's Model Content Standards and to Colorado students' readiness for college.

Section A: ACT's College Readiness Standards present and missing in Colorado Model Content Standards

Using thousands of student records and responses, content and measurement experts developed data-driven, empirically derived statements of what students know and are typically able to do in various score ranges on the ACT English, Reading, Writing, Mathematics, and Science Tests. These empirically derived score descriptors are called **ACT's College Readiness Standards**. Because of this unique way the ACT Standards were derived, ACT's Standards contain specific descriptions of proficiency and content, including descriptions of the complexity of the test material.

- Colorado Model Content Standards that are matched to ACT College Readiness Standards appear next to each other on the following tables. (Each Colorado statement is written out once. If a Colorado standard is matched to additional ACT standards in that strand, *only the number* of that Colorado standard will appear further down the column.)

- For the ACT College Readiness Standards, the **columns (strands**) describe groups of specific skills and knowledge needed to understand concepts in that strand. **Rows** contain specific statements based on different score ranges and therefore specifically capture the different levels of proficiencies of those skills.

- The ACT College Readiness Benchmark score for each test is denoted in large font with a red box around it in the far left-hand column. *Statements appearing in the shaded areas within the score ranges at and below the benchmark score should be considered requisite for all students in order to succeed in college and work.*

- At the bottom of each table are listed those Colorado Model Content Standards that are not sufficiently sampled on the ACT test to infer student proficiency of those skills. Most often, these skills are not matched because performance requirements implied by the standards' wording necessitate more individualized assessment.

ACT College Readiness Standards for English **compared to Colorado Grades 9–12 Model Content Standards**

	Topic Development in Terms of Purpose and Focus	Corresponding Colorado Model Content Standards	Organization, Unity, and Coherence	Corresponding Colorado Model Content Standards	Word Choice in Terms of Style, Tone, Clarity, and Economy	Corresponding Colorado Model Content Standards	Sentence Structure and Formation	Corresponding Colorado Model Content Standards	Conventions of Usage	Corresponding Colorado Model Content Standards	Conventions of Punctuation	Corresponding Colorado Model Content Standards
13–15			Use conjunctive adverbs or phrases to show time relationships in simple narrative essays (e.g., *then*, *this time*)	**2.3.** plan, draft, revise, proofread, and edit written communications **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing	Revise sentences to correct awkward and confusing arrangements of sentence elements Revise vague nouns and pronouns that create obvious logic problems	**2.3.** plan, draft, revise, proofread, and edit written communications **2.4.** use a variety of devices such as figurative language, symbolism, dialect, and precise vocabulary to convey meaning **3.5.** using pronoun reference correctly in writing and speaking **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing 2.3, 2.4 4.1	Use conjunctions or punctuation to join simple clauses Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences	**2.3.** plan, draft, revise, proofread, and edit written communications **3.1.** know and use correct grammar in speaking and writing **3.3.** use correct sentence structure in writing **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing 2.3 3.1, 3.3 4.1	Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives	**2.3.** plan, draft, revise, proofread, and edit written communications **3.1.** know and use correct grammar in speaking and writing **3.2.** apply correct usage in speaking and writing **3.6.** using phrases and clauses for purposes of modification and parallel structure in writing and speaking **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing	Delete commas that create basic sense problems (e.g., between verb and direct object)	**2.3.** plan, draft, revise, proofread, and edit written communications **3.4.** demonstrate correct punctuation, capitalization, and spelling **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing
16–19 **18**	Identify the basic purpose or role of a specified phrase or sentence Delete a clause or sentence because it is obviously irrelevant to the essay	**2.1.** write and speak for a variety of purposes such as telling stories, presenting analytical responses to literature, conveying technical information, explaining concepts and procedures, and persuading **2.3.** plan, draft, revise, proofread, and edit written communications **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing 2.1, 2.3 4.1	Select the most logical place to add a sentence in a paragraph	2.3 4.1	Delete obviously synonymous and wordy material in a sentence Revise expressions that deviate from the style of an essay	2.3 4.1 2.3, 2.4 4.1	Determine the need for punctuation and conjunctions to avoid awkward-sounding sentence fragments and fused sentences Decide the appropriate verb tense and voice by considering the meaning of the entire sentence	2.3 3.1, 3.3 4.1 2.3 3.1, 3.3 4.1	Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject-verb and pronoun-antecedent agreement, and which preposition to use in simple contexts Recognize and use the appropriate word in frequently confused pairs such as *there* and *their*, *past* and *passed*, and *led* and *lead*	2.3 3.1, 3.2, 3.6 4.1 PLUS **3.5.** using pronoun reference correctly in writing and speaking 2.3 3.1, 3.2 4.1	Provide appropriate punctuation in straightforward situations (e.g., items in a series) Delete commas that disturb the sentence flow (e.g., between modifier and modified element)	2.3 3.4 4.1 2.3 3.4 4.1
20–23	Identify the central idea or main topic of a straightforward piece of writing Determine relevancy when presented with a variety of sentence-level details	2.1, 2.3 4.1 2.1, 2.3 4.1	Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first*, *afterward*, *in response*) Decide the most logical place to add a sentence in an essay Add a sentence that introduces a simple paragraph	2.3 4.1 2.3 4.1 2.3 4.1	Delete redundant material when information is repeated in different parts of speech (e.g., "alarmingly startled") Use the word or phrase most consistent with the style and tone of a fairly straightforward essay Determine the clearest and most logical conjunction to link clauses	2.3 4.1 2.3, 2.4 4.1 2.3, 2.4 4.1	Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers)	2.3 3.1, 3.3 4.1 PLUS **3.6.** using phrases and clauses for purposes of modification and parallel structure in writing and speaking	Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for*, *appeal to*) Ensure that a verb agrees with its subject when there is some text between the two	2.3 3.1, 3.2 4.1 2.3 3.1, 3.2 4.1	Use commas to set off simple parenthetical phrases Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause)	2.3 3.4 4.1 2.3 3.4 4.1

ACT College Readiness Standards for English **compared to Colorado Grades 9–12 Model Content Standards**

	Topic Development in Terms of Purpose and Focus	Corresponding Colorado Model Content Standards	Organization, Unity, and Coherence	Corresponding Colorado Model Content Standards	Word Choice in Terms of Style, Tone, Clarity, and Economy	Corresponding Colorado Model Content Standards	Sentence Structure and Formation	Corresponding Colorado Model Content Standards	Conventions of Usage	Corresponding Colorado Model Content Standards	Conventions of Punctuation	Corresponding Colorado Model Content Standards
24–27	Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal	2.1, 2.3 4.1	Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore*, *however*, *in addition*)	2.3 4.1	Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence	2.3 4.1	Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems	2.3 3.1, 3.3, 3.6 4.1	Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences	2.3 3.1, 3.2, 3.5 4.1	Use punctuation to set off complex parenthetical phrases	2.3 3.4 4.1
	Delete material primarily because it disturbs the flow and development of the paragraph	2.1, 2.3 4.1	Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic	2.3 4.1	Identify and correct ambiguous pronoun references	2.3, 2.4 3.5 4.1	Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence	2.3 3.1, 3.3 4.1	Identify the correct past and past participle forms of irregular and infrequently used verbs and form present-perfect verbs by using *have* rather than *of*	2.3 3.1, 3.2 4.1	Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*)	2.3 3.4 4.1
	Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement	2.1, 2.3 4.1	Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward	2.3 4.1	Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay	2.3, 2.4 4.1					Use apostrophes to indicate simple possessive nouns	2.3 3.4 4.1
											Recognize inappropriate uses of colons and semicolons	2.3 3.4 4.1
28–32	Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence, or to determine the need to delete plausible but irrelevant material Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation		Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs Rearrange sentences to improve the logic and coherence of a complex paragraph Add a sentence to introduce or conclude a fairly complex paragraph		Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., "an aesthetic viewpoint" versus "the outlook of an aesthetic viewpoint") Correct vague and wordy or clumsy and confusing writing containing sophisticated language		Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole	3.6	Correctly use reflexive pronouns, the possessive pronouns *its* and *your*, and the relative pronouns *who* and *whom* Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject-verb order is inverted or when the subject is an indefinite pronoun)	3.5	Use commas to set off a nonessential/nonrestrictive appositive or clause Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical) Use an apostrophe to show possession, especially with irregular plural nouns Use a semicolon to indicate a relationship between closely related independent clauses	
33–36	Determine whether a complex essay has accomplished a specific purpose Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay		Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay		Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole		Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses	3.6	Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb		Use a colon to introduce an example or an elaboration	

Colorado Writing benchmarks NOT measured by the ACT English Test:

2.2. write and speak for audiences such as peers, teachers, and the community
2.5. organize written and oral presentations using strategies such as lists, outlining, cause/effect relationships, comparison/contrast, problem/solution, and narration
2.6. use handwriting and at the most appropriate time, word processing to produce a product that is legible
2.7. using fictional, dramatic, and poetic techniques in writing
2.8. conveying technical information in a written form appropriate to the audience
2.9. supporting an opinion using various forms of persuasion (factual or emotional) in speaking and writing
2.10. incorporating material from a wider range of sources (for example, newspapers, magazines, interviews, technical publications, books) in their writing and speaking
2.11. selecting a focused topic and drafting, revising, editing, and proofreading a legible final copy
2.12. writing in various specialized fields such as career and academic interest areas (for example, scientific, technical, business communications)
2.13. experimenting with stylistic elements such as voice, tone, and style

3.7. using internal capitalization and punctuation of secondary quotations in writing
3.8. using manuscript forms specified in various style manuals for writing (for example, indenting for extended quotations, precise placement and form of page numbers, appropriate line spacing)
3.9. refining spelling and grammatical skills and becoming a self-evaluator of their writing and speaking

4.2. use reading, writing, speaking, listening, and viewing to define and solve problems
4.3. recognize, express, and defend points of view orally and in writing
4.4. identify the purpose, perspective, and historical and cultural influences of a speaker, author, or director
4.5 evaluate the reliability, accuracy, and relevancy of information
4.6. recognizing an author's point of view, purpose, and historical and cultural context
4.7. using reading, writing, listening, articulate speaking, and viewing to solve problems
4.8. knowing what constitutes literary quality based on elements such as the author's point of view, the author's selection of significant details, theme development, and the author's reflection of events and ideas of his or her lifetime
4.9. critiquing the content of written work and oral presentations

	Basic Operations & Applications	Corresponding Colorado Model Content Standards	Probability, Statistics, & Data Analysis	Corresponding Colorado Model Content Standards	Numbers: Concepts & Properties	Corresponding Colorado Model Content Standards	Expressions, Equations, & Inequalities	Corresponding Colorado Model Content Standards
13–15	Perform one-operation computation with whole numbers and decimals Solve problems in one or two steps using whole numbers Perform common conversions (e.g., inches to feet or hours to minutes)	6.2. select and use appropriate methods for computing with real numbers in problem-solving situations and determine whether the results are reasonable 6.2	Calculate the average of a list of positive whole numbers Perform a single computation using information from a table or chart		Recognize equivalent fractions and fractions in lowest terms		Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$) Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals	
16–19	Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent Solve some routine two-step arithmetic problems	6.2 PLUS 6.1. use ratios, proportions, and percents in problem-solving situations 6.2	Calculate the average of a list of numbers Calculate the average, given the number of data values and the sum of the data values Read tables and graphs Perform computations on data from tables and graphs Use the relationship between the probability of an event and the probability of its complement	2.1. model real-world phenomena (for example, distance-versus-time relationships, compound interest, amortization tables, mortality rates) using functions, equations, inequalities, and matrices 3.1. design and conduct a statistical experiment to study a problem, and interpret and communicate the results using the appropriate technology (for example, graphing calculators, computer software) 3.5. use experimental and theoretical probability to represent and solve problems involving uncertainty (for example, the chance of playing professional sports if a student is a successful high school athlete)	Recognize one-digit factors of a number Identify a digit's place value		Substitute whole numbers for unknown quantities to evaluate expressions Solve one-step equations having integer or decimal answers Combine like terms (e.g., $2x + 5x$)	
20–23 **22**	Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average	6.1, 6.2	Calculate the missing data value, given the average and all data values but one Translate from one representation of data to another (e.g., a bar graph to a circle graph) Determine the probability of a simple event Exhibit knowledge of simple counting techniques	2.2. represent functional relationships using written explanations, tables, equations, and graphs, and describe the connections among these representations 3.3. fit curves to scatter plots, using informal methods or appropriate technology, to determine the strength of the relationship between two data sets and to make predictions 3.5 3.6. solve real-world problems with informal use of combinations and permutations (for example, determining the number of possible meals at a restaurant featuring a given number of side dishes)	Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor	1.1. demonstrate meanings for real numbers, absolute value, and scientific notation using physical materials and technology in problem-solving situations 1.2. develop, test, and explain conjectures about properties of number systems and sets of numbers 1.3. use number sense to estimate and justify the reasonableness of solutions to problems involving real numbers	Evaluate algebraic expressions by substituting integers for unknown quantities Add and subtract simple algebraic expressions Solve routine first-degree equations Perform straightforward word-to-symbol translations Multiply two binomials	2.1. model real-world phenomena (for example, distance-versus-time relation-ships, compound interest, amortization tables, mortality rates) using functions, equations, inequalities, and matrices
24–27	Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour)		Calculate the average, given the frequency counts of all the data values Manipulate data from tables and graphs Compute straightforward probabilities for common situations Use Venn diagrams in counting	2.1, 2.2 3.3 3.5	Find and use the least common multiple Order fractions Work with numerical factors Work with scientific notation Work with squares and square roots of numbers Work problems involving positive integer exponents Work with cubes and cube roots of numbers Determine when an expression is undefined Exhibit some knowledge of the complex numbers	1.1	Solve real-world problems using first-degree equations Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions) Identify solutions to simple quadratic equations Add, subtract, and multiply polynomials Factor simple quadratics (e.g., the difference of squares and perfect square trinomials) Solve first-degree inequalities that do not require reversing the inequality sign	2.1 PLUS 2.2. represent functional relationships using written explanations, tables, equa-tions, and graphs, and describe the con-nections among these representations
28–32	Solve word problems containing several rates, proportions, or percentages		Calculate or use a weighted average Interpret and use information from figures, tables, and graphs Apply counting techniques Compute a probability when the event and/or sample space are not given or obvious	2.1, 2.2, 3.1 PLUS 3.2. analyze statistical claims for erroneous conclusions or distortions 3.6	Apply number properties involving prime factorization Apply number properties involving even/odd numbers and factors/multiples Apply number properties involving positive/negative numbers Apply rules of exponents Multiply two complex numbers	1.2 1.2 1.2	Manipulate expressions and equations Write expressions, equations, and inequalities for common algebra settings Solve linear inequalities that require reversing the inequality sign Solve absolute value equations Solve quadratic equations Find solutions to systems of linear equations	2.1, 2.2
33–36	Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings)		Distinguish between mean, median, and mode for a list of numbers Analyze and draw conclusions based on information from figures, tables, and graphs Exhibit knowledge of conditional and joint probability	3.4. draw conclusions about distributions of data based on analysis of statistical summaries (for example, the combination of mean and standard deviation, and differences between the mean and median) 2.1 3.2, 3.4 PLUS 2.4. analyze and explain the behaviors, transformations, and general properties of types of equations and functions (for example, linear, quadratic, exponential)	Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers Exhibit knowledge of logarithms and geometric sequences Apply properties of complex numbers	1.2, 1.3 PLUS 6.3. describe the limitations of estimation, and assess the amount of error resulting from estimation within acceptable limits	Write expressions that require planning and/or manipulating to accurately model a situation Write equations and inequalities that require planning, manipulating, and/or solving Solve simple absolute value inequalities	2.1 2.1

	Graphical Representations	Corresponding Colorado Model Content Standards	Properties of Plane Figures	Corresponding Colorado Model Content Standards	Measurement	Corresponding Colorado Model Content Standards	Functions	Corresponding Colorado Model Content Standards
13–15	Identify the location of a point with a positive coordinate on the number line				Estimate or calculate the length of a line segment based on other lengths given on a geometric figure			
16–19	Locate points on the number line and in the first quadrant		Exhibit some knowledge of the angles associated with parallel lines		Compute the perimeter of polygons when all side lengths are given Compute the area of rectangles when whole number dimensions are given	4.2. derive and use methods to measure perimeter, area, and volume of regular and irregular geometric figures 4.2		
20–23 **22**	Locate points in the coordinate plane Comprehend the concept of length on the number line Exhibit knowledge of slope		Find the measure of an angle using properties of parallel lines Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)		Compute the area and perimeter of triangles and rectangles in simple problems Use geometric formulas when all necessary information is given	4.2 4.2	Evaluate quadratic functions, expressed in function notation, at integer values	2.3. solve problems involving functional relationships using graphing calculators and/or computers as well as appropriate paper-and-pencil techniques
24–27	Identify the graph of a linear inequality on the number line Determine the slope of a line from points or equations Match linear graphs with their equations Find the midpoint of a line segment	2.2. represent functional relationships using written explanations, tables, equations, and graphs, and describe the connections among these representations	Use several angle properties to find an unknown angle measure Recognize Pythagorean triples Use properties of isosceles triangles		Compute the area of triangles and rectangles when one or more additional simple steps are required Compute the area and circumference of circles after identifying necessary information Compute the perimeter of simple composite geometric figures with unknown side lengths	4.2 4.2 4.2	Evaluate polynomial functions, expressed in function notation, at integer values Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths	2.3
28–32	Interpret and use information from graphs in the coordinate plane Match number line graphs with solution sets of linear inequalities Use the distance formula Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle)	2.2 PLUS 2.5. interpret algebraic equations and inequalities geometrically and describe geometric relationships algebraically 3.3. fit curves to scatter plots, using informal methods or appropriate technology, to determine the strength of the relationship between two data sets and to make predictions 2.5	Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles Use the Pythagorean theorem		Use relationships involving area, perimeter, and volume of geometric figures to compute another measure	5.1. measure quantities indirectly using techniques of algebra, geometry, or trigonometry	Evaluate composite functions at integer values Apply basic trigonometric ratios to solve right-triangle problems	4.4. use trigonometric ratios in problem-solving situations (for example, finding the height of a building from a given point, if the distance to the building and the angle of elevation are known) 5.1. measure quantities indirectly using techniques of algebra, geometry, or trigonometry
33–36	Match number line graphs with solution sets of simple quadratic inequalities Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$ Solve problems integrating multiple algebraic and/or geometric concepts Analyze and draw conclusions based on information from graphs in the coordinate plane	2.5 2.4. analyze and explain the behaviors, transformations, and general properties of types of equations and functions (for example, linear, quadratic, exponential) 4.1. find and analyze relationships among geometric figures using transformations (for example, reflections, translations, rotations, dilations) in coordinate systems 5.4. demonstrate the meanings of area under a curve and length of an arc 2.4 4.1	Draw conclusions based on a set of conditions Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas Use relationships among angles, arcs, and distances in a circle	4.3. make and test conjectures about geometric shapes and their properties, incorporating technology where appropriate 2.5. interpret algebraic equations and inequalities geometrically and describe geometric relationships algebraically 4.1. find and analyze relationships among geometric figures using transformations (for example, reflections, translations, rotations, dilations) in coordinate systems 5.1. measure quantities indirectly using techniques of algebra, geometry, or trigonometry 5.4. demonstrate the meanings of area under a curve and length of an arc 5.4	Use scale factors to determine the magnitude of a size change Compute the area of composite geometric figures when planning or visualization is required	5.4. demonstrate the meanings of area under a curve and length of an arc	Write an expression for the composite of two simple functions Use trigonometric concepts and basic identities to solve problems Exhibit knowledge of unit circle trigonometry Match graphs of basic trigonometric functions with their equations	5.1

ACT College Readiness Standards for Reading **compared to Colorado Grades 9–12 Model Content Standards**

	Main Ideas and Author's Approach	Corresponding Colorado Model Content Standards	Supporting Details	Corresponding Colorado Model Content Standards	Sequential, Comparative, and Cause-Effect Relationships	Corresponding Colorado Model Content Standards	Meanings o
13–15	Recognize a clear intent of an author or narrator in uncomplicated literary narratives	**1.1.** use comprehension skills such as previewing, predicting, inferring, comparing and contrasting, re-reading and self-monitoring, summarizing, identifying the author's purpose, determining the main idea, and applying knowledge of foreshadowing, metaphor, simile, symbolism, and other figures of speech **1.3.** adjust reading strategies for different purposes such as reading carefully, idea by idea; skimming and scanning; fitting materials into an organizational pattern, such as reading a novel chronologically; finding information to support particular ideas; and finding the sequence of steps in a technical publication **1.6.** using a full range of strategies to comprehend essays, speeches, autobiographies, and first-person historical documents in addition to the types of literature mentioned above **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing **4.4.** identify the purpose, perspective, and historical and cultural influences of a speaker, author, or director **4.6.** recognizing an author's point of view, purpose, and historical and cultural context **6.7.** reading, responding to, and discussing novels, poetry, short stories, non-fiction, content-area and technical material, plays, essays, and speeches	Locate basic facts (e.g., names, dates, events) clearly stated in a passage	**1.1.** use comprehension skills such as previewing, predicting, inferring, comparing and contrasting, re-reading and self-monitoring, summarizing, identifying the author's purpose, determining the main idea, and applying knowledge of foreshadowing, metaphor, simile, symbolism, and other figures of speech **1.3.** adjust reading strategies for different purposes such as reading carefully, idea by idea; skimming and scanning; fitting materials into an organizational pattern, such as reading a novel chronologically; finding information to support particular ideas; and finding the sequence of steps in a technical publication **1.6.** using a full range of strategies to comprehend essays, speeches, autobiographies, and first-person historical documents in addition to the types of literature mentioned above **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing **6.7.** reading, responding to, and discussing novels, poetry, short stories, non-fiction, content-area and technical material, plays, essays, and speeches	Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages Recognize clear cause-effect relationships described within a single sentence in a passage	**1.1.** use comprehension skills such as previewing, predicting, inferring, comparing and contrasting, re-reading and self-monitoring, summarizing, identifying the author's purpose, determining the main idea, and applying knowledge of foreshadowing, metaphor, simile, symbolism, and other figures of speech **1.3.** adjust reading strategies for different purposes such as reading carefully, idea by idea; skimming and scanning; fitting materials into an organizational pattern, such as reading a novel chronologically; finding information to support particular ideas; and finding the sequence of steps in a technical publication **1.6.** using a full range of strategies to comprehend essays, speeches, autobiographies, and first-person historical documents in addition to the types of literature mentioned above **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing **6.7.** reading, responding to, and discussing novels, poetry, short stories, non-fiction, content-area and technical material, plays, essays, and speeches 1.1, 1.3, 1.6 4.1 6.7	Understand f familiar word simple descri
16–19	Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives	1.1, 1.3, 1.6 4.1, 4.4, 4.6 6.7	Locate simple details at the sentence and paragraph level in uncomplicated passages Recognize a clear function of a part of an uncomplicated passage	1.1, 1.3, 1.6 4.1 6.7 1.1, 1.3, 1.6 4.1 6.7	Identify relationships between main characters in uncomplicated literary narratives Recognize clear cause-effect relationships within a single paragraph in uncomplicated literary narratives	1.1, 1.3, 1.6 4.1 6.7 1.1, 1.3, 1.6 4.1 6.7	Use context f basic figurati
20–23	Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary	1.1, 1.3, 1.6 4.1, 4.4, 4.6 6.7	Locate important details in uncomplicated passages	1.1, 1.3, 1.6 4.1 6.7	Order simple sequences of events in uncomplicated literary narratives	1.1, 1.3, 1.6 4.1 6.7	Use context f appropriate m figurative and

ACT College Readiness Standards for Reading **compared to Colorado Grades 9–12 Model Content Standards**

	Main Ideas and Author's Approach	Corresponding Colorado Model Content Standards	Supporting Details	Corresponding Colorado Model Content Standards	Sequential, Comparative, and Cause-Effect Relationships	Corresponding Colorado Model Content Standards	Meanings o
24–27	Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages	1.1, 1.3, 1.6 4.1, 4.4, 4.6 6.7	Locate important details in more challenging passages		Order sequences of events in uncomplicated passages	1.1, 1.3, 1.6 4.1 6.7	Use context t appropriate m virtually any w statement in passages
	Infer the main idea or purpose of straightforward paragraphs in more challenging passages		Locate and interpret minor or subtly stated details in uncomplicated passages	1.1, 1.3, 1.6 4.1 6.7	Understand relationships between people, ideas, and so on in uncomplicated passages	1.1, 1.3, 1.6 4.1 6.7	Use context t appropriate m figurative and words, phras statements in passages
	Summarize basic events and ideas in more challenging passages	1.1	Discern which details, though they may appear in different sections throughout a pas-sage, support important points in more challenging passages		Identify clear relationships between characters, ideas, and so on in more challenging literary narratives		
	Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages				Understand implied or subtly stated cause-effect relationships in uncomplicated passages	1.1, 1.3, 1.6 4.1 6.7	
					Identify clear cause-effect relationships in more challenging passages		
28–32	Infer the main idea or purpose of more challenging passages or their paragraphs		Locate and interpret minor or subtly stated details in more challenging passages		Order sequences of events in more challenging passages		Determine th meaning of w statements fr somewhat te
	Summarize events and ideas in virtually any passage		Use details from different sections of some complex informational passages to support a specific point or argument		Understand the dynamics between people, ideas, and so on in more challenging passages		
	Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage				Understand implied or subtly stated cause-effect relationships in more challenging passages		
33–36	Identify clear main ideas or purposes of complex passages or their paragraphs		Locate and interpret details in complex passages		Order sequences of events in complex passages		Determine, e language is r and the voca the appropria context-depe phrases, or s virtually any p
			Understand the function of a part of a passage when the function is subtle or complex		Understand the subtleties in relationships between people, ideas, and so on in virtually any passage		
					Understand implied, subtle, or complex cause-effect relation-ships in virtually any passage		

Descriptions of the ACT Reading Passages

Uncomplicated Literary Narratives refers to excerpts from essays, short stories, and novels that tend to use simple language and structure, have a clear purpose and a familiar style, present straightforward interactions between characters, and employ only a limited number of literary devices such as metaphor, simile, or hyperbole.

More Challenging Literary Narratives refers to excerpts from essays, short stories, and novels that tend to make moderate use of figurative language, have a more intricate structure and messages conveyed with some subtlety, and may feature somewhat complex interactions between characters.

Complex Literary Narratives refers to excerpts from essays, short stories, and novels that tend to make gen-erous use of ambiguous language and literary devices, feature complex and subtle interactions between char-acters, often contain challenging context-dependent vocab-ulary, and typically contain messages and/or meanings that are not explicit but are embedded in the passage.

Uncomplicated Informational Passages refers to materials that tend to contain a limited amount of data, address basic concepts using familiar language and conventional organiza-tional patterns, have a clear purpose, and are written to be accessible.

Colorado Reading benchmarks NOT measured by the ACT Reading Test:

1.2. make connections between their reading and what they already know, and identify what they need to know about a topic before reading about it

1.5. use information from their reading to increase vocabulary and enhance language usage

4.2. use reading, writing, speaking, listening, and viewing to define and solve problems

6.2. read literature to investigate common issues and interests

6.3. read literature to understand places, people, events, and vocabulary, both familiar and unfamiliar

6.4. read literature that reflects the uniqueness and integrity of the American experience

6.5. read classic and contemporary literature, representing various cultural and ethnic traditions from throughout the world

ACT College Readiness Standards for Science **compared to Colorado Grades 9–12 Model Content Standards**

	Interpretation of Data	Corresponding Colorado Model Content Standards	Scientific Investigation	Corresponding Colorado Model Content Standard
13–15	Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables; a food web diagram)	**1.2.** select and use appropriate technologies to gather, process, and analyze data and to report information related to an investigation **1.5.** construct and revise scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables **5.3.** graphs, equations or other models are used to analyze systems involving change and constancy (for example: comparing the geologic time scale to shorter time frame, exponential growth, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium)		
	Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)	1.2, 1.5 5.3		
16–19	Select two or more pieces of data from a simple data presentation	1.2, 1.5 5.3	Understand the methods and tools used in a simple experiment	**1.1.** ask questions and state hypotheses using prior scie knowledge to help design and guide development and implementation of a scientific investigation
	Understand basic scientific terminology	1.2, 1.5 5.3		**1.2.** select and use appropriate technologies to gather, p and analyze data and to report information related to an investigation
	Find basic information in a brief body of text	1.2, 1.5 5.3		**1.3.** identify major sources of error or uncertainty within a investigation (for example: particular measuring devices experimental procedures)
	Determine how the value of one variable changes as the value of another variable changes in a simple data presentation	1.2, 1.5 5.3 PLUS **5.4.** there are cause-effect relationships within systems (for example: the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid)		**1.5.** construct and revise scientific explanations and mod using evidence, logic, and experiments that include ident and controlling variables **5.3.** graphs, equations or other models are used to analy systems involving change and constancy (for example: comparing the geologic time scale to shorter time frame, exponential growth, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium)
20–23	Select data from a complex data presentation (e.g., a table or graph with more than three variables; a phase diagram)		Understand the methods and tools used in a moderately complex experiment	
	Compare or combine data from a simple data presentation (e.g., order or sum data from a table)	1.2, 1.5 5.3	Understand a simple experimental design Identify a control in an experiment Identify similarities and differences between experiments	1.1, 1.2, 1.3, 1.5 5.3 1.3
	Translate information into a table, graph, or diagram	1.2, 1.5 5.3		

ACT College Readiness Standards for Science **compared to Colorado Grades 9–12 Model Content Standards**

	Interpretation of Data	Corresponding Colorado Model Content Standards	Scientific Investigation	Corresponding Colorado Model Content Standard
24–27 **24**	Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table) Compare or combine data from a complex data presentation Interpolate between data points in a table or graph Determine how the value of one variable changes as the value of another variable changes in a complex data presentation Identify and/or use a simple (e.g., linear) mathematical relationship between data Analyze given information when presented with new, simple information		Understand the methods and tools used in a complex experiment Understand a complex experimental design Predict the results of an additional trial or measurement in an experiment Determine the experimental conditions that would produce specified results	
28–32	Compare or combine data from a simple data presentation with data from a complex data presentation Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data Extrapolate from data points in a table or graph		Determine the hypothesis for an experiment Identify an alternate method for testing a hypothesis	1.1
33–36	Compare or combine data from two or more complex data presentations Analyze given information when presented with new, complex information		Understand precision and accuracy issues Predict how modifying the design or methods of an experiment will affect results Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results	1.3

Science College Readiness Standards are measured in the context of science topics students encounter courses. These topics may include:

Life Science/Biology	Physical Science/Chemistry, Physics	Earth & Spa
• Animal behavior • Animal development and growth • Body systems • Cell structure and processes • Ecology • Evolution • Genetics • Homeostasis • Life cycles • Molecular basis of heredity • Origin of life • Photosynthesis • Plant development, growth, structure • Populations • Taxonomy	• Atomic structure • Chemical bonding, equations, nomenclature, reactions • Electrical circuits • Elements, compounds, mixtures • Force and motions • Gravitation • Heat and work • Kinetic and potential energy • Magnetism • Momentum • The Periodic Table • Properties of solutions • Sound and light • States, classes, and properties of matter • Waves	• Earthquakes and • Earth's atmosph • Earth's resource • Fossils and geol • Geochemical cy • Groundwater • Lakes, rivers, oc • Mass movement • Plate tectonics • Rocks, minerals • Solar system • Stars, galaxies, • Water cycle • Weather and cli • Weathering and

Colorado Science benchmarks NOT measured by the ACT Science Test:

ACT College Readiness Standards for the ACT Writing Test **compared to Colorado Grades 9–12 Model Content Standards**

	Expressing Judgments	Corresponding Colorado Model Content Standards	Focusing on the Topic	Corresponding Colorado Model Content Standards	Developing a Position	Corresponding Colorado Model Content Standards	Organizing
3–4	Show a little understanding of the persuasive purpose of the task but neglect to take or to maintain a position on the issue in the prompt Show limited recognition of the complexity of the issue in the prompt	**2.1.** write and speak for a variety of purposes such as telling stories, presenting analytical responses to literature, conveying technical information, explaining concepts and procedures, and persuading **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing **4.3.** recognize, express, and defend points of view orally and in writing 2.1 4.1, 4.3	Maintain a focus on the general topic in the prompt through most of the essay		Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas Show little or no movement between general and specific ideas and examples	**2.5.** organize written and oral presentations using strategies such as lists, outlining, cause/effect relationships, comparison/contrast, problem/solution, and narration **4.1.** make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing **4.3.** recognize, express, and defend points of view orally and in writing	Provide a disc organization v grouping of id the essay Use a few sim transitions Present a disc minimally dev introduction a
5–6 **6**	Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt but may not maintain that position Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer's position	2.1 4.1, 4.3 4.3	Maintain a focus on the general topic in the prompt throughout the essay		Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas Show little movement between general and specific ideas and examples	2.5 4.1, 4.3	Provide a sim with logical gr in parts of the Use some sim transitional w may at times or misleading Present a disc underdevelop and conclusio
7–8	Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt	2.1 4.1, 4.3 PLUS **2.9.** supporting an opinion using various forms of persuasion (factual or emotional) in speaking and writing	Maintain a focus on the general topic in the prompt throughout the essay and attempt a focus on the specific issue in the prompt Present a thesis that establishes focus on the topic	**2.11.** selecting a focused topic and drafting, revising, editing,	Develop ideas by using some specific reasons, details, and examples	2.5 4.1, 4.3 PLUS **2.3.** plan, draft, revise, proofread, and edit written communications **2.9.** supporting an opinion	Provide an ad simple organi grouping of id the essay but evidence of lo of ideas

ACT College Readiness Standards for the ACT Writing Test **compared to Colorado Grades 9–12 Model Content Standards**

	Expressing Judgments	Corresponding Colorado Model Content Standards	Focusing on the Topic	Corresponding Colorado Model Content Standards	Developing a Position	Corresponding Colorado Model Content Standards	Organizing
9–10	Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion Show recognition of the complexity of the issue in the prompt by • partially evaluating implications and/or complications of the issue, and/or • posing and partially responding to counterarguments to the writer's position		Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay Present a thesis that establishes a focus on the writer's position on the issue		Develop most ideas fully, using some specific and relevant reasons, details, and examples Show clear movement between general and specific ideas and examples		Provide unity throughout th sometimes wi progression o Use relevant, simple and ob transitional wo to convey logi between idea Present a son developed int conclusion
11–12	Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion Show understanding of the complexity of the issue in the prompt by • examining different perspectives, and/or • evaluating implications or complications of the issue, and/or • posing and fully discussing counterarguments to the writer's position		Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay Present a critical thesis that clearly establishes the focus on the writer's position on the issue		Develop several ideas fully, using specific and relevant reasons, details, and examples Show effective movement between general and specific ideas and examples		Provide unity throughout th with a logical ideas Use relevant words, phrase to convey logi between idea Present a wel introduction a

Colorado Writing benchmarks NOT measured by the ACT Writing Test:

2.2. write and speak for audiences such as peers, teachers, and the community

2.6. use handwriting and at the most appropriate time, word processing to produce a product that is legible

2.7. using fictional, dramatic, and poetic techniques in writing

2.8. conveying technical information in a written form appropriate to the audience

2.10. incorporating material from a wider range of sources (for example, newspapers, magazines, interviews, technical publications, books) in their writing and speaking

2.12. writing in various specialized fields such as career and academic interest areas (for example, scientific, technical, business communications)

2.13. experimenting with stylistic elements such as voice, tone, and style

3.8. using manuscript forms specified in various style manuals for writing (for example, indenting for extended quotations, precise placement and form of page numbers, appropriate line spacing)

4.2. use reading, writing, speaking, listening, and viewing to define and solve problems

4.4. identify the purpose, perspective, and historical and cultural influences of a speaker, author, or director

4.5. evaluate the reliability, accuracy, and relevancy of information

Section B: Colorado's Grades 9–12 Standards and Benchmarks Measured by the ACT

Reading and Writing

COLORADO Grades 9–12 Reading and Writing
Model Content Standards

Standard 1: Students read and understand a variety of materials.

In order to meet this standard, students will

- use comprehension skills such as previewing, predicting, inferring, comparing and contrasting, re-reading and self-monitoring, summarizing, identifying the author's purpose, determining the main idea, and applying knowledge of foreshadowing, metaphor, simile, symbolism, and other figures of speech;
- make connections between their reading and what they already know, and identify what they need to know about a topic before reading about it;
- adjust reading strategies for different purposes such as reading carefully, idea by idea; skimming and scanning; fitting materials into an organizational pattern, such as reading a novel chronologically; finding information to support particular ideas; and finding the sequence of steps in a technical publication;
- use word recognition skills and resources such as phonics, context clues, picture clues, word origins, and word order clues; reference guides; roots, prefixes, and suffixes of words for comprehension; and
- use information from their reading to increase vocabulary and enhance language usage.

What grade 9–12 students know and are able to do includes:

- using a full range of strategies to comprehend essays, speeches, autobiographies, and first-person historical documents in addition to the types of literature mentioned above.

Extending beyond standards:

- using a full range of strategies to comprehend literary criticism and literary analysis, professional and technical journals, and professional-level reading materials that match their career or academic interests.

Standard 2: Students write and speak for a variety of purposes and audiences.

In order to meet this standard, students will

- write and speak for a variety of purposes such as telling stories, presenting analytical responses to literature, conveying technical information, explaining concepts and procedures, and persuading;
- write and speak for audiences such as peers, teachers, and the community;
- plan, draft, revise, proofread, and edit written communications;
- use a variety of devices such as figurative language, symbolism, dialect, and precise vocabulary to convey meaning;
- organize written and oral presentations using strategies such as lists, outlining, cause/effect relationships, comparison/contrast, problem/solution, and narration; and
- use handwriting and at the most appropriate time, word processing to produce a product that is legible.

What grade 9–12 students know and are able to do includes:

- using fictional, dramatic, and poetic techniques in writing;
- conveying technical information in a written form appropriate to the audience;
- supporting an opinion using various forms of persuasion (factual or emotional) in speaking and writing;
- incorporating material from a wider range of sources (for example, newspapers, magazines, interviews, technical publications, books) in their writing and speaking;
- selecting a focused topic and drafting, revising, editing, and proofreading a legible final copy;
- writing in various specialized fields such as career and academic interest areas (for example, scientific, technical, business communications); and
- experimenting with stylistic elements such as voice, tone, and style.

Extending beyond standards:

- writing longer, formal papers using sources such as technical journals and government publications to support an original thesis;
- making oral presentations for audiences within or outside the school in a variety of media;
- using style books or technical manuals to become self-evaluators of their writing; and
- analyzing, synthesizing, and evaluating a variety of written and spoken material.

Standard 3: Students write and speak using conventional grammar, usage, sentence structure, punctuation, capitalization, and spelling.

In order to meet this standard, students will

- know and use correct grammar in speaking and writing;
- apply correct usage in speaking and writing;
- use correct sentence structure in writing; and
- demonstrate correct punctuation, capitalization, and spelling.

What grade 9–12 students know and are able to do includes:

- using pronoun reference correctly in writing and speaking;
- using phrases and clauses for purposes of modification and parallel structure in writing and speaking;
- using internal capitalization and punctuation of secondary quotations in writing;
- using manuscript forms specified in various style manuals for writing (for example, indenting for extended quotations, precise placement and form of page numbers, appropriate line spacing); and
- refining spelling and grammatical skills and becoming a self-evaluator of their writing and speaking.

Standard 4: Students apply thinking skills to their reading, writing, speaking, listening, and viewing.

In order to meet this standard, students will

- make predictions, analyze, draw conclusions, and discriminate between fact and opinion in writing, reading, speaking, listening, and viewing;
- use reading, writing, speaking, listening, and viewing to define and solve problems;
- recognize, express, and defend points of view orally and in writing;
- identify the purpose, perspective, and historical and cultural influences of a speaker, author, or director; and
- evaluate the reliability, accuracy, and relevancy of information.

What grade 9–12 students know and are able to do includes:

- recognizing an author's point of view, purpose, and historical and cultural context;
- using reading, writing, listening, articulate speaking, and viewing to solve problems;
- knowing what constitutes literary quality based on elements such as the author's point of view, the author's selection of significant details, theme development, and the author's reflection of events and ideas of his or her lifetime; and
- critiquing the content of written work and oral presentations.

Extending beyond standards:

- applying principles of formal logic to written and oral texts.

Standard 5: Students read to locate, select, and make use of relevant information from a variety of media, reference, and technological sources.

In order to meet this standard, students will

- using organizational features of printed text such as citations, end notes, and bibliographic references to locate relevant information;
- evaluating information in light of what they know and their specific needs;
- using organizational features of electronic text such as bulletin boards, database keyword searches, and e-mail addresses to locate information when technology is available;
- using strategies to gain information from journals, research studies, and technical documents; and
- using available technology to access information, conduct research, and produce a carefully documented product.

Extending beyond standards:

- understanding and applying knowledge of the structure, organization, and use of various media, reference, and technological information sources in their reading and writing as they meet academic, personal, and professional challenges;
- locating information appropriate for their reading and writing purposes such as career and academic interest, leisure time, and self-improvement;
- using information from various resources, both primary and secondary, as a vehicle for expressing their own thoughts, impressions, and ideas;
- giving precise, formal credit for others' ideas, images, or information; and
- planning and presenting multimedia presentations.

Standard 6: Students read and recognize literature as a record of human experience.

In order to meet this standard, students will

- know and use literary terminology;
- read literature to investigate common issues and interests;
- read literature to understand places, people, events, and vocabulary, both familiar and unfamiliar;
- read literature that reflects the uniqueness and integrity of the American experience;
- read classic and contemporary literature, representing various cultural and ethnic traditions from throughout the world; and
- read classic and contemporary literature of the United States about the experiences and traditions of diverse ethnic groups.

What grade 9–12 students know and are able to do includes:

- reading, responding to, and discussing novels, poetry, short stories, non-fiction, content-area and technical material, plays, essays, and speeches;
- using literary terminology accurately, such as theme, mood, diction, idiom, perspective, style, and point of view;
- identifying recurrent themes in United States literature; and
- developing and supporting a thesis about the craft and significance of particular works of literature, both classic and contemporary, from a variety of ethnic writers.

Extending beyond standards:

- comparing and contrasting stories, novels, poems, and other forms of literature from different countries, time periods, or cultures;

- using novels, poetry, short stories, non-fiction, autobiographies, plays, essays, speeches, literary criticisms and analyses, and any other literature to explore academic, personal, or career issues; and
- understanding the common themes in the literature of the United States and in world literature.

COLORADO Grades 9–12 Mathematics
Model Content Standards

Standard 1: Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.

1. demonstrate meanings for real numbers, absolute value, and scientific notation using physical materials and technology in problem-solving situations;
2. develop, test, and explain conjectures about properties of number systems and sets of numbers; and
3. use number sense to estimate and justify the reasonableness of solutions to problems involving real numbers.

Education beyond standards:

- investigate limiting processes by examining infinite sequences and series; and
- explain relationships among real numbers, complex numbers, and vectors using models.

Standard 2: Students use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, and graphs in problem-solving situations and communicate the reasoning used in solving these problems.

1. model real-world phenomena (for example, distance-versus-time relationships, compound interest, amortization tables, mortality rates) using functions, equations, inequalities, and matrices;
2. represent functional relationships using written explanations, tables, equations, and graphs, and describe the connections among these representations;
3. solve problems involving functional relationships using graphing calculators and/or computers as well as appropriate paper-and-pencil techniques;
4. analyze and explain the behaviors, transformations, and general properties of types of equations and functions (for example, linear, quadratic, exponential); and
5. interpret algebraic equations and inequalities geometrically and describe geometric relationships algebraically.

Education beyond standards:

- use rational, polynomial, trigonometric, and inverse functions to model real-world phenomena;
- represent and solve problems using linear programming and difference equations;
- solve systems of linear equations using matrices and vectors;
- describe the concept of continuity of a function;
- perform operations on and between functions; and
- make the connections between trigonometric functions and polar coordinates, complex numbers, and series.

Standard 3: Students use data collection and analysis, statistics, and probability in problem-solving situations and communicate the reasoning used in solving these problems.

1. design and conduct a statistical experiment to study a problem, and interpret and communicate the results using the appropriate technology (for example, graphing calculators, computer software);
2. analyze statistical claims for erroneous conclusions or distortions;
3. fit curves to scatter plots, using informal methods or appropriate technology, to determine the strength of the relationship between two data sets and to make predictions;
4. draw conclusions about distributions of data based on analysis of statistical summaries (for example, the combination of mean and standard deviation, and differences between the mean and median);
5. use experimental and theoretical probability to represent and solve problems involving uncertainty (for example, the chance of playing professional sports if a student is a successful high school athlete); and
6. solve real-world problems with informal use of combinations and permutations (for example, determining the number of possible meals at a restaurant featuring a given number of side dishes).

Education beyond standards:

- create and interpret discrete and continuous probability distributions, and understand their application to real-world situations (for example, insurance);
- test hypotheses using appropriate statistics;
- explore the effect of sample size on the results of statistical surveys using experiments and simulations; and
- solve real-world problems with formal use of combinations and permutations.

Standard 4: Students use geometric concepts, properties, and relationships in problem-solving situations and communicate the reasoning used in solving these problems.

1. find and analyze relationships among geometric figures using transformations (for example, reflections, translations, rotations, dilations) in coordinate systems;
2. derive and use methods to measure perimeter, area, and volume of regular and irregular geometric figures;
3. make and test conjectures about geometric shapes and their properties, incorporating technology where appropriate; and

4. use trigonometric ratios in problem-solving situations (for example, finding the height of a building from a given point, if the distance to the building and the angle of elevation are known).

Education beyond standards:

- deduce properties of figures using vectors;
- apply transformations, coordinates, and vectors in problem-solving situations; and
- describe, analyze, and extend patterns produced by processes of geometric change (for example, limits and fractals).

Standard 5: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

1. measure quantities indirectly using techniques of algebra, geometry, or trigonometry;
2. select and use appropriate techniques and tools to measure quantities in order to achieve specified degrees of precision, accuracy, and error (or tolerance) of measurements; and
3. determine the degree of accuracy of a measurement (for example, by understanding and using significant digits).
4. demonstrate the meanings of area under a curve and length of an arc.

Education beyond standards:

- demonstrate the meanings of area under a curve and length of an arc.

Standard 6: Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic, paper-and-pencil, calculators, and computers, in problem-solving situations and communicate the reasoning used in solving these problems.

1. use ratios, proportions, and percents in problem-solving situations;
2. select and use appropriate methods for computing with real numbers in problem-solving situations and determine whether the results are reasonable; and
3. describe the limitations of estimation, and assess the amount of error resulting from estimation within acceptable limits.

Education beyond standards:

- analyze and solve optimization problems;
- analyze different algorithms (for example, sorting) for efficiency;
- analyze and use critical path algorithms (for example, determining in which order to perform a set of tasks in a large project); and
- investigate problem situations that arise in connection with computer validation and the application of algorithms.

Science

COLORADO Grades 9–12 Science

Model Content Standards

Standard 1: Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

1. ask questions and state hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation
2. select and use appropriate technologies to gather, process, and analyze data and to report information related to an investigation
3. identify major sources of error or uncertainty within an investigation (for example: particular measuring devices and experimental procedures)
4. recognize and analyze alternative explanations and models
5. construct and revise scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables
6. communicate and evaluate scientific thinking that leads to particular conclusions

Standard 2: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. (Focus: Biology—Anatomy, Physiology, Botany, Zoology, Ecology)

1. elements can be organized by their physical and chemical properties (Periodic Table)
2. the spatial configuration of atoms and the structure of the atoms in a molecule determine the chemical properties of the substance
3. there are observable and measurable physical and chemical properties that allow one to compare, contrast, and separate substances (for example: pH, melting point, conductivity, magnetic attraction)
4. word and chemical equations are used to relate observed changes in matter to its composition and structure (for example: conservation of matter)
5. quantitative relationships involved with thermal energy can be identified, measured, calculated and analyzed (for example: heat transfer in a system involving mass, specific heat, and change in temperature of matter)
6. energy can be transferred through a variety of mechanisms and in any change some energy is lost as heat (for example: conduction, convection, radiation, motion, electricity, chemical bonding changes)
7. light and sound waves have distinct properties; frequency, wavelengths and amplitude
8. quantities that demonstrate conservation of mass and conservation of energy in physical interactions can be measured and calculated
9. Newton's Three Laws of Motion explain the relationship between the forces acting on an object, the object's mass, and changes in its motion

Standard 3: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. (Focus: Biology—Anatomy, Physiology, Botany, Zoology, Ecology)

1. the pattern/process of reproduction and development is specific to different organisms
2. there is a relationship between the processes of photosynthesis and cellular respiration (for example: in terms of energy and products)
3. there is a purpose of synthesis and breakdown of macromolecules in an organism (for example: carbohydrates, lipids, amino acids serve as building blocks of proteins; carbon dioxide and water are the basic materials for building sugars through photosynthesis)
4. energy is used in the maintenance, repair, growth, and production of tissues
5. the human body functions in terms of interacting organ systems composed of specialized structures that maintain or restore health (for example: mechanisms involved in homeostasis [balance], such as feedback in the endocrine system)
6. changes in an ecosystem can affect biodiversity and biodiversity contributes to an ecosystem's dynamic equilibrium
7. there is a cycling of matter (for example: carbon, nitrogen) and the movement and change of energy through the ecosystem (for example: some energy dissipates as heat as it is transferred through a food web)
8. certain properties of water sustain life (for example: polarity, cohesion, solubility)
9. cellular organelles have specific functions (for example: the relationship of ribosomes to protein, and the relationship of mitochondria to energy transformation)
10. cell reproduction/division has various processes and purposes (mitosis, meiosis, binary fission)
11. DNA has a general structure and function and a role in heredity and protein synthesis (for example: replication of DNA and the role of RNA in protein synthesis)

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____ = Content sampled by the ACT Science Test

12. genes serve as the vehicle for genetic continuity and the source of genetic diversity upon which natural selection can act
13. some traits can be inherited while others are due to the interaction of genes and the environment (for example: skin cancer triggered by over-exposure to sunlight or contact with chemical carcinogens)
14. organisms are classified into a hierarchy of groups and subgroups based on similarities which reflect their evolutionary relationships
15. mutation, natural selection, and reproductive isolation can lead to new species and affect biodiversity
16. an organism's adaptations (for example, structure, behavior) determine its niche (role) in the environment
17. variation within a population improves the chances that the species will survive under new environmental conditions
18. organisms change over time in terms of biological evolution and genetics

Standard 4: Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. (Focus: Geology, Meteorology, Astronomy, Oceanography)

1. the Earth's interior has a composition and structure
2. the theory of plate tectonics helps to explain relationships among earthquakes, volcanoes, mid-ocean ridges, and deep-sea trenches
3. the feasibility of predicting and controlling natural events can be evaluated (for example: earthquakes, floods, landslides)
4. there are costs, benefits, and consequences of natural resource exploration, development, and consumption (for example: geosphere, biosphere, hydrosphere, atmosphere and greenhouse gas)
5. there are consequences for the use of renewable and nonrenewable resources
6. evidence is used (for example: fossils, rock layers, ice cores, radiometric dating) to investigate how Earth has changed or remained constant over short and long periods of time (for example: Mount St. Helen's' eruption, Pangaea, and geologic time)
7. the atmosphere has a current structure and composition and has evolved over geologic time (for example: effects of volcanic activity and the change of life forms)
8. energy transferred within the atmosphere influences weather (for example: the role of conduction, radiation, convection, and heat of condensation in clouds, precipitation, winds, storms)
9. weather is caused by differential heating, the spin of the Earth and changes in humidity (air pressure, wind patterns, coriolis effect)
10. there are interrelationships between the circulation of oceans and weather and climate
11. there are factors that may influence weather patterns and climate and their effects within ecosystems (for example: elevation, proximity to oceans, prevailing winds, fossil fuel burning, volcanic eruptions)
12. water and other Earth systems interact (for example: the biosphere, lithosphere, and atmosphere)
13. continental water resources are replenished and purified through the hydrologic cycle
14. gravity governs the motions observed in the solar system and beyond
15. there is electromagnetic radiation produced by the Sun and other stars (for example: X-ray, ultraviolet, visible light, infrared, radio)
16. stars differ from each other in mass, color, temperature and age
17. the scales of size and separation of components of the solar system are complex

Standard 5: Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.

1. print and visual media can be evaluated for scientific evidence, bias, or opinion
2. the scientific way of knowing uses a critique and consensus process (for example: peer review, openness to criticism, logical arguments, skepticism)
3. graphs, equations or other models are used to analyze systems involving change and constancy (for example: comparing the geologic time scale to shorter time frame, exponential growth, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium)
4. there are cause-effect relationships within systems (for example: the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid)
5. scientific knowledge changes and accumulates over time; usually the changes that take place are small modifications of prior knowledge but major shifts in the scientific view of how the world works do occur
6. interrelationships among science, technology and human activity lead to further discoveries that impact the world in positive and negative ways
7. there is a difference between a scientific theory and a scientific hypothesis

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