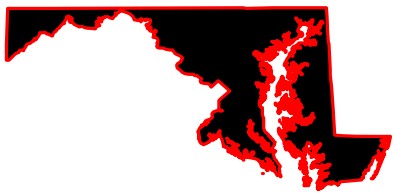
STATE MATCH

Maryland Voluntary State Curriculum and Core Learning Goals

Reading/English Language Arts, Mathematics, and Science
Grades 8–12

and

EXPLORE®, PLAN®, the ACT®, and WorkKeys®



June 2008

ACT®

About This Report

EXECUTIVE SUMMARY

(pp. 1–3)

This portion summarizes the findings of the alignment between Maryland's Voluntary State Curriculum Performance Standards and Core Learning Goals and ACT's Educational Planning and Assessment System (EPAS™) tests—EXPLORE® (8th and 9th grades), PLAN® (10th grade), and the ACT® (11th and 12th grades)—and ACT's WorkKeys® assessments (Reading for Information, Applied Mathematics, and Locating Information). It also presents ACT's involvement in meeting NCLB requirements and describes additional information about the unique programs and services ACT can provide to Maryland.

SECTION A

(pp. 5–7)

This section provides tables by content area (Reading/English Language Arts, Mathematics, and Science) listing the precise number of Maryland Standards and Core Learning Goals measured by ACT's EPAS tests and/or WorkKeys assessments by grade level.

SECTION B

(pp. 9–46)

All Maryland Standards and Core Learning Goals are listed here; each one highlighted is measured by ACT's EPAS tests and/or WorkKeys assessments. Maryland Standards and Core Learning Goals listed here are from the Maryland Voluntary State Curriculum Performance Standards and Core Learning Goals as presented on the Maryland Department of Education's website in October 2007. Underlined science content indicates that the content topics are included in, but not directly measured by, ACT's EPAS Science Tests.

SECTION C

(pp. 47–56)

ACT's College Readiness Standards appear here. Highlighting indicates that a statement reflects one or more statements in the Maryland Voluntary State Curriculum Performance Standards and Core Learning Goals. College Readiness Standards not highlighted are not addressed in the Maryland Standards and Core Learning Goals.

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SECTION D
(pp. 57–58)

WorkKeys skill levels appear here. Highlighting indicates that a statement reflects one or more statements in the Maryland Core Learning Goals. Skills not highlighted are not addressed in the Maryland Core Learning Goals.

A supplement is available that identifies the specific ACT College Readiness Standard(s) and WorkKeys Skill(s) corresponding to each Maryland Standard and Core Learning Goal in a side-by-side format. To request this supplement, please e-mail ACT at **statematch@act.org**.

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Executive Summary

We at ACT believe our programs offer many advantages to Maryland students and educators, and this report offers strong evidence for this belief. This alignment analysis clearly answers four critical questions:

1. To what extent do ACT's Educational Planning and Assessment System (EPAS™) tests—EXPLORE® (8th and 9th grades), PLAN® (10th grade), and the ACT® (11th and 12th grades)—and ACT's WorkKeys® assessments (Reading for Information, Applied Mathematics, and Locating Information) measure Maryland's Standards and Core Learning Goals?
2. Can the results from ACT's testing programs be used to meet Maryland's NCLB requirement?
3. Why should Maryland choose EPAS?
4. Why choose to include WorkKeys assessments?

ACT'S TESTS MEASURE ALMOST ALL OF MARYLAND'S STANDARDS AND CORE LEARNING GOALS IN READING/ENGLISH LANGUAGE ARTS, MATHEMATICS, AND SCIENCE.

1. Match Results: Comparisons conducted by our content specialists show that ACT's Reading, English, Writing, Mathematics and Science tests and WorkKeys Reading for Information (RI) and Applied Mathematics (AM) assessments measure many of Maryland's Reading/English Language Arts, Mathematics, and Science Standards and Core Learning Goals. WorkKeys Locating Information (LI) assessment measures some skills listed in three of Maryland's Science courses.

- Reading/English Language Arts: 9 out of 11 Standards and Core Learning Goals

  Almost all of Maryland's Reading/English Language Arts Standards and Core Learning Goals are covered by ACT's English, Reading, and Writing tests and WorkKeys Reading for Information assessment.

- Mathematics: 10 out of 10 Standards and Core Learning Goals

  All of Maryland's Mathematics Standards and Core Learning Goals are covered by ACT's Mathematics tests and WorkKeys Applied Mathematics assessment.

- Science: Process Standards and Core Learning Goals: 2 out of 2
  (Content Standards and Core Learning Goals: 10 out of 10)

  All of Maryland's Science Standards and Core Learning Goals are covered by ACT's Science tests and WorkKeys Locating Information assessment.

  (A note about science content: ACT's Science tests present content from biology, chemistry, physics, and Earth/space sciences. Although content knowledge in these content areas is needed to answer some of the test questions, the test questions emphasize scientific reasoning and are based in experimental science contexts. Factual content knowledge, although needed to answer some of the test questions, is not systematically sampled from the full content knowledge domain. Therefore, each ACT Science Test covers some, but not all, of the discrete science content knowledge specifically described in the Maryland Standards and Core Learning Goals.

  To emphasize the point that content is included, but not necessarily covered in its entirety, on every test form, science content match results appear in parentheses in Section A of this document (which describes the number of Maryland Standards and Core Learning Goals measured by ACT's tests), and are underlined rather than highlighted in Section B. Our goal

STATES CHOOSE ACT BECAUSE:

- **STUDENT MOTIVATION IS HIGH.**
- **ACT'S IS THE ONLY CURRICULUM-BASED ASSESSMENT SYSTEM THAT MEASURES STUDENT READINESS ALONG A CONTINUUM OF EMPIRICALLY DERIVED COLLEGE READINESS BENCHMARKS.**
- **EPAS DATA PROVIDE HELPFUL FEEDBACK FOR TEACHERS, STUDENTS, AND POLICYMAKERS TO MAKE EDUCATIONAL DECISIONS AND IDENTIFY WAYS TO IMPROVE.**

ACT BUILDS ITS DEFINITION OF COLLEGE READINESS ON A SOUND EMPIRICAL BASE:

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

here is to clearly communicate that science content will be included, but each specific content topic will not be covered consistently enough for inferences to be made about student proficiency in all areas.)

Most exceptions to a match between ACT's tests and Maryland's Standards and Core Learning Goals arise from standards not being assessable in group settings, standards that are personal in nature, and standards requiring measurement over extended time. If additional testing is deemed necessary, ACT would be interested in working with Maryland on developing any necessary augmentation.

2. NCLB requirement? Yes; states like Michigan and Illinois use ACT components as part of testing that is submitted to the U.S. Department of Education for NCLB approval.

3. Why choose ACT? States and school districts choose ACT's EPAS programs because student motivation is high, and EPAS is the *only curriculum-based assessment system that measures student readiness along a continuum of empirically derived college readiness benchmarks*. 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:

- **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 the ACT 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 at ACT have developed detailed statements that describe what students typically know and are able to do at different levels of test performance. These data-driven, empirically derived score descriptors

articulate student achievement within various score ranges on the English, Reading, Writing, Mathematics, and Science tests on the EXPLORE, PLAN, and ACT. These statements provide specific details about students' college readiness and can be used to identify next steps for improvement.

4. Why choose to include WorkKeys assessments? Students can use WorkKeys to help determine the skill levels and education required for various jobs. Educators can use WorkKeys to ensure that students enter the work world with the foundational skills needed in any field they choose.

Further, the WorkKeys scores offer a clear way for students to demonstrate their knowledge and skills to prospective employers. WorkKeys is at the center of the nationwide Career Readiness System that links qualified individuals with employers who recognize the value of skilled job applicants. ACT's National Career Readiness Certificate (NCRC) ensures that an individual has certain foundational skills that are important across a range of positions. The NCRC is a portable credential that employees can use anywhere in the nation. Individuals seeking employment gain a competitive edge with an NCRC because they are able to provide prospective employers with clear evidence that their knowledge and skills align with the requirements of the job they are applying for. The NCRC offers job seekers, employers, and educators an easily understood, conveniently attained, and universally valued credential.

Test takers are most commonly certified in the skills areas of Applied Mathematics, Locating Information, and Reading for Information. Higher scores qualify students for more jobs than do lower scores. New Jersey, Virginia, Louisiana, Kentucky, North Carolina, and New Mexico have already initiated certificate programs, and many other states are in the process of developing similar programs.

In sum, ACT's EPAS and WorkKeys programs provide abundant data regarding student readiness for college and work. This information can help Maryland educators and students make well-informed decisions in planning students' career and academic goals.

Section A: Number of Maryland Standards and Core Learning Goals Measured by EXPLORE, PLAN, the ACT, and WorkKeys

Table A-1. Maryland Reading/English Language Arts Standards Measured by EXPLORE		
Maryland Standards*	**Number of Maryland Indicators Measured by EXPLORE**	**Aspects of Maryland Standards that are Not Measured**
1. General Reading Processes	Grade 8: 2 out of 5	Phonemic Awareness Read orally at an appropriate rate
2. Comprehension of Informational Text	Grade 8: 1 out of 1	
3. Comprehension of Literary Text	Grade 8: 1 out of 1	
4. Writing	Grade 8: 1 out of 1	Compose presentations Compose texts using effective prewriting strategies
5. Controlling Language	Grade 8: 3 out of 5	Recognize conventional spelling Produce legible writing
6. Listening	Grade 8: 0 out of 1	Demonstrate effective listening
7. Speaking	Grade 8: 0 out of 1	Deliver oral presentations
TOTALS 5 out of 7 Standards	Grade 8: 8 out of 15	

Table A-2. Maryland English Language Arts Core Learning Goals Measured by EXPLORE, PLAN, the ACT, and WorkKeys		
Maryland Core Learning Goals*	**Number of Maryland Indicators Measured by ACT's tests**	**Aspects of Maryland Core Learning Goals that are Not Measured**
1. Reading, Reviewing and Responding to Texts	Grades 9-12: 3 out of 3	
2. Composing in a Variety of Modes	Grades 9-12: 2 out of 3	Locate, retrieve, and use information from various sources
3. Controlling Language	Grades 9-12: 3 out of 3	
4. Evaluating the Content, Organization, and Language Use of Texts	Grades 9-12: 2 out of 3	Describe the effect that a given text, heard or read, has on a listener or reader
TOTALS 4 out of 4 Core Learning Goals	Grades 9-12: 10 out of 12	

*Refer to Maryland's Reading/English Language Arts Standards and Core Learning Goals on pages 9–21.

Table A-3. Maryland Mathematics Standards Measured by EXPLORE		
Maryland Standards*	**Number of Maryland Indicators Measured by EXPLORE**	**Aspects of Maryland Standards that are Not Measured**
1. Knowledge of Algebra, Patterns, and Functions	Grade 8: 3 out of 3	
2. Knowledge of Geometry	Grade 8: 3 out of 4	Represent plane geometric figures
3. Knowledge of Measurement	Grade 8: 1 out of 1	
4. Knowledge of Statistics	Grade 8: 2 out of 2	
5. Knowledge of Probability	Grade 8: 3 out of 3	
6. Knowledge of Number Relationships and Computation/Arithmetic	Grade 8: 2 out of 2	
7. Processes of Mathematics	Grade 8: 4 out of 4	
TOTALS 7 out of 7 Standards	Grade 8: 18 out of 19	

Table A-4. Maryland Mathematics Core Learning Goals Measured by EXPLORE, PLAN, the ACT, and WorkKeys		
Maryland Core Learning Goals*	**Number of Maryland Indicators Measured by ACT's tests**	**Aspects of Maryland Core Learning Goals that are Not Measured**
1. Functions and Algebra	Grades 9-12: 2 out of 2	
2. Geometry, Measurement, and Reasoning	Grades 9-12: 3 out of 3	
3. Data Analysis and Probability	Grades 9-12: 2 out of 2	
TOTALS 3 out of 3 Core Learning Goals	Grades 9-12: 7 out of 7	

*Refer to Maryland's Mathematics Standards and Core Learning Goals on pages 22–29.

Table A-5. Maryland Science Standards Measured by EXPLORE						
Maryland Standards*	**Number of Maryland Indicators Measured by EXPLORE**					**Aspects of Maryland Standards that are Not Measured**
1. Skills and Processes	Grade 8:	3	out of	4		Explain that complex systems require control mechanisms
TOTALS 1 out of 1 Standards	**Process Standards**	3	out of	4		
2. Earth/Space Science	Grade 8:	(3)	out of	(3)		
3. Life Science	Grade 8:	(1)	out of	(1)		
4. Chemistry	Grade 8:	(4)	out of	(4)		
5. Physics	Grade 8:	(2)	out of	(2)		
6. Environmental Science	Grade 8:	(1)	out of	(1)		
TOTALS 5 out of 5 Standards	**Content Standards**	(11)	out of	(11)		

Table A-6. Maryland Science Core Learning Goals Measured by EXPLORE, PLAN, the ACT, and WorkKeys						
Maryland Core Learning Goals*	**Number of Maryland Indicators Measured by ACT's tests**					**Aspects of Maryland Core Learning Goals that are Not Measured**
1. Skills and Processes	Grades 9-12:	7	out of	7		
TOTALS 1 out of 1 Core Learning Goals	**Process Standards**	7	out of	7		
2. Concepts of Earth/Space Science	Grades 9-12:	(5)	out of	(5)		
3. Concepts of Biology	Grades 9-12:	(6)	out of	(6)		
4. Concepts of Chemistry	Grades 9-12:	(5)	out of	(5)		
5. Concepts of Physics	Grades 9-12:	(5)	out of	(5)		
6. Environmental Science	Grades 9-12:	(4)	out of	(4)		
TOTALS 5 out of 5 Core Learning Goals	**Content Standards**	(25)	out of	(25)		

*Refer to Maryland's Science Standards and Core Learning Goals on pages 30–46.

Reading/English Language Arts

MARYLAND Grade 8 Standards

Standard 1.0: General Reading Processes

A. Phonemic Awareness

B. Phonics

C. Fluency

1. Read orally at an appropriate rate
   a. Read familiar and independent level text at a rate that is conversational and consistent
   b. Read instructional level text that is challenging yet manageable
2. Read grade-level text with both high accuracy and appropriate pacing, intonation, and expression
   a. Apply knowledge of word structures and patterns to read with automaticity
   b. Demonstrate appropriate use of phrasing
      - Attend to sentence patterns and structures that signal meaning in text
      - Use punctuation cues to guide meaning and expression
      - Use pacing and intonation to convey meaning and expression
      - Adjust intonation and pitch appropriately
   c. Increase sight words read fluently

D. Vocabulary

1. Develop and apply vocabulary through exposure to a variety of texts
   a. Acquire new vocabulary through listening to, independently reading, and discussing a variety of literary and informational texts
   b. Discuss words and word meanings daily as they are encountered in text, instruction, and conversation
2. Apply and refine a conceptual understanding of new words
   a. Classify and categorize increasingly complex words
   b. Explain relationships between and among words
      - Antonyms and synonyms
      - Multiple meaning words
3. Understand, acquire, and use new vocabulary
   a. Use context to determine the meanings of words
      - Above grade-level words used in context
      - Words with multiple meanings
      - Connotations versus denotations
      - Grade-appropriate idioms, colloquialisms, and figurative expressions
   b. Use word structure to determine the meaning of words
      - Grade-appropriate prefixes and suffixes
      - Grade-appropriate roots and ba e words
   c. Use resources to confirm definitions and gather further information about words
   d. Use new vocabulary in speaking and writing to gain and extend content knowledge and clarify expression

E. General Reading Comprehension

1. Apply and refine comprehension skills through exposure to a variety of print and non-print texts, including traditional print and electronic texts
   a. Listen to critically, read, and discuss texts representing diversity in content, culture, authorship, and perspective, including areas such as race, gender, disability, religion, and socio-economic background
   b. Read a minimum of 25 self-selected and/or assigned books or book equivalents representing various genres
   c. Discuss reactions to and ideas/information gained from reading experiences with adults and peers in both formal and informal situations
2. Use strategies to prepare for reading (before reading)
   a. Select and apply appropriate strategies to prepare for reading the text
3. Use strategies to make meaning from text (during reading)
   a. Select and apply appropriate strategies to make meaning from text during reading
4. Use strategies to demonstrate understanding of the text (after reading)
   a. Identify and explain the main idea or argument of the text or a portion of the text
   b. Identify and explain information directly stated in the text or a portion of the text
   c. Draw inferences and/or conclusions and make generalizations
      - From the text or a portion of the text
   d. Confirm, refute, or make predictions

- The development, topics, or ideas that might logicaly be included if the text were extended

e. Summarize or paraphrase
   - The text or a portion of the text

f. Connect the text to prior knowledge or personal experience
   - Prior knowledge or experience that clarifies, extends, or challenges the ideas and/or information in the text or a portion of the text

Standard 2.0: Comprehension of Informational Text

Students will read, comprehend, interpret, analyze, and evaluate informational text.

A. Comprehension of Informational Text

1. Apply and refine comprehension skills by selecting, reading, and analyzing a variety of print and non-print informational texts, including electronic media
   a. Read, use, and identify the characteristics of primary and secondary sources of academic information such as textbooks, trade books, reference and research materials, periodicals, editorials, speeches, interviews, articles, non-print materials, and online materials, other appropriate content-specific texts
      - Grade-appropriate primary and secondary texts
   b. Read, use, and identify the characteristics of workplace and other real-world documents such as sets of directions, science investigations, atlases, posters, flyers, forms, instructional manuals, menus, pamphlets, rules, invitations, recipes, advertisements, other functional documents
      - Grade-appropriate workplace and real-world documents
   c. Select and read to gain information from personal interest materials such as books, pamphlets, how-to manuals, magazines, web sites, and other online materials
2. Analyze text features to facilitate and extend understanding of informational texts
   a. Analyze print features that contribute to meaning
      - In the text or a portion of the text
   b. Analyze graphic aids that contribute to meaning
      - In the text or a portion of the text
   c. Analyze informational aids that contribute to meaning
      - In the text or a portion of the text
   d. Analyze organizational aids that contribute to meaning
      - In the text or a portion of the text
   e. Analyze online features that contribute to meaning
      - In the text or a portion of the text
   f. Analyze the relationship between the text features and the content of the text as a whole
      - In the text or a portion of the text
3. Apply knowledge of organizational patterns of informatioal text to facilitate understanding and analysis
   a. Analyze the organizational patterns of texts such as common organizational patterns, transition or signal words and phrases that indicate the organizational pattern
      - In the text or a portion of the text
   b. Analyze the contribution of the organizational pattern to clarify or reinforce meaning and support the author's purpose and/or argument
      - in the text or a portion of the text
   c. Analyze shifts in organizational patterns
      - Portions of text that illustrate a shift in organizational pattern
   d. Use organizational structure to locate specific information
4. Analyze important ideas and messages in informational texts
   a. Analyze the author's/text's purpose and intended audience
      - Purpose of the author or the text or a portion of the text
      - Connections between the text and the intended audience
   b. Analyze the author's argument, viewpoint, or perspective
      - In the text or a portion of the text
   c. State and support main ideas and messages
      - In the text or a portion of the text
   d. Summarize or paraphrase
      - The text or a portion of the text
   e. Identify and explain information or ideas peripheral to the main idea or message
      - In the text or a portion of the text
   f. Analyze relationships between and among ideas
      - Relationships between and among ideas in one text or across multiple texts
      - In the text or a portion of the text
   g. Synthesize ideas from text
      - From one text or a portion of the text or across multiple texts
   h. Explain the implications of the text or how someone might use the text
      - Application of the text for personal use or content-specific use

- Issues and ideas within a text or across texts that may have implications for readers or contemporary society

i. Connect the text to prior knowledge or experience

- Prior knowledge that clarifies, extends, or challenges the ideas in the text or a portion of the text

5. Analyze purposeful use of language
   a. Analyze specific word choice that contributes to the meaning and/or creates style
      - Significant words and phrases (e.g., figurative language, idioms, colloquialisms, etc.) in the text or a portion of the text
      - Connotations of grade-appropriate words in context
      - Denotations of above-grade-level words in context
      - Discernible styles such as persuasive, informal, formal, etc.
   b. Analyze specific language choices to determine tone
      - In the text or a portion of the text
   c. Analyze the appropriateness of tone
      - In the text or a portion of the text
   d. Analyze repetition and variation of specific words and phrases that contribute to meaning
      - In the text or a portion of the text
6. Read critically to evaluate informational text
   a. Analyze the extent to which the text or texts fulfill the reading purpose
      - Connections between the content of the text and the purpose for reading
   b. Analyze the extent to which the structure and text features clarify the purpose and the information
      - Connections between effectiveness of format and text features in clarifying the main idea and/or purpose of the text
      - Connections between effectiveness of organizational pattern and clarity of the main idea and/or purpose of the text
   c. Analyze the text and its information for reliability
      - Connections between the credentials of the author and the information in the text
      - Currency of the information in the text
      - Verification of information across multiple sources
   d. Analyze the author's argument or position for clarity and/or bias
      - Evidence of opposing points of view
   e. Analyze additional information that would clarify or strengthen the author's argument or viewpoint
      - Information that would enhance or clarify the reader's understanding of the main idea of the text or a portion of the text
   f. Analyze the effectiveness of persuasive techniques to sway the reader to a particular point of view
      - Significant words and phrases that have an emotional appeal
   g. Analyze the effect of elements of style on meaning
      - Stylistic elements (e.g., formal versus informal language, varied sentence structure, or the use of non-sentences)

Standard 3.0: Comprehension of Literary Text

Students will read, comprehend, interpret, analyze, and evaluate literary text.

A. Comprehension of Literary Text

1. Refine comprehension skills by reading and analyzing a variety of self-selected and assigned literary texts including print and non-print
   a. Listen to critically, read, and discuss a variety of literary texts representing diverse cultures, perspectives, ethnicities, and time periods
   b. Listen to critically, read, and discuss a variety of literary forms and genres
2. Analyze and evaluate text features to facilitate and extend understanding of literary texts
   a. Analyze text features that contribute to meaning
      - In the text or a portion of the text
3. Analyze and evaluate elements of narrative texts to facilitate understanding and interpretation
   a. Distinguish among types of grade-appropriate narrative texts such as short stories, folklore, realistic fiction, science fiction, historical fiction, fantasy, essays, memoirs, biographies, autobiographies, personal narratives, plays, and lyric and narrative poetry
      - Grade-appropriate narrative texts
   b. Analyze the events of the plot
      - Exposition, rising action, climax, and resolution
   c. Analyze details that provide information about the setting, the mood created by the setting, and the role the setting plays in the text
      - Details create the setting and/or mood in the text or a portion of the text
      - Connections among the characters, the setting, and the mood in the text or a portion of the text
      - Connections between setting and theme

d. Analyze characterization
   - Character's traits based on what character says, does, and thinks and what other characters or the narrator says
   - Character's motivations
   - Character's personal growth and development

e. Analyze relationships between and among characters, setting, and events
   - In the text or a portion of the text or across multiple texts

f. Analyze the actions of characters that serve to advance the plot
   - In the text or a portion of the text or across multiple texts

g. Analyze internal and/or external conflicts that motivate characters and those that advance the plot
   - In the text or a portion of the text

h. Analyze the author's approach to issues of time in a narrative
   - Flashback
   - Foreshadowing

i. Analyze the point of view and its effect on meaning
   - Connections between point of view and meaning
   - Conclusions about the narrator based on his/her thoughts and/or observations

j. Analyze the interactions among narrative elements and their contribution to meaning
   - Connections among narrative elements and meaning

4. Analyze and evaluate elements of poetry to facilitate understanding and interpretation
   a. Use structural features to distinguish among types of poetry such as ballad, narrative, lyric, elegy, etc.
   b. Analyze language and structural features to determine meaning
      - Literal versus figurative meaning
   c. Analyze sound elements of poetry that contribute to meaning
      - Rhyme, rhyme scheme
      - Alliteration and other repetition
      - Onomatopoeia
   d. Identify and explain other poetic elements such as setting, mood, tone, etc., that contribute to meaning
      - Elements of grade-appropriate lyric and narrative poems that contribute to meaning

5. Analyze and evaluate elements of drama to facilitate understanding and interpretation
   a. Use structural features to distinguish among types of plays
   b. Analyze structural features of drama that contribute to meaning
      - Literal versus interpretive meaning
   c. Analyze how dialogue and stage directions work together to create characters and plot
      - In the text or a portion of the text

6. Analyze and interpret important ideas and messages in literary texts
   a. Analyze main ideas and universal themes
      - Experiences, emotions, issues, and ideas in a text that give rise to universal themes
      - Of the text or a portion of the text
   b. Analyze similar themes across multiple texts
      - Experiences, emotions, issues, and ideas across texts that give rise to universal themes
   c. Summarize or paraphrase
      - The text or a portion of the text
   d. Reflect on and explain personal connections to the text
      - Connections between personal experiences and the theme or main ideas
   e. Explain the implications of the text for the reader and/or society
      - Ideas and issues of a text that may have implications for the reader

7. Analyze and evaluate the author's purposeful use of language
   a. Analyze and evaluate how specific language choices contribute to meaning
      - Significant words (e.g., idioms, colloquialisms, etc.) with a specific effect on meaning
      - Denotations of above-grade-level words used in context
      - Connotations of grade-appropriate words and phrases in context
   b. Analyze and evaluate language choices that create tone
      - In the text or a portion of the text
   c. Analyze the appropriateness of a particular tone
      - Connections between tone and other narrative elements
   d. Analyze and evaluate figurative language that contributes to meaning and/or creates style
      - In the text or a portion of the text
   e. Analyze imagery that contributes to meaning and/or creates style
      - Specific words and phrases that create sensory images or contribute to style in the text or a portion of the text

f. Analyze elements of style and their contribution to meaning
   - Common elements of style such as repetition, hyperbole and rhetorical questions

8. Read critically to evaluate literary texts
   a. Analyze and evaluate the plausibility of the plot and the credibility of the characters
      - In the text or a portion of the text
   b. Analyze and evaluate the extent to which the text contains ambiguities, subtleties, or contradictions
      - Questions and predictions about events, situations, and conflicts that might occur if the text were extended
   c. Analyze and evaluate the relationship between a literary text and its historical, social, and/or political context
      - Implications of the historical or social context on a literary text
   d. Analyze the relationship between the structure and the purpose of the text
      - In the text or a portion of the text

Standard 4.0: Writing

Students will compose in a variety of modes by developing content, employing specific forms, and selecting language appropriate for a particular audience and purpose.

A. Writing

1. Compose texts using the prewriting and drafting strategies of effective writers and speakers
   a. Use a variety of self-selected prewriting strategies to generate, select, narrow, and develop ideas
      - Evaluate topic for personal relevance, scope, and feasibility
      - Begin a coherent plan for developing ideas
      - Explore and evaluate relevant sources of information
   b. Select, organize, and develop ideas appropriate to topic, audience, and purpose
      - Organize information logically
      - Use techniques such as graphic organizers and signal words to complete and clarify organizational structures
      - Verify the effectiveness of paragraph development by modifying topic, support, and concluding sentences as necessary
2. Compose oral, written and visual presentations that express personal ideas, inform, and persuade
   a. Compose to express personal ideas by experimenting with a variety of forms and techniques suited to topic, audience, and purpose in order to develop a personal style, a distinctive voice, and a deliberate tone
   b. Describe in prose and/or poetic forms to clarify, extend, or elaborate on ideas by using evocative language and appropriate organizational structure to create a dominant impression
   c. Compose to inform using relevant support and appropriate organizational structures while maintaining an objective perspective
   d. Compose to persuade by supporting, modifying, or refuting a position, using effective rhetorical strategies
      - Write an assertion and use evidence that appeals to audience emotion, reasoning, or trust
      - Organize ideas to construct a logical progression
      - Use diction and syntax that is sincere, honest, and trustworthy
      - Use connotation, repetition, and figurative language to control audience emotion and reaction
      - Use authoritative citations when effective and document appropriately
   e. Use writing-to-learn strategies such as reflective journals, metacognitive writings, and projections based on reflections to analyze and synthesize thinking and learning
   f. Manage time and process when writing for a given purpose
3. Compose texts using the revising and editing strategies of effective writers and speakers
   a. Revise texts for clarity, completeness, and effectiveness
      - Eliminate redundant and irrelevant words and ideas
      - Clarify meaning through the placement of antecedents, modifiers, connectors, and transitional devices
      - Clarify the relationships among ideas through coordination and subordination that are purposeful, logical, succinct, and parallel
      - Clarify meaning and purpose by using active voice and consistent person, number, tense, and mood
      - Vary sentence types and lengths to clarify and extend meaning, to demonstrate style, and to sustain audience interest
   b. Use suitable traditional or electronic resources to refine presentations and edit texts for effective and appropriate and conventions such as capitalization, punctuation, spelling, and pronunciation
      - Self edit
      - Peer edit
      - Dictionary

- Thesaurus
- Spell checker
- Language handbook
- Grammar checker
- Style book

c. Prepare the final product for presentation to an audience

4. Identify how language choices in writing and speaking affect thoughts and feelings
   a. Choose a level of language, formal to informal, appropriate for a specific audience, situation, or purpose
   b. Differentiate connotative from denotative meanings of words to make precise word choices
   c. Consider how readers or listeners might respond differently to the same words
5. Assess the effectiveness of choice of details, organizational pattern, word choice, syntax, use of figurative language, and rhetorical devices in the student's own composing
   a. Assess the effectiveness of diction that reveals his or her purpose
      - Language appropriate for a particular audience
      - Language suitable for a given purpose
      - Words/phrases/sentences that extend meaning in a given context
   b. Explain how the specific language and expression used by the writer or speaker affects reader/listener response
   c. Evaluate the use of transitions and their effectiveness in a text
6. Evaluate textual changes in a work and explain how these changes alter tone, clarify meaning, address a particular purpose, or fulfill a purpose
   a. Alter the tone of one's own writing by revising its diction for a specific purpose and/or audience
   b. Justify revisions in syntax and diction from a previous draft of his or her same text by explaining how the change affects meaning
7. Locate, retrieve, and use information from various sources to accomplish a purpose
   a. Identify, evaluate, and use appropriate sources of information on a self-selected and/or given topic
   b. Use various information retrieval sources (traditional and/or electronic) to obtain information on a self-selected and/or given topic
   c. Use a systematic process for recording, documenting, and organizing this information
      - Appropriate strategies for taking notes
      - Appropriate strategies for organizing source information or notes
      - Information to include or exclude when using a note taking method
      - Advantages, disadvantages, or limitations of a given strategy or procedure for recording or organizing information
      - Advantages, disadvantages, or limitations of asources of information such as bias, accuracy, availability, variety currency
      - Use a recognized format for documentation such as MLA
   d. Synthesize information from two or more sources to fulfill a self-selected or given purpose
   e. Use a recognized format to credit sources when paraphrasing, summarizing, and quoting to avoid plagiarism

Standard 5.0: Controlling Language

Students will control language by applying the conventions of standard English in speaking and writing.

A. Grammar

1. Recognize elements of grammar in personal and academic reading
2. Apply knowledge of grammar concepts and skills to control oral and written language
   a. Consider the meaning, position, form, and function of words when identifying and using all grammatical concepts
   b. Combine and expand sentences by incorporating subjects, predicates, and modifiers and by logically coordinating, subordinating, and sequencing ideas
   c. Differentiate grammatically complete sentences from non-sentences
   d. Compose simple, compound, complex, and compound-complex sentences using independent, dependent, restrictive, and nonrestrictive clauses; transitions; conjunctions; and appropriate punctuation to connect ideas

B. Usage

1. Recognize examples of conventional usage in personal and academic reading
2. Comprehend and apply standard English usage in oral and written language
   a. Apply appropriate English usage, involving subject/verb agreement
   b. Apply consistent and appropriate use of the person, number, and case of pronouns; pronoun/antecedent agreement; special pronoun problems such as who - whom, and incomplete constructions; active and passive voice; and verbal and verbal phrases
   c. Recognize and correct common usage errors such as misplaced and dangling modifiers; incorrect use of verbs, double negatives; and commonly confused words such as *accept - except*

d. Use available resources to correct or confirm editorial choices
e. Explain editorial choices

C. Mechanics

1. Explain and justify the purpose of mechanics to make and clarify meaning in academic and personal reading and writing
2. Apply standard English punctuation and capitalization in written language
   a. Punctuate at the word level
      - Hyphen
      - Slash
   b. Use the mechanics of writing correctly
   c. Use available resources for all mechanics of writing rules that may be in flux
3. Explain editorial choices involving mechanics

D. Spelling

1. Recognize conventional spelling in and through personal and academic reading
2. Apply conventional spelling in written language
   a. Use conventional spelling in personal writing
   b. Develop self-monitoring strategies for frequently misspelled words
   c. Use suitable traditional and electronic resources as a spelling aid
3. Maintain a personal list of words to use in editing original writing

E. Handwriting

1. Produce writing that is legible to the audience
   a. Write fluidly and legibly in manuscript and cursive
   b. Use word processing technology when appropriate

Standard 6.0: Listening

Students will demonstrate effective listening to learn, process, and analyze information.

A. Listening

1. Apply and demonstrate listening skills appropriately in a variety of settings and for a variety of purposes
   a. Respond to a speaker's cues appropriately
   b. Identify regional and social language differences
   c. Determine and apply criteria to evaluate oral presentations
2. Demonstrate comprehension and literary analysis strategies and skills for a variety of listening purposes and settings
   a. Evaluate the effectiveness of the elements of the speech or performance or presentation
   b. Interpret the speech or performance or presentation
   c. Analyze a speaker's purpose and viewpoint
   d. Identify and evaluate a speaker's stylistic devices such as clear organization, clear viewpoint, use of support, language appropriate to audience, topic appropriate to audience
   e. Evaluate a speaker's credibility such as bias, hidden agendas, use of research/information from reliable sources
   f. Explain and support a personal response to an oral presentation

Standard 7.0: Speaking

Student will communicate effectively in a variety of situations with different audiences, purposes, and formats.

A. Speaking

1. Demonstrate appropriate organizational strategies and delivery techniques to plan for a variety of oral presentation purposes
   a. Refine a presentation using varied media
   b. Uses a combination of organizational structures such as narrative, cause and effect, chronological/sequential order, description, main idea with supporting details, problem/solution, question/answer, comparison and contrast, making appropriate transitions within a presentation
   c. Speak to persuade by including a well-defined thesis, differentiating fact from opinion, and support arguments with detailed evidence, examples, reasoning and persuasive language

MARYLAND Grades 9-12 Core Learning Goals

Goal 1: Reading, Reviewing and Responding to Texts

The student will demonstrate the ability to respond to a text by employing personal experiences and critical analysis.

1.1. The student will use effective strategies before, during, and after reading, viewing, and listening to self-selected and assigned materials.

1.1.1. The student will use pre-reading strategies appropriate to both the text and purpose for reading by surveying the text, accessing prior knowledge, formulating questions, setting purpose(s), and making predictions.

- Recognizing the implications of text features
- Linking appropriate experiences and prior knowledge about the topic, author, or type of material to the text
- Identifying an appropriate purpose for reading the text
- Identifying questions a reader would expect to be answered by reading the text
- Identifying topics of discussion that may enhance a reader's understanding of a text

1.1.2. The student will use during-reading strategies appropriate to both the text and purpose for reading by visualizing, making connections, and using fix-up strategies such as re-reading, questioning, and summarizing.

- Using visual aids
- Making connections between ideas within the text
- Making connections between ideas within the text and relevant prior knowledge
- Identifying the organizational pattern of the text
- Focusing on similarities or differences in organizational patterns, text/author's purpose, and relevant prior knowledge within or across texts
- Identifying the meaning of above-grade-level words as they are used in context
- Identifying the appropriate meaning of multiple-meaning words as they are used in context
- Identifying the meaning of phrases as they are used in context
- Predicting the development of ideas that might logically be included in the text

1.1.3. The student will use after-reading strategies appropriate to both the text and purpose for reading by summarizing, comparing, contrasting, synthesizing, drawing conclusions, and validating the purpose for reading.

- Summarizing, comparing, contrasting, and synthesizing significant ideas in a text
- Summarizing or synthesizing significant ideas across texts and drawing conclusions based on the information in more than one text
- Drawing conclusions based upon information from the text
- Confirming the usefulness or purpose for reading the text
- Predicting the development, topics, or ideas that might logically be included if the text were extended

1.1.4. The student will apply reading strategies when comparing, making connections, and drawing conclusions about non-print text.

- Recognizing the implications of non-print text such as photographs, posters, art reproductions, cartoons, and stills from film or stage productions
- Identifying an appropriate purpose for viewing non-print text
- Confirming the usefulness or purpose for viewing a non-print text
- Evaluating non-print text as it relates to a print text
- Focusing on similarities and/or differences in purpose and effect across texts
- Summarizing, comparing, drawing conclusions about, and synthesizing significant ideas between print and non-print text

1.1.5. The student will identify specific structural elements of particular literary forms: poetry, short story, novel, drama, essay, biography, autobiography, journalistic writing, and film.

1.2. The student will construct, examine, and extend meaning of traditional and contemporary works recognized as having significant literary merit.

1.2.1. The student will consider the contributions of plot, character, setting, conflict, and point of view when constructing the meaning of a text.

- Determining the significance of the following as each contributes to the meaning of a text

- plot sequence of events (including foreshadowing and flashback), cause-and-effect relationships, and events that are exposition, climax or turning point, resolution (Students will not be asked to label events.)
- characters' defining traits, motivations, and developments throughout the text
- details that provide clues to the setting, the mood created by the setting, and the role the setting plays in the text
- conflicts that motivate characters and those that serve to advance the plot
- the perspective of the author or speaker as well as the effects of first or third person narration and multiple narrators within and across text(s)

1.2.2. The student will determine how the speaker, organization, sentence structure, word choice, tone, rhythm, and imagery reveal an author's purpose.

- Identifying and/or explaining the significance of the following as each contributes to the author's purpose
- a particular speaker in a text
- the arrangement of ideas in a particular way
- the arrangement of words or phrases
- words that convey author's purpose
- syntax, words, and syllables that create rhythm to reveal the meaning of the text
- implied meaning or particular image associated with a particular word or phrase

1.2.3. The student will explain the effectiveness of stylistic elements in a text that communicate an author's purpose.

- Identifying and/or explaining the effect and/or effectiveness of the following as each contributes to the author's purpose
  - repetition
  - exaggeration
  - parallelism
  - allusion
  - analogy
- figurative language
- transitions
- choice of details
- syntax
- organizational patterns
- structural features

1.2.4. The student will identify and/or explain connections between and among themes and/or styles of two or more texts.

- Analyzing the similarities or differences in styles (e.g., formal, informal, conversational, scholarly, journalistic, poetic) of two or more texts
- Analyzing the similarities or differences in themes of two or more texts
- Analyzing the ways in which different texts illustrate a similar theme

1.2.5. The student will extend or further develop meaning by explaining the implications of the text for the reader or contemporary society.

- Identifying and/or explaining ideas and issues of a text or across texts that may have implications for readers or contemporary society
- Extending ideas found in a text or across texts by connecting them to ideas that have personal or societal relevance

1.2.6. The student will extend or further develop meaning by comparing texts presented in different media.

1.3. The student will explain and give evidence to support perceptions about print and non-print works.

1.3.1. The student will explain how language and textual devices create meaning.

1.3.2. The student will interpret a work by using a critical approach (e.g., reader response, historical, cultural, biographical, structural) that is supported with textual references.

1.3.3. The student will identify features of language that create tone and voice.

- Analyzing the effects of certain words and phrases on the tone or voice of a text or across texts
- Identifying similarities or differences in the overall tone created by language choices throughout a text or across texts

1.3.4. The student will explain how devices such as staging, lighting, blocking, special effects, graphics, language, and other techniques unique to a non-print medium are used to create meaning and evoke response.

1.3.5. The student will explain how common and universal experiences serve as the source of literary themes that cross time and cultures.

- Identifying the experiences, emotions, issues and ideas in a text or across texts that give rise to universal literary themes

- Considering the influence, effect, or impact of historical, cultural, or biographical information on a text (will not be dependent on student's prior knowledge)

1.3.6. The student will assess the literary merit of a text.

Goal 2: Composing in a Variety of Modes

The student will demonstrate the ability to compose in a variety of modes by developing content, employing specific forms, and selecting language appropriate for a particular audience and purpose.

2.1. The student will compose oral, written, and visual presentations that inform, persuade, and express personal ideas.

2.1.1. The student will compose to inform by using appropriate types of prose.

- Composing to explain an idea or examine a topic
- using description to support the writing purpose
- using personal ideas to support the writing purpose
- Composing to meet the criteria of the ECR rubric
- fulfilling the writing purpose as stated in the prompt
- including relevant and complete support of ideas
- organizing appropriately for the writing purpose
- using language carefully and correctly
- demonstrating attention to audience understanding and interest
- having no errors in usage or conventions that interfere with meaning

2.1.2. The student will compose to describe, using prose and/or poetic forms.

2.1.3. The student will compose to express personal ideas, using prose and/or poetic forms.

2.1.4. The student will compose persuasive texts that support, modify, or refute a position and include effective rhetorical strategies.

- Composing to state and support, refute, or modify a position
- using description to support the writing purpose
- using personal ideas to support the writing purpose
- Composing to meet the criteria of the ECR rubric
- fulfilling the writing purpose as stated in the prompt
- including relevant and complete support of ideas
- organizing appropriately for the writing purpose
- using language carefully and correctly
- demonstrating attention to audience understanding and interest
- having no errors in usage or conventions that interfere with meaning

2.2. The student will compose texts using the prewriting, drafting, revising, and editing strategies of effective writers and speakers.

2.2.1. The student will use a variety of prewriting strategies to generate and develop ideas.

- Identifying an appropriate prewriting strategy for a specific purpose or topic
- Identifying relevant sources of information

2.2.2. The student will select and organize ideas for specific audiences and purposes.

- Selecting a logical sequence of ideas or sentences
- Determining an appropriate organizational structure emphasizing purpose and/or audience
- Selecting or deleting information to suit a given purpose or audience
- Identifying the logical placement of a sentence or paragraph within a text

2.2.3. The student will revise and edit texts for clarity, completeness, and effectiveness.

- Completing or expanding ideas
- logical coordination of ideas
- subordination to replace excessive coordination
- logical or succinct subordination
- subordination to show space or time, cause or effect, condition, or concession
- sequence of ideas in a sentence for effectiveness and emphasis
- conciseness (eliminating redundancy, superfluous words and phrases, and awkward constructions)
- Attending to audience
- elaboration or support sentences
- transitional devices between sentences and paragraphs
- coherence (focusing on a central idea)

- clear connectors
- word choice
- inverted word order for effectiveness
- Controlling language structures
- clear placement of modifiers
- shifts in person, number, and tone
- misplaced and dangling modifiers

2.2.4. The student will rehearse oral texts for effective application of diction, intonation, and rhetorical strategies, such as introductions, sequence, illustrations, and conclusions.

2.2.5. The student will use suitable traditional and electronic resources to refine presentations and edit texts for effective and appropriate use of language and conventions.

- Using resources to select and use appropriate language
- avoiding the use of trite expressions and clichés
- using smooth and informative transitions
- arranging parallel elements appropriately and effectively
- selecting appropriate use of active or passive voice
- selecting an appropriate word for a given purpose

2.2.6. The student will prepare the final product for presentation to an audience.

2.3. The student will locate, retrieve, and use information from various sources to accomplish a purpose.

2.3.1. The student will identify sources of information on a self-selected and/or given topic and assess their appropriateness to accomplish a purpose.

- Determining the appropriateness of a resource to accomplish a purpose
- dictionary
- thesaurus
- encyclopedia
- magazines
- newspapers
- fiction and nonfiction books
- card catalogue (traditional and electronic)
- on-line websites and electronic resources

2.3.2. The student will use various information retrieval sources (traditional and electronic) to obtain information on a self-selected and/or given topic. Electronic sources include automated catalogs, CD ROM products, and on-line services like Internet, World Wide Web, and others.

2.3.3. The student will use a systematic process for recording and documenting information.

- Assessing the advantages, disadvantages, or limitations of sources of information (e.g., comprehensiveness, honesty, reliability, bias, accuracy, availability, variety, currency, multiple points of view)
- Identifying information to include or exclude in a reference citation when using either traditional or electronic sources of information
- Determining information that should be documented

2.3.4. The student will take a position and support it with documented information from an authoritative source.

2.3.5. The student will synthesize information from two or more sources to fulfill a self-selected or given purpose.

Goal 3: Controlling Language

The student will demonstrate the ability to control language by applying the conventions of Standard English in writing and speaking.

3.1. The student will demonstrate understanding of the nature and structure of language, including grammar concepts and skills, to strengthen control of oral and written language.

3.1.1. The student will demonstrate the advantages and limitations of speech and writing when communicating in various situations for specific audiences and purposes.

3.1.2. The student will describe how intonation, pitch, volume, pause, and rate all influence meaning.

3.1.3. The student will determine grammatical classification of words by using meaning, position, form, and function.

- Using the position and form to determine the function or classification of words and phrases
- subjects and objects: noun, pronoun, gerund, infinitive, appositive, simple, compound
- predicates: verb, verb phrase, simple, compound
- modifiers: adjective (including pronouns used as adjectives), adverb, prepositional phrase, participle, infinitive, article

- conjunctions: coordinating, subordinating, correlative, and conjunctive adverbs

3.1.4. The student will differentiate grammatically complete sentences from non-sentences.

- Identifying sentence fragments
- Identifying run-on sentences, including fused sentences and comma splices
- Completing inappropriate sentence fragments

3.1.5. The student will incorporate subjects, predicates, and modifiers when composing original sentences.

3.1.6. The student will compound various sentence elements—subjects, predicates, modifiers, phrases, and clauses—to link or contrast related ideas.

- Combining sentences through the use of
- logical coordination
- logical and effective subordination
- logical sequencing of ideas

3.1.7. The student will vary sentence types—simple, compound, complex, and compound/complex—to sustain reader or listener interest.

3.1.8. The student will expand sentences by positioning phrases and clauses to accomplish a purpose.

- Expanding sentences by using correctly placed modifiers, including appositives, verbals, dependent clauses, and restrictive or nonrestrictive clauses

3.1.9. The student will recognize, combine, and transform basic sentence patterns to vary sentence structure, to emphasize selected ideas, and to achieve syntactic maturity.

3.2. The student will identify how language choices in writing and speaking affect thoughts and feelings.

3.2.1. The student will choose a level of language, formal to informal, appropriate for a specific audience, situation, or purpose.

3.2.2. The student will differentiate connotative from denotative meanings of words.

- Determining implied meaning(s) or image(s) associated with a particular word or phrase
  - Will not focus on the meaning of above-grade-level words

3.2.3. The student will describe how readers or listeners might respond differently to the same words.

3.2.4. The student will describe regional and social language differences.

3.2.5. The student will describe the impact of regional and social variations of language on listener or reader response.

3.3. The student will use capitalization, punctuation, and correct spelling appropriately.

3.3.1. The student will edit texts for spelling, capitalization, and punctuation.

- Using internalized knowledge to identify and correct errors
- spelling of commonly confused words
- end punctuation
- commas: in a series, after introductory elements, setting off appositives and parenthetical statements, in dates and places, before coordinating conjunctions in compound sentences
- semicolons between closely-related main clauses
- semicolon and comma in compound sentence with a conjunctive adverb
- apostrophes
- capitalization: proper nouns, proper adjectives, geographic places, businesses, organizations and institutions

3.3.2. The student will use available resources to correct or confirm revisions and/or editorial choices.

- Using a resource for all punctuation or capitalization skills not internalized or for rules that may be in flux
- Using a resource for standard English usage
- agreement of subject and verb
- agreement of pronoun and antecedent
- clear pronoun reference
- appropriate case of nouns and pronouns
- appropriate and consistent verb tenses
- Using a resource to apply other common rules of language usage that are grade appropriate
- Using a resource for standard English in place of nonstandard English and slang

Goal 4: Evaluating the Content, Organization, and Language Use of Texts

The student will demonstrate the ability to evaluate the content, organization, and language use of texts.

4.1. The student will describe the effect that a given text, heard or read, has on a listener or reader.

4.1.1. The student will state and explain a personal response to a given text.

- Explaining the effectiveness of text(s) in accomplishing a purpose
- Explaining connections within or between texts
- Selecting and explaining appropriate textual evidence that supports a personal response
- specific words and phrases
- details
- scenes
- images
- symbols

4.2. The student will assess the effectiveness of choice of details, organizational pattern, word choice, syntax, use of figurative language, and rhetorical devices.

4.2.1. The student will assess the effectiveness of diction that reveals an author's purpose.

- Evaluating author's choice of words, phrases, sentences, and word order
- for a particular audience or effect
- for a given purpose
- to extend meaning in a context
- to provide emphasis

4.2.2. The student will explain how the specific language and expression used by the writer or speaker affects reader or listener response.

4.2.3. The student will evaluate the use of transitions and their effectiveness in a text.

4.2.4. The student will explain how repetitions of words, phrases, structural features, and ideas affect the meaning and/or tone of a text.

4.3. The student will evaluate textual changes in a work and explain how these changes alter tone, clarify meaning, address a particular audience, or fulfill a purpose.

4.3.1. The student will alter the tone of a text by revising its diction.

- Selecting appropriate revisions of words and phrases
- tone (e.g., humorous, urgent, official, authoritative, more or less critical, commanding, diplomatic, detached, resentful, sympathetic, formal, informal)
- purpose (inform, persuade, express personal ideas)
- audience (e.g., peer, adult, child, official authority)

4.3.2. The student will justify revisions in syntax and diction from a previous draft of a text by explaining how the change affects meaning.

4.3.3. The student will alter a text to present the same content to a different audience via the same or different media.

4.3.4. The student will compare the differences in effect of two texts on a given subject.

MARYLAND Grade 8 Standards

Standard 1.0: Knowledge of Algebra, Patterns, and Functions

Students will algebraically represent, model, analyze, or solve mathematical or real-world problems involving patterns or functional relationships.

A. Patterns and Functions

1. Identify, describe, extend, and create patterns, functions and sequences
   a. Determine the recursive relationship of arithmetic sequences represented in words, in a table or in a graph
      - Provide the *n*th term no more than 10 terms beyond the last given term using common differences no more than 10 with integers (–100 to 5000)
   b. Determine the recursive relationship of geometric sequences represented in words, in a table, or in a graph
      - Provide the *n*th term no more than 5 terms beyond the last given term using the recursive relationship of geometric sequences with whole numbers and a common ratio of no more than 5:1 (0 – 10,000)
   c. Determine whether relationships are linear or nonlinear when represented in words, in a table, symbolically, or in a graph
      - Use a graph to determine if a relationship is linear or nonlinear
   d. Determine whether relationships are linear or nonlinear when represented symbolically

B. Expressions, Equations, and Inequalities

1. Write, simplify, and evaluate expressions
   a. Write an algebraic expression to represent unknown quantities
      - Use one unknown and no more than 3 operations and rational numbers (–1000 to 1000)
   b. Evaluate an algebraic expression
      - Use one or two unknowns and up to three operations and rational numbers (–100 to 100)
   c. Evaluate numeric expressions using the order of operations
      - Use no more than 5 operations including exponents of no more than 3 and 2 sets of parentheses, brackets, a division bar, or absolute value with rational numbers (–100 to 100)
   d. Simplify algebraic expressions by combining like terms
      - Use no more than 3 variables with integers (–50 to 50), or proper fractions with denominators as factors of 20 (–20 to 20)
   e. Describe a real-world situation represented by an algebraic expression
2. Identify, write, solve, and apply equations and inequalities
   a. Write equations or inequalities to represent relationships
      - Use a variable, the appropriate relational symbols (>, ≥, <, ≤, =) and no more than 3 operational symbols (+, –, ×, ÷) on either side and rational numbers (–1000 to 1000)
   b. Solve for the unknown in a linear equation
      - Use one unknown no more than 3 times on one side and up to three operations (same or different but only one division) and rational numbers (–2000 to 2000)
   c. Solve for the unknown in an inequality
      - Use a one– or two–operation inequality with one variable on one side no more than 3 times whose result after combining coefficients is a positive whole number coefficient with integers (– 100 to 100)
   d. Identify or graph solutions of inequalities on a number line
      - Use one variable once with a positive whole number coefficient and integers (–100 to 100)
   e. Identify equivalent equations
      - Use one unknown no more than 3 times on one side and up to three operations (same or different but only one division) and integers (–2000 to 2000)
   f. Apply given formulas to a problem-solving situation
      - Use no more than four variables and up to three operations with rational numbers (–500 to 500)
   g. Write equations and inequalities that describe real-world problems

C. Numeric and Graphic Representations of Relationships

1. Locate points on a number line and in a coordinate plane
   a. Graph linear equations in a coordinate plane
      - Use two unknowns having integer coefficients (–9 to 9) and integer constants (–20 to 20)

2. Analyze linear relationships
    a. Determine the slope of a graph in a linear relationship
        - Use an equation with integer coefficients (–9 to 9) and integer constants (–20 to 20) and a given graph of the relationship
    b. Determine the slope of a linear relationship represented numerically or algebraically

Standard 2.0: Knowledge of Geometry

Students will apply the properties of one-, two-, or three-dimensional geometric figures to describe, reason, or solve problems about shape, size, position, or motion of objects.

A. Properties of Plane Geometric Figures

1. Analyze the properties of plane geometric figures
    a. Identify and describe geometric relationships between angles formed when parallel lines are cut by a transversal.
        - Use alternate interior, alternate exterior, or corresponding angles
    b. Identify and describe the relationship among the parts of a right triangle
        - Use the hypotenuse or the legs of right triangles
2. Analyze geometric relationships
    a. Determine the measurements of angles formed by parallel lines cut by a transversal
        - Use alternate interior, alternate exterior, and corresponding angles
    b. Apply right angle concepts to solve real-world problems
        - Use the Pythagorean Theorem
    c. Determine whether three given side lengths form a right triangle

C. Representation of Geometric Figures

1. Represent plane geometric figures
    a. Draw quadrilaterals
        - Provide given whole number dimensions in inches or centimeters or angle measurements
    b. Construct perpendicular line segments
        - Provide a given point on a given line segment
    c. Construct triangles
        - Construct a triangle congruent to a given triangle

D. Congruence and Similarity

1. Apply the properties of similar polygons
    a. Determine similar parts of polygons
        - Use the length of corresponding sides or the measure of corresponding angles and rational numbers with no more than 2 decimal places (0 – 1000)

E. Transformations

1. Analyze a transformation on a coordinate plane
    a. Identify, describe, and plot the results of multiple transformations on a coordinate plane
        - Identify or plot the result of two transformations on one figure using translations (horizontal or vertical), reflections (horizontal or vertical), or rotations about a given point (90° or 180°)

Standard 3.0: Knowledge of Measurement

Students will identify attributes, units, or systems of measurements or apply a variety of techniques, formulas, tools or technology for determining measurements.

C. Applications in Measurement

1. Estimate and apply measurement formulas
    a. Estimate and determine the circumference or area of a circle
        - Include circles using rational numbers with no more than 2 decimal places (0 – 10,000)
    b. Estimate and determine area of a composite figure
        - Include composite figures with no more than 6 polygons (triangles, rectangles, or circles) by measuring, partitioning, or using formulas with whole number dimensions (0 – 10,000)
    c. Estimate and determine the volume of a cylinder
        - Use cylinders, given the formula, and whole number dimensions (0 – 10,000)
    d. Determine the volume of cones, pyramids, and spheres
    e. Determine the surface area of cylinders, prisms, and pyramids
2. Analyze measurement relationships
    a. Use proportional reasoning to solve measurement problems
        - Use proportions, scale drawings with scales as whole numbers, or rates using whole numbers or decimals (0 – 1000)

Standard 4.0: Knowledge of Statistics

Students will collect, organize, display, analyze, or interpret data to make decisions or predictions.

A. Data Displays

1. Organize and display data
    a. Organize and display data to make circle graphs

- Use no more than 5 categories with data in whole number percents

b. Organize and display data to make box-and-whisker plots

- Use no more than 12 pieces of data and whole numbers (0 – 1000)

c. Organize and display data to make a scatter plot

- Use no more than 10 points and whole numbers (0 – 1000)

B. Data Analysis

1. Analyze data
   a. Interpret tables
      - Use no more than 5 categories having no more than 2 quantities per category and whole numbers or decimals with no more than 2 decimal places (0 – 100)
   b. Interpret box-and-whisker plots
      - Use minimum, first (lower) quartile, median (middle quartile), third (upper) quartile, or maximum and whole numbers (0 – 100)
   c. Interpret scatter plots
      - Use no more than 10 points using whole numbers or decimals with no more than 2 decimal places (0 – 100)
   d. Interpret circle graphs
      - Use no more than 8 categories (0 – 1000)
   e. Analyze multiple box-and-whisker plots using the same scale

Standard 5.0: Knowledge of Probability

Students will use experimental methods or theoretical reasoning to determine probabilities to make predictions or solve problems about events whose outcomes involve random variation.

A. Sample Space

1. Identify a sample space
   a. Describe the difference between independent and dependent events
   b. Determine the number of outcomes
      - Use no more than 5 dependent events with no more than 10 outcomes in the first event

B. Theoretical Probability

1. Determine the probability of an event comprised of no more than 2 independent events
   a. Express the probability of an event as a fraction, a decimal, or a percent
      - Use a sample space of 36 to 60 outcomes
2. Determine the probability of a second event that is dependent on a first event of equally likely outcomes
   a. Express the probability as a fraction, a decimal, or a percent
      - Use a sample space of no more than 60 outcomes

C. Experimental Probability

1. Analyze the results of a survey or simulation
   a. Make predictions and express the probability of the results as a fraction, a decimal with no more than 2 decimal places, or a percent
      - Use 20 to 500 results
2. Conduct a probability experiment
3. Compare outcomes of theoretical probability with the results of experimental probability
4. Describe the difference between theoretical and experimental probability

Standard 6.0: Knowledge of Number Relationships and Computation/Arithmetic

Students will describe, represent, or apply numbers or their relationships or will estimate or compute using mental strategies, paper/pencil or technology.

A. Knowledge of Number and Place Value

1. Apply knowledge of rational numbers and place value
   a. Read, write, and represent rational numbers
      - Use exponential notation or scientific notation from (–10,000 to 1,000,000,000)
   b. Compare, order, and describe rational numbers with and without relational symbols (<, >, =)
      - Use no more than 4 integers(–100 to 100) or positive rational numbers (0 – 100) using equivalent forms or absolute value

C. Number Computation

1. Analyze number relations and compute
   a. Add, subtract, multiply and divide integers
      - Use one operation (–1000 to 1000)
   b. Calculate powers of integers and square roots of perfect square whole numbers
      - Use powers with bases no more than 12 and exponents no more than 3, or square roots of perfect squares no more than 144
   c. Identify and use the laws of exponents to simplify expressions
      - Use the rules of power times power or power divided by power with the same integer as a base (-20 to 20) and exponents (0 – 10)
   d. Use properties of addition and multiplication to simplify expressions

- Use the commutative property of addition or multiplication, associative property of addition or multiplication, additive inverse property, the distributive property, or the identity property for one or zero with integers (–100 to 100)

2. Estimation
   a. Estimate the square roots of whole numbers
      - Use whole numbers (0 – 100)
3. Analyze ratios, proportions, and percents
   a. Determine unit rates
      - Use positive rational numbers (0 – 100)
   b. Determine or use percents, rates of increase and decrease, discount, commission, sales tax, and simple interest in the context of a problem
      - Use positive rational numbers (0 – 10,000)
   c. Solve problems using proportional reasoning
      - Use positive rational numbers (0 – 1000)

Standard 7.0: Processes of Mathematics

Students demonstrate the processes of mathematics by making connections and applying reasoning to solve problems and to communicate their findings.

A. Problem Solving

1. Apply a variety of concepts, processes, and skills to solve problems
   a. Identify the question in the problem
   b. Decide if enough information is present to solve the problem
   c. Make a plan to solve a problem
   d. Apply a strategy, i.e., draw a picture, guess and check, finding a pattern, writing an equation
   e. Select a strategy, i.e., draw a picture, guess and check, finding a pattern, writing an equation
   f. Identify alternative ways to solve a problem
   g. Show that a problem might have multiple solutions or no solution
   h. Extend the solution of a problem to a new problem situation

B. Reasoning

1. Justify ideas or solutions with mathematical concepts or proofs
   a. Use inductive or deductive reasoning
   b. Make or test generalizations
   c. Support or refute mathematical statements or solutions
   d. Use methods of proof, i.e., direct, indirect, paragraph, or contradiction

C. Communication

1. Present mathematical ideas using words, symbols, visual displays, or technology
   a. Use multiple representations to express concepts or solutions
   b. Express mathematical ideas orally
   c. Explain mathematically ideas in written form
   d. Express solutions using concrete materials
   e. Express solutions using pictorial, tabular, graphical, or algebraic methods
   f. Explain solutions in written form
   g. Ask questions about mathematical ideas or problems
   h. Give or use feedback to revise mathematical thinking

D. Connections

1. Relate or apply mathematics within the discipline, to other disciplines, and to life
   a. Identify mathematical concepts in relationship to other mathematical concepts
   b. Identify mathematical concepts in relationship to other disciplines
   c. Identify mathematical concepts in relationship to life
   d. Use the relationship among mathematical concepts to learn other mathematical concepts

MARYLAND Grades 9-12 Core Learning Goals

Goal 1: Functions and Algebra

The student will demonstrate the ability to investigate, interpret, and communicate solutions to mathematical and real-world problems using patterns, functions, and algebra.

1.1 The student will analyze a wide variety of patterns and functional relationships using the language of mathematics and appropriate technology.

1.1.1. The student will recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and/or geometrically.

- The given pattern must represent a relationship of the form $y = mx + b$ (linear), $y = x^2 + c$ (simple quadratic), $y = x^3 + c$ (simple cubic), simple arithmetic progression, or simple geometric progression with all exponents being positive.
- The student will not be asked to draw three-dimensional figures.
- Algebraic description of patterns is in indicator 1.1.2

1.1.2. The student will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expression.

- The given pattern must represent a relationship of the form $mx + b$ (linear), x^2 (simple quadratic), simple arithmetic progression, or simple geometric progression with all exponents being positive.

1.1.3. The student will apply addition, subtraction, multiplication, and/or division of algebraic expressions to mathematical and real-world problems.

- The algebraic expression is a polynomial in one variable.
- The polynomial is not simplified.

1.1.4. The student will describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.

- A coordinate graph will be given with easily read coordinates.
- "Zeros" refers to the x–intercepts of a graph, "roots" refers to the solution of an equation in the form $p(x) = 0$.
- Problems will not involve a real-world context.

1.2 The student will model and interpret real-world situations using the language of mathematics and appropriate technology.

1.2.1. The student will determine the equation for a line, solve linear equations, and/or describe the solutions using numbers, symbols, and/or graphs.

- Functions are to have no more than two variables with rational coefficients.
- Linear equations will be given in the form: $Ax + By = C$, $Ax + By + C = 0$, or $y = mx + b$.
- Vertical lines are included.
- The majority of these items should be in real-world context.

1.2.2. The student will solve linear inequalities and describe the solutions using numbers, symbols, and/or graphs.

- Inequalities will have no more than two variables with rational coefficients.
- Acceptable forms of the problem or solution are the following:
- $Ax + By < C$, $Ax + By < C$, $Ax + By > C$, $Ax + By > C$, $Ax + By + C < 0$, $Ax + By + C < 0$, $Ax + By + C > 0$, $Ax + By + C > 0$, $y < mx + b$, $y < mx + b$, $y > mx + b$, $y > mx + b$, $y < b$, $y < b$, $y > b$, $y > b$, $x < b$, $x < b$, $x > b$, $x > b$, $a < x < b$, $a < x < b$, $a < x < b$, $a < x < b$, $a < x + c < b$, $a < x + c < b$, $a < x + c < b$, $a < x + c < b$.
- The majority of these items should be in real-world context.
- Systems of linear inequalities will not be included.
- Compound inequalities will be included.
- Disjoint inequalities will not be included.
- Absolute value inequalities will not be included.

1.2.3. The student will solve and describe using numbers, symbols, and/or graphs if and where two straight lines intersect.

- Functions will be of the form: $Ax + By = C$, $Ax + By + C = 0$, or $y = mx + b$.
- All coefficients will be rational.
- Vertical lines will be included.
- Systems of linear functions will include coincident, parallel, or intersecting lines.

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- The majority of these items should be in real-world context.

1.2.4. The student will describe how the graphical model of a non-linear function represents a given problem and will estimate the solution.

- The problem is to be in a real-world context.
- The function will be represented by a graph.
- The equation of the function may be given.
- The features of the graph may include maxima/minima, zeros (roots), rate of change over a given interval (increasing/decreasing), continuity, or domain and range.
- "Zeros" refers to the *x*–intercepts of a graph, "roots" refers to the solution of an equation in the form $p(x) = 0$.
- Functions may include step, absolute value, or piece-wise functions.

1.2.5. The student will apply formulas and/or use matrices (arrays of numbers) to solve real-world problems.

- Formulas will be provided in the problem or on the reference sheet.
- Formulas may express linear or non-linear relationships.
- The students will be expected to solve for first degree variables only.
- Matrices will represent data in tables.
- Matrix addition, subtraction, and/or scalar multiplication may be necessary.
- Inverse and determinants of matrices will not be required.

Goal 2: Geometry, Measurement, and Reasoning

The student will demonstrate the ability to solve mathematical and real-world problems using measurement and geometric models and will justify solutions and explain processes used.

2.1 The student will represent and analyze two– and three–dimensional figres using tools and technology when appropriate.

2.1.1. The student will analyze the properties of geometric figures.

- Essential properties, relationships, and geometric models include the following:
  - Congruence and similarity
  - line/segment/plane relationships (parallel, perpendicular, intersecting, bisecting, midpoint, median, altitude)
  - point relationships (collinear, coplanar)
  - angles and angle relationships (vertical, adjacent, complementary, supplementary, obtuse, acute, right, interior, exterior)
  - angle relationships with parallel lines
  - polygons (regular, non-regular, composite, equilateral, equiangular)
  - geometric solids (cones, cylinders, prisms, pyramids, composite figures)
  - circle/sphere (tangent, radius, diameter, chord, secant, central/inscribed angle, inscribed, circumscribed).

2.1.2. The student will identify and/or verify properties of geometric figures using the coordinate plane and concepts from algebra.

- "Verify properties" means to justify solutions using definitions and/or mathematical principles.
- Properties, relationships, and geometric models include the following:
  - Congruence and similarity
  - line/segment relationships (parallel, perpendicular, intersecting, bisecting, midpoint, median, altitude)
  - point relationships (collinear)
  - angles and angle relationships (obtuse, acute, right)
  - polygons (regular, non-regular, equilateral, equiangular)
  - circle (tangent, radius, diameter, chord).
- Items for this indicator may be set on the coordinate plane or may just have coordinates identified with no grid.
- Concepts from algebra include applications of the distance, midpoint, and slope formulas.

2.1.3. The student will use transformations to move figures, create designs, and/or demonstrate geometric properties.

- Transformations include reflections, rotations, translations, and dilations.
- Items should go beyond the identification of transformations.
- Essential properties and relationships include the following: congruence, similarity, and symmetry.

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- The student's explanation of a transformation must include the following:
  - translation–distance and direction
  - reflection–line of reflection
  - rotation–center of rotation, angle measure, direction (clockwise or counterclockwise)
  - dilation–center and scale factor
  - Paper folding and the use of Miras™ and mirrors are appropriate methods for performing transformations, and their use must be referenced.

2.1.4. The student will construct and/or draw and/or validate properties of geometric figures using appropriate tools and technology.

- "Validate properties" in this indicator, means justifying solutions using definitions, mathematical principles and/or measurement.
- Students may use a compass, straightedge, patty paper, a Mira™, and/or a mirror as construction tools. Using a ruler or protractor cannot be part of the strategy.
- Students may use a compass, ruler, patty paper, a Mira™, a mirror and/or a protractor as drawing tools.
- It is acceptable to do a construction when the item asks for a drawing.
- Paper folding and the use of Miras™ and mirrors are appropriate methods for representing, constructing, and/or analyzing figures, and their use must be referenced.
- Constructions and drawings are limited to the two-dimensional relationships listed in 2.1.1.

2.2 The student will apply geometric properties and relationships to solve problems using tools and technology when appropriate.

2.2.1. The student will identify and/or verify congruent and similar figures and/or apply equality or proportionality of their corresponding parts.

- Students will demonstrate geometric reasoning and justify conclusions. Although the focus is on geometric theory, answers to some items may include a numeric answer.
- Corresponding measurements include length, angle measure, perimeter, circumference, area, volume, surface area and lateral area.

2.2.2. The student will solve problems using two-dimensional figures and/or right-triangle trigonometry.

- Students will demonstrate geometric reasoning and justify conclusions.
- Trigonometric functions may be used to find sides or angles.
- Trigonometric functions will be limited to sine, cosine, and tangent and their inverses.

2.2.3. The student will use inductive or deductive reasoning.

- Students are expected to demonstrate their geometric reasoning and justify conclusions. Although the focus is on geometric theory, answers to some questions may include a numeric answer.
- Items may include geometric applications, patterns, and logic, including syllogisms.
- Narrative, flow chart, or two-column proof may be used as a valid argument.

2.3 The student will apply concepts of measurement using tools and technology when appropriate.

2.3.1. The student will use algebraic and/or geometric properties to measure indirectly.

- "Measure indirectly" means to use mathematical concepts such as congruence, similarity, and ratio and proportion to calculate measurements.
- Similarity and congruence will be directly stated or implied (scale drawings, enlargements).
- Items may require the student to make comparisons.
- This indicator may incorporate measuring.
- This indicator does not include right-triangle trigonometry.

2.3.2. The student will use techniques of measurement and will estimate, calculate, and/or compare perimeter, circumference, area, volume, and/or surface area of two-and three-dimensional figures and their parts.

- Two-dimensional shapes include polygons, circles, and composite figures.
- Three-dimensional shapes include cubes, prisms, pyramids, cylinders, cones, spheres, and composite figures.
- Formulas will be provided.
- No oblique solids will be used.
- Items may involve applications of geometric properties and relationships.

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- Students may be required to make comparisons which do not require calculations.

Goal 3: Data Analysis and Probability

The student will demonstrate the ability to apply probability and statistical methods for representing and interpreting data and communicating results, using technology when needed.

3.1 The student will collect, organize, analyze, and present data.

3.1.1. The student will design and/or conduct an investigation that uses statistical methods to analyze data and communicate results.

- The student will design investigations stating how data will be collected and justify the method.
- Types of investigations may include: simple random sampling, representative sampling, and probability simulations.
- Probability simulations may include the use of spinners, number cubes, or random number generators.
- In simple random sampling each member of the population is equally likely to be chosen and the members of the sample are chosen independently of each other. Sample size will be given for these investigations.

3.1.2. The student will use the measures of central tendency and/or variability to make informed conclusions.

- Measures of central tendency include mean, median, and mode.
- Measures of variability include range, interquartile range, and quartiles.
- Data may be displayed in a variety of representations which may include: frequency tables, box and whisker plots, and other displays.

3.1.3. The student will calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.

- This indicator does not include finding probabilities of dependent events.

3.2 The student will apply the basic concepts of statistics and probability to predict possible outcomes of real-world situations.

3.2.1. The student will make informed decisions and predictions based upon the results of simulations and data from research.

3.2.2. The student will interpret data and/or make predictions by finding and using a line of best fit and by using a given curve of best fit.

- Items should include a definition of the data and what it represents.
- Data will be given when a line of best fit is required.
- Equation or graph will be given when a curve of best fit is required.

3.2.3. The student will communicate the use and misuse of statistics.

- Examples of “misuse of statistics” include the following:
  - misuse of scaling on a graph misuse of measures of central tendency and variability to represent data,
  - using three-dimensional figures inappropriately
  - using data to sway interpretation to a predetermined conclusion
  - using incorrect sampling techniques
  - using data from simulations incorrectly
  - predicting well beyond the data set.

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MARYLAND Grade 8 Standards

Standard 1.0: Skills and Processes

Students will demonstrate the thinking and acting inherent in the practice of science.

A. Constructing Knowledge

1. Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided.
   a. Explain that scientists differ greatly in what phenomena they study and how they go about their work.
   b. Develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations.
   c. Explain and provide examples that all hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.
   d. Locate information in reference books, back issues of newspapers, magazines and compact disks, and computer databases.
   e. Explain that if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one of the variables.
   f. Give examples of when further studies of the question being investigated may be necessary.
   g. Give reasons for the importance of waiting until an investigation has been repeated many times before accepting the results as correct.
   h. Use mathematics to interpret and communicate data.
   i. Explain why accurate recordkeeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.

B. Applying Evidence and Reasoning

1. Review data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.
   a. Verify the idea that there is no fixed set of steps all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.
   b. Explain that what people expect to observe often affects what they actually do observe and that scientists know about this danger to objectivity and take steps to try to avoid it when designing investigations and examining data.
   c. Explain that even though different explanations are given for the same evidence, it is not always possible to tell which one is correct.
   d. Describe the reasoning that lead to the interpretation of data and conclusions drawn.
   e. Question claims based on vague statements or on statements made by people outside their area of expertise.

C. Communicating Scientific Information

1. Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries.
   a. Organize and present data in tables and graphs and identify relationships they reveal.
   b. Interpret tables and graphs produced by others and describe in words the relationships they show.
   c. Give examples of how scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.
   d. Criticize the reasoning in arguments in which
      - Fact and opinion are intermingled
      - Conclusions do not follow logically from the evidence given.
      - Existence of control groups and the relationship to experimental groups is not made obvious.
      - Samples are too small, biased, or not representative.
   e. Explain how different models can be used to represent the same thing. What kind of a model to use and how complex it should be depend on its purpose. Choosing a useful model is one of the instances in which intuition and creativity come into play in science, mathematics, and engineering
   f. Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.
   g. Recognize that important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.

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D. Technology

1. Explain that complex systems require control mechanisms.
   a. Explain that the choice of materials for a job depends on their properties and on how they interact with other materials.
   b. Demonstrate that all control systems have inputs, outputs, and feedback.
   c. Realize that design usually requires taking constraints into account. (Some constraints, such as gravity or the properties of the materials to be used, are unavoidable. Other constraints, including economic, political, social, ethical, and aesthetic ones also limit choices.)
   d. Identify reasons that systems fail-they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with.
2. Analyze, design, assemble and troubleshoot complex systems.
   a. Provide evidence that a system can include processes as well as things.
   b. Explain that thinking about things as systems means looking for how every part relates to others. (The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.)
   c. Analyze any system to determine its connection, both internally and externally to other systems and explain that a system may be thought of as containing subsystems and as being a subsystem of a larger system.
3. Analyze the value and the limitations of different types of models in explaining real things and processes.
   a. Explain that the kind of model to use and how complex it should be depends on its purpose and that it is possible to have different models used to represent the same thing.
   b. Explain, using examples that models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or that are too vast to be changed deliberately, or that are potentially dangerous.
   c. Explain that models may sometimes mislead by suggesting characteristics that are not really shared with what is being modeled.

Standard 2.0: Earth/Space Science

Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.

B. Earth History

1. Explain how sedimentary rock is formed periodically, embedding plant and animal remains and leaving a record of the sequence in which the plants and animals appeared and disappeared.
   a. Explain how sedimentary rock buried deep enough may be reformed by pressure and heat and these reformed rock layers may be forced up again to become land surface and even mountains.
   b. Cite evidence to confirm that thousands of layers of sedimentary rock reveal the long history of the changing surface of the Earth.
   c. Explain why some fossils found in the top layers of sedimentary rock are older then those found beneath in lower layers.
      - Folding
      - Breaking
      - Uplift
      - Faulting
      - Tilting
2. Recognize and explain that fossils found in layers of sedimentary rock provide evidence of changing life forms.
   a. Recognize how different types of fossils are formed, such as petrified remains, imprints, molds and casts.
   b. Recognize and explain that the fossil record of plants and animals describes changes in life forms over time.

D. Astronomy

1. Identify and describe the components of the universe.
   a. Recognize that a galaxy contains billions of stars that cannot be distinguished by the unaided eye because of their great distance from Earth, and that there are billions of galaxies.
   b. Identify that our solar system is a component of the Milky Way Galaxy.
   c. Identify and describe the various types of galaxies
   d. Identify and describe the type, size, and scale, of the Milky Way Galaxy.
2. Identify and explain celestial phenomena using the regular and predictable motion of objects in the solar system.
   a. Identify and describe the relationships among the period of revolution of a planet, the length of its solar year, and its distance from the sun.
   b. Identify and explain the relationship between the rotation of a planet or moon on its axis and the length of the solar day for that celestial object.
   c. Identify and explain the cause of the phases of the moon.
   d. Describe how lunar and solar eclipses occur.

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e. Identify and describe how the shape and location of the orbits of asteroids and comets affect their periods of revolution.

3. Recognize and explain the effects of the tilt of Earth's axis.
   a. Recognize and describe that Earth's axis is tilted about 23¼° from vertical with respect to the plane of its orbit and points in the same direction during the year.
   b. Recognize and describe that the tilt of Earth's axis causes
      - Changes in the angle of the sun in the sky during the year
      - Seasonal differences in the northern and southern latitudes
   c. Recognize and describe how the tilt of Earth's axis affects the climate in Maryland.
4. Recognize and explain how the force of gravity causes the tides.
   a. Identify and describe the cause of high and low tides.

E. Interactions of Hydrosphere and Atmosphere

1. Cite evidence to explain the relationship between the hydrosphere and atmosphere.
   a. Describe the composition of the atmosphere and hydrosphere.
   b. Recognize and describe the water cycle as the distribution and circulation of Earth's water through the glaciers, surface water, groundwater, oceans, and atmosphere.
   c. Identify and describe how the temperature and precipitation in a geographic area are affected by surface features and changes in atmospheric and ocean content.
      - Relative location of mountains
      - Volcanic eruptions
      - Proximity to large bodies of water
      - Heat energy of ocean currents
2. Recognize and describe the various factors that affect climate.
   a. Identify and describe how the temperature and precipitation of an area are affected by surface and ocean features.
      - Relative location of mountains
      - Proximity to large bodies of water
      - Warm and cold ocean currents
   b. Recognize and describe the global effects of volcanic eruptions, greenhouse gases, and El Nino.
3. Identify and describe the atmospheric and hydrospheric conditions related to weather systems.
   a. Identify and describe weather patterns associated with high and low pressure systems and frontal systems.
   b. Identify and describe the atmospheric and hydrospheric conditions associated with the formation and development of hurricanes, tornadoes, and thunderstorms.
   c. Identify and describe how various tools are used to collect weather data and forecast weather conditions.
      - Barometer
      - Thermometer
      - Anemometer
      - Psychrometer

Standard 3.0: Life Science

The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.

D. Evolution

1. Recognize and describe that evolutionary change in species over time occurs as a result of natural variation in organisms and environmental changes.
   a. Recognize and describe that gradual (climatic) and sudden (floods and fires) changes in environmental conditions affect the survival of organisms and populations.
   b. Recognize that adaptations may include variations in structures, behaviors, or physiology, such as spiny leaves on a cactus, birdcalls, and antibiotic resistant bacteria.
   c. Recognize and describe that adaptation and speciation involve the selection of natural variations in a population.
   d. Recognize and describe that extinction occurs when the adaptive traits of a population do not support its survival.
   e. Recognize that evolution accounts for the diversity of species.

Standard 4.0: Chemistry

Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations.

A. Structure of Matter

1. Provide evidence to explain how compounds are produced.(No electron transfer)
   a. Describe how elements form compounds and molecules.
   b. Investigate and describe what happens to the properties of elements when they react chemically with other elements.

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c. Based on data from investigations and research compare the properties of compounds with those of the elements from which they are made.

B. Conservation of Matter

1. Provide evidence to support the fact that the idea of atoms explains conservation of matter.
   a. Use appropriate tools to gather data and provide evidence that equal volumes of different substances usually have different masses.
   b. Cite evidence from investigations that the total mass of a system remains the same throughout a chemical reaction because the number of atoms of each element remains the same.
   c. Give reasons to justify the statement, "If the number of atoms stays the same no matter how the same atoms are rearranged, then their total mass stays the same."

C. States of Matter

1. Describe how the motion of atoms and molecules in solids, liquids, and gases changes as heat energy is increased or decreased.
   a. Based on data from investigations and video technology, describe and give reasons for what happens to a sample of matter when heat energy is added to it (most substances expand).
   b. Describe what the temperature of a solid, or a liquid, or a gas reveals about the motion of its atoms and molecules.
   c. Formulate an explanation for the different characteristics and behaviors of solids, liquids, and gases using an analysis of the data gathered on the motion and arrangement of atoms and molecules.

D. Physical and Chemical Changes

1. Compare compounds and mixtures based on data from investigations and research.
   a. Cite evidence from investigations to explain how the components of mixtures can be separated.
   b. Use evidence from data gathered to explain why the components of compounds cannot be separated using physical properties.
   c. Analyze the results of research completed to develop a comparison of compounds and mixtures.
2. Cite evidence and give examples of chemical properties of substances.
   a. Based on data from investigations and research, identify and describe chemical properties of common substances.
      - Reacts with oxygen (rusting/tarnishing and burning
      - Reacts with acids
      - Reacts with bases

   b. Use information gathered from investigations using indicators to classify materials as acidic, basic, or neutral.
3. Provide evidence to support the fact that common substances have the ability to change into new substances.
   a. Investigate and describe the occurrence of chemical reactions using the following evidence:
      - Color change
      - Formation of a precipitate or gas
      - Release of heat or light

   b. Use evidence from observations to identify and describe factors that influence reaction rates.
      - Change in temperature
      - Acidity

   c. Identify the reactants and products involved in a chemical reaction given a symbolic equation, a word equation, or a description of the reaction.
   d. Provide data from investigations to support the fact that energy is transformed during chemical reactions.
   e. Provide examples to explain the difference between a physical change and a chemical change.

Standard 5.0: Physics

Students will use scientific skills and processes to explain the interactions of matter and energy and the energy transformations that occur

A. Mechanics

1. Develop an explanation of motion using the relationships among time, distance, velocity, and acceleration.
   a. Observe, describe, and compare the motions of objects using position, speed, velocity, and the direction.
   b. Based on data given or collected, graph and calculate average speed using distance and time.
   c. Compare accelerated and constant motions using time, distance, and velocity.
   d. Describe and calculate acceleration using change in the speed and time.
2. Identify and relate formal ideas (Newton's Laws) about the interaction of force and motion to real world experiences.
   a. Investigate and explain the interaction of force and motion that causes objects that are at rest to move.
   b. Demonstrate and explain, through a variety of examples, that moving objects will stay in motion at the same speed and in the same direction unless acted on by an unbalanced force.

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c. Investigate and collect data from multiple trials, about the motion that explain the motion that results when the same force acts on objects of different mass; and when different amounts of force act on objects of the same mass.

d. Based on data collected and organized, explain qualitatively the relationship between net force applied to an object and its mass for a given acceleration.

e. Calculate the net force given the mass and acceleration.

3. Recognize and explain that every object exerts gravitational force on every other object.

a. Explain the difference between mass and weight.

- Mass is a measure of inertia
- Weight is a measure of the force of gravity

b. Describe the relationship between the gravitational force and the masses of the attracting objects.

c. Describe the relationship between the gravitational force and the distance between the attracting objects.

d. Recognize and cite examples showing that mass remains the same in all locations while weight may vary with a change in location (weight on Earth compared to weight on moon).

e. Recognize that gravity is the force that holds planets, moons, and satellites in their orbits.

4. Recognize and explain that energy can neither be created nor destroyed; rather it changes form or is transferred through the action of forces.

a. Observe and describe the relationship between the distance an object is moved by a force and the change in its potential energy or kinetic energy, such as in a slingshot, in mechanical toys, the position of an object and its potential energy.

b. Identify the relationship between the amount of energy transferred (work) to the product of the applied force and the distance moved in the direction of that force.

c. Identify and describe that simple machines (levers and inclined planes) may reduce the amount of effort required to do work.

- Calculate input and output work using force and distance
- Demonstrate that input work is always greater than output work

B. Thermodynamics

1. Describe and cite evidence that heat can be transferred by conduction, convection and radiation.

a. Based on observable phenomena, identify and describe examples of heat being transferred through conduction and through convection.

b. Based on observable phenomena, identify examples to illustrate that radiation does not require matter to transfer heat energy.

c. Research and identify the types of insulators that best reduce heat loss through conduction, convection, or radiation.

2. Identify and explain that heat energy is a product of the conversion of one form of energy to another.

a. Identify and describe the various forms of energy that are transformed in order for systems (living and non-living) to operate.

- Chemical–Flashlight-Light
- Mechanical–Pulleys-Motion
- Solar/Radiant–Solar calculator
- Chemical–Plant cells

b. Explain that some heat energy is always lost from a system during energy transformations.

Standard 6.0: Environmental Science

Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.

B. Environmental Issues

1. Recognize and explain how human activities can accelerate or magnify many naturally occurring changes.

a. Based on data from research identify and describe how natural processes change the environment.

- Cyclic climate change
- Sedimentation in watersheds
- Population cycles
- Extinction

b. Identify and describe how human activities produce changes in natural processes:

- Climate change
- Loss of habitat
- Introduction of nonnative species
- Cycling of matter

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MARYLAND Grades 9-12 Core Learning Goals

Goal 1: Skills And Processes

The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.

1.1 The student will explain why curiosity, honesty, openness, and skepticism are highly regarded in science.

- 1.1.1. The student will recognize that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues.
- 1.1.2. The student will modify or affirm scientific ideas according to accumulated evidence.
- 1.1.3. The student will critique arguments that are based on faulty, misleading data or on the incomplete use of numbers.
- 1.1.4. The student will recognize data that are biased.
- 1.1.5. The student will explain factors that produce biased data (incomplete data, using data inappropriately, conflicts of interest, etc.).

1.2 The student will pose scientific questions and suggest investigative approaches to provide answers to questions.

- 1.2.1. The student will identify meaningful, answerable scientific questions.
- 1.2.2. The student will pose meaningful, answerable scientific questions.(NTB)
- 1.2.3. The student will formulate a working hypothesis.
- 1.2.4. The student will test a working hypothesis.(NTB)
- 1.2.5. The student will select appropriate instruments and materials to conduct an investigation.
- 1.2.6. The student will identify appropriate methods for conducting an investigation (independent and dependent variables, proper controls, repeat trials, appropriate sample size, etc.).
- 1.2.7. The student will use relationships discovered in the lab to explain phenomena observed outside the laboratory.
- 1.2.8. The student will defend the need for verifiable data.

1.3 The student will carry out scientific investigations effectively and employ the instruments, systems of measurement, and materials of science appropriately.

- 1.3.1. The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques.(NTB)
- 1.3.2. The student will recognize safe laboratory procedures.
- 1.3.3. The student will demonstrate safe handling of the chemicals and materials of science.(NTB)
- 1.3.4. The student will learn the use of new instruments and equipment by following instructions in a manual or from oral direction.(NTB)

1.4 The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication.

- 1.4.1. The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title).
- 1.4.2. The student will analyze data to make predictions, decisions, or draw conclusions.
- 1.4.3. The student will use experimental data from various investigators to validate results.
- 1.4.4. The student will determine the relationships between quantities and develop the mathematical model that describes these relationships.
- 1.4.5. The student will check graphs to determine that they do not misrepresent results.
- 1.4.6. The student will describe trends revealed by data.
- 1.4.7. The student will determine the sources of error that limit the accuracy or precision of experimental results.
- 1.4.8. The student will use models and computer simulations to extend his/her understanding of scientific concepts.(NTB)
- 1.4.9. The student will use analyzed data to confirm, modify, or reject a hypothesis.

1.5 The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.

- 1.5.1. The student will demonstrate the ability to summarize data (measurements/observations).
- 1.5.2. The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.

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1.5.3. The student will use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results.(NTB)

1.5.4. The student will use tables, graphs, and displays to support arguments and claims in both written and oral communication.

1.5.5. The student will create and/or interpret graphics. (scale drawings, photographs, digital images, field of view, etc.)

1.5.6. The student will read a technical selection and interpret it appropriately.

1.5.7. The student will use, explain, and/or construct various classification systems.

1.5.8. The student will describe similarities and differences when explaining concepts and/or principles.

1.5.9. The student will communicate conclusions derived through a synthesis of ideas.

1.6 The student will use mathematical processes.

1.6.1. The student will use ratio and proportion in appropriate situations to solve problems.

1.6.2. The student will use computers and/or graphing calculators to perform calculations for tables, graphs, or spreadsheets.(NTB)

1.6.3. The student will express and/or compare small and large quantities using scientific notation and relative order of magnitude.

1.6.4. The student will manipulate quantities and/or numerical values in algebraic equations.

1.6.5. The student will judge the reasonableness of an answer.

1.7 The student will show that connections exist both within the various fields of science and among science and other disciplines including mathematics, social studies, language arts, fine arts, and technology.

1.7.1. The student will apply the skills, processes, and concepts of biology, chemistry, physics, or earth science to societal issues.

1.7.2. The student will identify and evaluate the impact of scientific ideas and/or advancements in technology on society.

1.7.3. The student will describe the role of science in the development of literature, art, and music.(NTB)

1.7.4. The student will recognize mathematics as an integral part of the scientific process.(NTB)

1.7.5. The student will investigate career possibilities in the various areas of science.(NTB)

1.7.6. The student will explain how development of scientific knowledge leads to the creation of new technology and how technological advances allow for additional scientific accomplishments.

Goal 2: Concepts of Earth/Space Science

The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe.

2.1 The student will identify and describe techniques used to investigate the universe and Earth.

2.1.1. The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the universe.

- Tools (optical and radio telescopes, spectrometers)
- Delivery systems (satellite-based, ground-based, space probe)
- Techniques (imaging, spectroscopy)

2.1.2. The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the atmosphere, land and water on Earth.

- Tools (spectrometers, seismograph)
- Delivery systems (satellite-based, ground-based)
- Techniques (imaging, Geographic Information System, Global Positioning System, spectroscopy, Doppler, epicenter location/time-travel graphs)

2.2 The student will describe and apply the concept of natural forces and apply them to the study of Earth/Space Science.

2.2.1. The student will explain the role of forces in the formation and operation of the universe.

- Newton's Universal Law of Gravitation
- Structure and evolution of galaxies and the universe (Big Bang Theory)
- Stellar structure and evolution (life cycle of stars, stellar systems, H-R diagram)
- Formation and evolution of the solar system (Nebular theory, small bodies)
- Keplers 3 Laws of Planetary Motion
- Sun-Earth connection (thermonuclear process, sunspot cycle, coronal mass ejection, flares, solar wind, auroras)

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2.2.2. The student will explain the role and interaction of revolution, rotation and gravity on the Sun-Earth-Moon system.

- Seasons (change in solar angle, yearly variation in length of day/night, absorption/reflection/scattering of insolation, solstices and equinoxes, rotation/revolution/precession, yearly variation of the sun's altitude and azimuth)
- Eclipses (lunar, solar, total, annular, partial, umbra, penumbra, 2 eclipse "seasons" per Earth year, yearly/monthly variations in lunar position and length of visibility of the moon)
- Earth-moon interactions (relationship between lunar phase and tide, tidal bulge and rate of lunar revolution, tides and Earth-moon distance, sidereal and synodic lunar months)

2.3 The student will explain how the transfer of energy and matter affect Earth systems.

2.3.1. The student will describe how energy and matter transfer affect Earth systems.

- Atmospheric circulation (heat transfer systems – conduction/convection/radiation, phase change, latent heat, pressure gradients, general global circulation, Coriolis effect)
- Oceanic circulation (density differences, daily and seasonal land/sea breezes, Coriolis effect)

2.3.2. The student will explain how global conditions are affected when natural and human-induced change alter the transfer of energy and matter.

- Atmospheric composition and structure (greenhouse gases, stratospheric ozone concentration and distribution, aerosols, temperature)
- Pollutants (particulates, tropospheric ozone concentration and distribution, acid rain)
- Ocean-atmosphere-land interactions (current changes, continental movement, El Niño, La Niña)
- Cloud cover (amount, type, albedo)
- Climate type and distribution (temperature and precipitation)
- Sea level, glaciers and sea ice, biome location and distribution, emergent and submergent coastlines

2.4 The student will analyze the dynamic nature of the geosphere.

2.4.1. The student will compare the origin and structure of igneous, metamorphic and sedimentary rocks.

- Structure of matter (atoms, molecules, isotopes)
- Physical properties (density) and chemical composition of common rock-forming mineral groups
- Origin, texture (crystal size, shape) and mineral composition of common rock groups

2.4.2. The student will explain how the transfer of energy drives the rock cycle.

- Destructive processes (weathering, erosion, subsidence, melting)
- Constructive processes (lithification, deformation, metamorphism, volcanism, cooling/crystallization, deposition)
- Landform change (surface & groundwater, coasts, glacial processes, desert processes)

2.4.3. The student will explain changes in Earth's surface using plate tectonics.

- Continental drift (rock/structure/climate/fossil evidence, jigsaw fit)
- Sea floor spreading (age evidence, mantle circulation, outer core circulation/magnetic reversals, seismic activity, volcanism, mountain building, ocean ridges)
- Theory of Plate Tectonics (crustal plate composition, mantle circulation, divergent/convergent/transform fault boundaries, subduction zones, trenches, island arcs, seismic activity, volcanism, mountain building)

2.5 The student will investigate methods that geologists use to determine the history of Earth.

2.5.1. The student will apply geologic principles used to date Earth's geologic and biologic events.

- Relative dating (superposition in rock columns, core samples, unconformities; uniformitarianism; crosscutting relationships; correlation of rock layers, fossils)
- Absolute dating (radioactive dating)

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2.5.2. The student will compare events in Earth's history that have been grouped according to similarities.

- Geologic time (scale and magnitude)
- Era, period, epoch

Goal 3: Concepts of Biology

The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.

3.1 The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to cell processes.

3.1.1. The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems.

- water (inorganic molecule, polarity, density, and solvent properties)
- carbohydrates (organic molecule; monosaccharides are building blocks; supplier of energy and dietary fiber; structural component of cells: cell wall, cellulose)
- lipids (organic molecule; component of cell membranes; stored energy supply)
- proteins (organic molecule; amino acids are building blocks; structural and functional role, including enzymes)
- nucleic acids (organic molecule; nucleotides are building blocks - sugar, phosphate, & nitrogen bases; DNA is a double helix, RNA is a single strand; DNA replication; DNA role in storage of genetic information)
- minerals (inorganic substances essential for cellular processes)
- vitamins (organic molecule; role in human body: C – wound healing, K – blood clotting, D – bone growth)

3.1.2. The student will be able to discuss factors involved in the regulation of chemical activity as part of a homeostatic mechanism.

- osmosis (predicting water flow across a membrane based on the cell's environment; explain role in living systems)
- temperature (effect upon enzyme activity and metabolic rate; effect upon rate of diffusion and states of matter)
- pH (pH scale: relative values for acids and bases; effect on living systems: cellular, organismal)
- enzyme regulation (effect of temperature, pH, and enzyme/substrate concentration on enzyme activity)

3.1.3. The student will be able to compare the transfer and use of matter and energy in photosynthetic and non-photosynthetic organisms.

- water cycle (movement of water between living systems and the environment)
- carbon cycle (movement of carbon between living systems and the environment, cyclic relationship between photosynthesis and respiration)
- nitrogen cycle (roles of bacteria; human impact)
- photosynthesis (energy conversion: light, chemical; basic molecules involved)
- cellular respiration (distinctions between aerobic and anaerobic, energy released, use of oxygen; basic molecules involved in aerobic)
- chemosynthesis (from inorganic compounds)
- ATP (energy carrier molecule)

3.2 The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms.

3.2.1. The student will explain processes and the function of related structures found in unicellular and multicellular organisms.

- transportation of materials (role of cellular membranes; role of vascular tissues in plants and animals; role of circulatory systems)
- waste disposal (role of cellular membrane; role of excretory and circulatory systems)
- movement (cellular – flagella, cilia, pseudopodia; interaction between skeletal and muscular systems)
- feedback (maintaining cellular and organismal homeostasis - water balance, pH, temperature, role of endocrine system)

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- asexual (binary fission, budding, vegetative, mitosis: role in growth and repair, chromosome number remains the same) and sexual reproduction (angiosperms, mammals)
- control of structures (cellular organelles and human systems) and related functions (role of nucleus, role of sensory organs and nervous system)
- capture and release of energy (chloroplasts, mitochondria)
- protein synthesis (ribosomes)

3.2.2. The student will conclude that cells exist within a narrow range of environmental conditions and changes to that environment, either naturally occurring or induced, may cause changes in the metabolic activity of the cell or organism.

- pH
- temperature
- light
- water
- oxygen
- carbon dioxide
- radiation (role in cancer or mutations)
- toxic substances (natural, synthetic)

3.3 The student will analyze how traits are inherited and passed on from one generation to another.

3.3.1. The student will demonstrate that the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.

- meiosis (process that forms gametes; chromosome number reduced by one-half; crossing-over occurs; new gene combinations)
- fertilization (combination of gametes to form zygote)

3.3.2. The student will illustrate and explain how expressed traits are passed from parent to offspring.

- phenotypes (expression of inherited characteristics)
- dominant and recessive traits
- sex-linked traits (X-linked only; recessive phenotypes are more often expressed in the male)
- genotypes (represented by heterozygous and homozygous pairs of alleles)
- punnett square (use to predict and/or interpret the results of a genetic cross; translate genotypes into phenotypes - monohybrid only)
- Pedigree (use to interpret patterns of inheritance within a family)

3.3.3. The student will explain how a genetic trait is determined by the code in a DNA molecule.

- definition of gene (a segment of DNA that codes for a protein or RNA)
- sequence of nitrogen bases directing protein formation (role of DNA, mRNA, tRNA, rRNA)
- proteins determine traits

3.3.4. The student will interpret how the effects of DNA alteration can be beneficial or harmful to the individual, society, and/or the environment.

- mutations
- chromosome number (abnormalities)
- genetic engineering (gene splicing, recombinant DNA, cloning)

3.4 The student will explain the mechanism of evolutionary change.

3.4.1. The student will explain how new traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.

- natural selection (definition; effects of environmental pressure)
- adaptations (effects on survival)
- variation (effects on survival and reproductive success)

3.4.2. The student will estimate degrees of relatedness among organisms or species.

- classification (recognize relationships among organisms; distinguish between prokaryotes and eukaryotes)
- anatomical similarities (evolutionary relationships; homologous structures)
- similarities of DNA base and/or amino acid sequence (including results from gel electrophoresis)

3.5 The student will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere.

3.5.1. The student will analyze the relationships between biotic diversity and abiotic factors in environments and the resulting influence on ecosystems.

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- Abiotic/Biotic factors
  - space
  - soil
  - water
  - air
  - temperature
  - food
  - light
  - organisms
- Relationships
  - predator – prey
  - parasite – host
  - mutualism
  - commensalism
  - competition

3.5.2. The student will analyze the interrelationships and interdependencies among different organisms and explain how these relationships contribute to the stability of the ecosystem.

- diversity
- succession
- trophic level (producer; consumer: herbivore, carnivore, omnivore, scavenger; decomposer)
- niche (role of organism within an ecosystem)
- pyramid (energy, biomass)

3.5.3. The student will investigate how natural and man-made changes in environmental conditions will affect individual organisms and the dynamics of populations.

- depletion of food
- destruction of habitats
- disease
- natural disasters
- pollution
- population increase
- urbanization

3.5.4. The student will illustrate how all organisms are part of and depend on two major global food webs that are positively or negatively influenced by human activity and technology.

- oceanic food web
- terrestrial food web

3.6 The student will investigate a biological issue and develop an action plan.

3.6.1. The student will analyze the consequences and/or trade-offs between technological changes and their effect on the individual, society, and the environment. They may select topics such as bioethics, genetic engineering, endangered species, or food supply. (NTB)

3.6.2. The student will investigate a biological issue and be able to defend their position on topics such as animal rights, drug and alcohol abuse, viral diseases (e.g., AIDS), genetic engineering, bioethics, biodiversity, population growth, global sustainability, or origin of life. (NTB)

Goal 4: Concepts of Chemistry

The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.

4.1 The student will explain that atoms have structure and this structure serves as the basis for the properties of elements and the bonds that they form.

4.1.1. The student will analyze the structure of the atom and describe the characteristics of the particles found there.

- subatomic particles (protons, neutrons, & electrons –not to include quantum mechanical details of electron configurations)
- nucleus & electron cloud (definition; no orbitals included)
- atomic number, mass number, and isotopes (definitions; calculate numbers of protons, neutrons, and electrons; notations)
- atomic mass (qualitative concept of weighted average only; atomic mass unit)
- neutral atom
- historical development and/or experimental evidence for the existence and structure of the atom (Democritus, Dalton, Thomson, Rutherford, Bohr, electron cloud model)

4.1.2. The student will demonstrate that the arrangement and number of electrons and the properties of elements repeat in a periodic manner illustrated by their arrangement in the periodic table.

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- groups/families and periods/series (groups 1-18; Alkali Metals, Alkaline Earth Metals, Transition Metals, Halogens, Noble Gases; Periods 1-7; Lanthanide Series, Actinide Series)
- For the following assessment limits, use only elements in groups 1,2, & 13-18. how trends behave (valence electrons; atomic radius; ionization energy; relative chemical reactivity; metallic/nonmetallic properties)

4.1.3. The student will explain how atoms interact with other atoms through the transfer and sharing of electrons in the formation of chemical bonds.

- formation of ions (relate charge of ions to number of electrons gained or lost as determined by valence electrons / location of elements on Periodic Table; cation; anion)
- bond (definition)
- formation of ionic bond (definition; metal-nonmetal; based on valence electrons / location of elements on the Periodic Table)
- formation of covalent bond (definition; nonmetal-nonmetal; based on valence electrons / location of elements on the Periodic Table; formation of single, double, and triple bonds)
- bond polarity (concept only, no electronegativity calculations; common examples)
- metallic bond (definition)
- bond energy (compare ionic and covalent)
- metallic, ionic, and molecular substances (melting point, boiling point, electrical conductivity)

4.2 The student will explain how the properties of compounds are related to the arrangement and type of atoms they contain.

4.2.1. The student will explain how the properties of a molecule are determined by the atoms it contains and their arrangement.

- polar and nonpolar molecules ("like dissolves like" and why; not to include prediction of polarity from shape)
- shapes of molecules (limited to linear, bent/angular, tetrahedral)
- water (definition and explanation of shape and polarity of molecule, observed changes in density as phases change, use as a "universal" solvent; conceptual understanding of hydrogen bonding, high surface tension, high specific heat)

4.2.2. The student will explain why organic compounds are so numerous and diverse.

- inorganic and organic compounds (define in terms of carbon content; do not include CO, CO2, or carbonates as organic compounds; definition of hydrocarbons)
- ability of carbon to form chains and make rings (recognize, but not produce structural formulas)

4.2.3. The student will describe the properties of solutions and explain how they form.

- solute, solvent, and solubility
- suspensions and colloids
- alloys and gaseous solutions
- concentration (relative: dilute, concentrated, unsaturated, saturated, supersaturated; molarity – conceptual only; interpretation of solubility curves)
- dissociation/ionization (basic description; factors that influence rate: surface area of solute, temperature, agitation)
- electrolytes (definition in terms of composition and properties)

4.2.4. The student will differentiate among acids, bases, and salts based on their properties.

- Arrhenius definition (H+ and OH-)
- ability of water to act as either an acid or a base
- neutralization (definition)
- salts (definition)
- indicators (phenolphthalein)
- function of buffers (conceptual only)

4.3 The student will apply the basic concepts of thermodynamics (thermochemistry) to phases of matter and phase and chemical changes.

4.3.1. The student will explain that thermal energy in a material consists of the ordered and disordered motions of its colliding particles.

- thermal energy (differentiate between thermal energy and temperature)
- phase changes

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- heating / cooling (temperature vs. time) curve (interpret the different parts of the curve in terms of motion / kinetic energy and organization of the particles; changes in particle motion and organization between phase changes; identify melting/freezing and boiling point; not to include potential energy or calculations of Q)

4.3.2. The student will describe observed changes in pressure, volume, or temperature of a sample in terms of macroscopic changes and the behavior of particles.

- constant temperature (effect of pressure or volume change to sample of solid, liquid, or gas)
- constant volume (effect of pressure or temperature change to sample of solid, liquid, or gas)
- constant pressure (effect of temperature or volume change to sample of solid, liquid, or gas)

4.3.3. The student will explain why the interactions among particles involve a change in the energy system.

- exothermic change (bond formation; dissociation; thermal energy released; no predictions/calculations of ΔH)
- endothermic change (bond breaking; dissociation; thermal energy absorbed; no predictions/calculations of ΔH)

4.4 The student will explain how and why substances are represented by formulas.

4.4.1. The student will illustrate that substances can be represented by formulas.

- subscripts (determine the numbers of atoms represented by a given formula; describe the function of subscripts in a chemical formula)
- use symbols to represent elements and polyatomic ions (limited to NH4+1,OH-1, NO3-1, NO2-1, ClO3-1,ClO2-1, HCO3-1, CO3-2, SO4-2, SO3-2, PO4-3, PO3-3; including diatomics – H2, O2, N2, Cl2, Br2, I2, F2; given periodic table and ion chart)
- acids (binary naming system; ternary/oxyacid naming system limited to polyatomic ions given above)
- write formulas for compounds (given Periodic Table, ion chart of polyatomic ions and transition metals, and compound name; Stock System/Roman Numerals for ionic compounds; prefixes (up through hexa) for molecular compounds; no hydrates)
- name compounds (given formula, Periodic Table, and ion chart of polyatomic ions and transition metals; Stock System/Roman Numerals for ionic compounds; prefixes (up through hexa) for molecular compounds; no hydrates)

4.4.2. The student will show that chemical reactions can be represented by symbolic or word equations that specify all reactants and products involved.

- convert word equations to symbolic equations
- convert symbolic equations to word equations

4.4.3. The student will use mole relationships.

- mole and Avogadro's Number (definitions)
- relationship between moles and mass
- relationship between moles and particles
- formula mass (calculate the formula mass of a compound given the periodic table; no hydrates)
- mass percent composition (calculate the mass percent composition of a compound given the formula, formula mass, and periodic table; no hydrates)

4.5 The student will explain that matter undergoes transformations, resulting in products that are different from the reactants.

4.5.1. The student will describe the general types of chemical reactions.

- synthesis and decomposition (definition; identify type given balanced formula equation or written description)
- combustion (definition; identify type given balanced formula equation or written description)
- single displacement (definition; identify type given balanced formula equation or written description; apply activity series to determine if reaction will occur)
- double displacement (definition; identify type given balanced formula equation or written description; apply solubility rules to predict if a precipitate will form)

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4.5.2. The student will balance simple equations (not to include redox reactions).

- Law of Conservation of Mass (apply to reactions to account for the same number of atoms of each type appearing in both the reactants and products)
- coefficients (define; use to balance symbolic equations; explain meaning in symbolic equations; differentiate between the use and meaning of coefficients and subscripts)

4.5.3. The student will demonstrate that adjusting quantities of reactants may affect the amounts of products formed.

- use of coefficients in a balanced equation to predict amounts of reactants and products (at the molecular/mole level – no mass-mass calculations)
- changing the amount of reactant(s) may change the amount of product(s) formed (no calculations)

4.5.4. The student will recognize that chemical reactions occur at different speeds.

- reaction rate (in order for atoms to react they must collide with sufficient energy; reaction rate increases as frequency of molecular collisions increases)
- effects of surface area, temperature, and concentration on the frequency and energy of molecular collisions (no calculations or specific concentration units)
- catalysts (definition; conceptual understanding of behavior)

Goal 5: Concepts of Physics

The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain and predict the outcome of certain interactions which occur between matter and energy.

5.1 The student will know and apply the laws of mechanics to explain the behavior of the physical world.

5.1.1. The student will use analytical techniques appropriate to the study of physics.

- distinguish between scalar and vector quantities (e.g. speed v. velocity; distance v. displacement)
- symbolically represent vector quantities (angle for direction, length for magnitude)
- add vectors (same and opposite directions and at right angles)
- resolve vectors graphically

5.1.2. The student will use algebraic and geometric concepts to qualitatively and quantitatively describe an object's motion.

- motion with a constant velocity
- motion with a constant acceleration
- linear frames of reference
- projectile motion (mathematical solutions limited to initial horizontal velocity only; conceptual questions not restricted)
- free fall

5.1.3. The student will analyze and explain how Newton's Laws describe changes in an object's motion.

- the effect of balanced forces (fnet = 0) (quantitative and qualitative)
- the effect of unbalanced forces (fnet ≠ 0) (quantitative and qualitative)
- inertia (application) (qualitative only)
- relationship among force, mass and acceleration (describe qualitative relationships and calculate)
- action/reaction (application)

5.1.4. The student will analyze the behavior of forces.

- friction (qualitative description of its nature and behavior)
- inverse square relationship of gravity (describe how the force changes as the distance changes)
- relation to work and power (qualitative and quantitative)
- relation to impulse and momentum (qualitative and quantitative)

5.1.5. The student will analyze systems with regard to the conservation laws.

- conservation of momentum (applications and calculation in one dimension)
- conservation of energy (relationship between potential and kinetic including calculations and conversions)

5.2 The student will know and apply the laws of electricity and magnetism and explain their significant role in nature and technology.

5.2.1. The student will describe the types of electric charges and the forces that exist between them.

- inverse square relationship of electrical forces (describe how the force changes as the distance changes)

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- the attractive/repulsive nature of the forces between charges
- Coulomb's Law (describe qualitative relationships)

5.2.2. The student will describe the sources and effects of electric and magnetic fields.

- Qualitative description of electric field created by a static charge distribution (point charge, line of charge, parallel plates)
- Qualitative description of magnetic field created by moving charges
- Qualitative description of the force on a moving charge or on a current carrying wire in a magnetic field
- Simple D.C. series and parallel circuits (diagram of series and parallel circuits; use of meters to measure quantities in each circuit; calculations of voltage, current, and resistance using Ohm's Law; and calculations of equivalent resistance and power)
- Practical applications (safety, grounding, circuit breakers, fuses)

5.2.3. The student will qualitatively describe the applications of electromagnetic induction.

- Electromagnetic induction (definition)
- Motors (energy transformations)
- Generators (energy transformations)

5.3 The student will recognize and relate the laws of thermodynamics to practical applications.

5.3.1. The student will relate thermodynamics to the balance of energy in a system.

- Thermal equilibrium (conditions and definition, differentiate between heat energy and temperature)
- Heat energy transfer (conduction, convection, radiation)
- Application of heat energy to the Law of Conservation of Energy
- Irreversibility of heat energy transformations
- Specific heat and calorimetry (both describe and calculate)

5.4 The student will explain and demonstrate how vibrations and waves provide a model for our understanding of various physical phenomena.

5.4.1. The student will compare qualitatively how waves are propagated and transmit energy.

- Physical v. electromagnetic (transmission media, relative speeds, examples such as sound and light)
- Longitudinal v. transverse (direction of vibration relative to direction of transmission, examples such as sound and light)

5.4.2. The student will describe wave characteristics using both diagrams and calculations.

- Wavelength
- Frequency (including relationship to period and energy transmitted)
- Velocity
- Amplitude (including relationship to energy transmitted)

5.4.3. The student will qualitatively describe the physical behaviors of waves.

- Reflection (apply the law of reflection, represent image formation for plane and concave surfaces using a ray diagram)
- Refraction (causes and resultant behavior, which may include ray diagrams for behavior at a plane boundary and for double convex lenses)
- Diffraction (causes and relationship between wavelength and size of opening)
- Interference (constructive and destructive)
- Polarization (relation to type of wave, effect on intensity of light)
- Doppler effect (examples and explanation including frequency shift)

5.5 The student will investigate certain topics in modern physics.

5.5.1. The student will cite evidence of the wave/particle duality in the nature of matter.

- Wave/particle duality of electromagnetic energy (electron-positron annihilation, conservation of mass and energy/$E = mc^2$)
- Photoelectric effect (relationship of current produced to frequency and intensity of wave)

5.5.2. The student will qualitatively explain the processes associated with nuclear energy and its applications.

- Radioactive decay (half-life; alpha, beta, and gamma emission processes)
- Fission/fusion (distinguish between, compare with other sources of energy)

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Goal 6: Environmental Science

The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions.

6.1 The student will explain how matter and energy move through the biosphere (lithosphere, hydrosphere, atmosphere and organisms).

6.1.1. The student will demonstrate that matter cycles through and between living systems and the physical environment constantly being recombined in different ways. At least—

- nitrogen cycle
- carbon cycle
- phosphorus cycle (rock/mineral)
- hydrologic cycle

6.1.2. The student will analyze how the transfer of energy between atmosphere, land masses and oceans results in areas of different temperatures and densities that produce weather patterns and establish climate zones around the earth. At least—

- differential heating and cooling
- oceanic and atmospheric circulation patterns
- climates and microclimates
- biomes

6.2 The student will investigate the interdependence of organisms within their biotic environment.

6.2.1. The student will explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level. At least—

- Photosynthesis/respiration
- Producers, consumers, decomposers
- Trophic levels
- Pyramid of energy/pyramid of biomass

6.2.2. The student will explain why interrelationships & interdependencies of organisms contribute to the dynamics of ecosystems. At least—

- Interspecific and intraspecific competition
- Niche
- Cycling of materials among organisms
- Equilibrium/cyclic fluctuations
- Dynamics of disturbance and recovery
- Succession: aquatic and terrestrial

6.2.3. The student will conclude that populations grow or decline due to a variety of factors. At least—

- Linear/exponential growth
- Carrying capacity/limiting factors
- Species specific reproductive factors (such as birth rate, fertility rate)
- Factors unique to the human population (medical, agricultural, cultural)
- Immigration/emigration
- Introduced species

6.2.4. The student will provide examples and evidence showing that natural selection leads to organisms that are well suited for survival in particular environments. At least—

- coevolutionary relationships, e.g.symbiotic relationships
- variation within a species increases survival potential
- natural selection provides a mechanism for evolution
- adaptations of organisms within biomes

6.3 The student will analyze the relationships between humans and the earth's resources.

6.3.1. The student will evaluate the interrelationship between humans and air quality. At least—

- ozone
- greenhouse gases
- volatile organic compounds (smog)
- acid rain
- indoor air
- human health

6.3.2. The student will evaluate the interrelationship between humans and water quality and quantity. At least—

- fresh water supply
- point source/nonpoint source pollution
- waste water treatment
- thermal pollution
- Chesapeake Bay and its watershed
- eutrophication
- human health

6.3.3. The student will evaluate the interrelationship between humans and land resources. At least—

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- wetlands
- soil conservation
- mining
- solid waste management
- land use planning
- human health

6.3.4. The student will evaluate the interrelationship between humans and biological resources. At least—

- food production/agriculture
- forest and wildlife resources
- species diversity/genetic resources
- integrated pest management
- human health

6.3.5. The student will evaluate the interrelationship between humans and energy resources. At least—

- renewable
- nonrenewable
- human health

6.4 The student will develop and apply knowledge and skills gained from an environmental issue investigation to an action project which protects and sustains the environment.

6.4.1. Identify an environmental issue and formulate related research questions.

- Methods of gathering information may include
  - writing letters
  - performing a literature search
  - using the internet
  - interviewing experts

6.4.2. Design and conduct the research.

- Methods of data collection may include
- field or laboratory
- questionnaire/opinionnaire

6.4.3. Interpret the findings to draw conclusions and make recommendations to help resolve the issue.

6.4.4. Apply the conclusions to develop and implement an action project.

- Methods of implementation may include
  - physical action
  - persuasion
  - consumer action
  - political action

6.4.5. Analyze the effectiveness of the action project in terms of achieving the desired outcomes.

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Section C: ACT's College Readiness Standards Included in Maryland's Grade 8–12 Voluntary State Curriculum and Core Learning Goals

In recent years ACT has brought a distinctive voice to the debate on what it means to be truly ready for college. Using a wealth of longitudinal data—data that no one else possesses—ACT has pioneered empirical approaches to assessing students' college readiness. Using thousands of student records and responses, content and measurement experts at ACT have developed detailed statements that describe what students typically know and are able to do at different levels of test performance. These data-driven, empirically derived score descriptors, known as **ACT's College Readiness Standards,** describe student achievement within various score ranges on the English, Reading, Writing, Mathematics, and Science tests on the EXPLORE, PLAN, and ACT.

In this section (Section C), the ACT College Readiness Standards included in Maryland's Performance Standards and Core Learning Goals are highlighted. College Readiness Standards not highlighted are those that include specific content, complexity, and/or proficiency level descriptors that ACT content experts determined were not included in Maryland's Standards and Core Learning Goals.

Table C-1. ACT's College Readiness Standards — English

	Topic Development in Terms of Purpose and Focus	Organization, Unity, and Coherence	Word Choice in Terms of Style, Tone, Clarity, and Economy
13–15		Use conjunctive adverbs or phrases to show time relationships in simple narrative essays (e.g., *then*, *this time*)	Revise sentences to correct awkward and confusing arrangements of sentence elements Revise vague nouns and pronouns that create obvious logic problems
16–19	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	Select the most logical place to add a sentence in a paragraph	Delete obviously synonymous and wordy material in a sentence Revise expressions that deviate from the style of an essay
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	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	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
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 Delete material primarily because it disturbs the flow and development of the paragraph Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement	Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore*, *however*, *in addition*) Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward	Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence Identify and correct ambiguous pronoun references Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay
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
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

Table C-1. ACT's College Readiness Standards — English (continued)

	Sentence Structure and Formation	Conventions of Usage	Conventions of Punctuation
13–15	Use conjunctions or punctuation to join simple clauses Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences	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	Delete commas that create basic sense problems (e.g., between verb and direct object)
16–19	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	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*	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)
20–23	Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers)	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	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)
24–27	Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence	Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences 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*	Use punctuation to set off complex parenthetical phrases 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*) Use apostrophes to indicate simple possessive nouns Recognize inappropriate uses of colons and semicolons
28–32	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	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)	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	Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses	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

Table C-2. ACT's College Readiness Standards — Reading		
	Main Ideas and Author's Approach	**Supporting Details**
13–15	Recognize a clear intent of an author or narrator in uncomplicated literary narratives	Locate basic facts (e.g., names, dates, events) clearly stated in a passage
16–19	Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives	Locate simple details at the sentence and paragraph level in uncomplicated passages Recognize a clear function of a part of an uncomplicated passage
20–23	Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages	Locate important details in uncomplicated passages Make simple inferences about how details are used in passages
24–27	Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages Infer the main idea or purpose of straightforward paragraphs in more challenging passages Summarize basic events and ideas in more challenging passages Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages	Locate important details in more challenging passages Locate and interpret minor or subtly stated details in uncomplicated passages Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages
28–32	Infer the main idea or purpose of more challenging passages or their paragraphs Summarize events and ideas in virtually any passage Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage	Locate and interpret minor or subtly stated details in more challenging passages Use details from different sections of some complex informational passages to support a specific point or argument
33–36	Identify clear main ideas or purposes of complex passages or their paragraphs	Locate and interpret details in complex passages Understand the function of a part of a passage when the function is subtle or complex

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 generous use of ambiguous language and literary devices, feature complex and subtle interactions between characters, often contain challenging context-dependent vocabulary, and typically contain messages and/or meanings that are not explicit but are embedded in the passage.

Table C-2. ACT's College Readiness Standards — Reading (continued)

	Sequential, Comparative, and Cause-Effect Relationships	Meanings of Words	Generalizations and Conclusions
13–15	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	Understand the implication of a familiar word or phrase and of simple descriptive language	Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives
16–19	Identify relationships between main characters in uncomplicated literary narratives Recognize clear cause-effect relationships within a single paragraph in uncomplicated literary narratives	Use context to understand basic figurative language	Draw simple generalizations and conclusions about people, ideas, and so on in uncomplicated passages
20–23	Order simple sequences of events in uncomplicated literary narratives Identify clear relationships between people, ideas, and so on in uncomplicated passages Identify clear cause-effect relationships in uncomplicated passages	Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages	Draw generalizations and conclusions about people, ideas, and so on in uncomplicated passages Draw simple generalizations and conclusions using details that support the main points of more challenging passages
24–27	Order sequences of events in uncomplicated passages Understand relationships between people, ideas, and so on in uncomplicated passages Identify clear relationships between characters, ideas, and so on in more challenging literary narratives Understand implied or subtly stated cause-effect relationships in uncomplicated passages Identify clear cause-effect relationships in more challenging passages	Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages	Draw subtle generalizations and conclusions about characters, ideas, and so on in uncomplicated literary narratives Draw generalizations and conclusions about people, ideas, and so on in more challenging passages
28–32	Order sequences of events in more challenging passages Understand the dynamics between people, ideas, and so on in more challenging passages Understand implied or subtly stated cause-effect relationships in more challenging passages	Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts	Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so on
33–36	Order sequences of events in complex passages Understand the subtleties in relationships between people, ideas, and so on in virtually any passage Understand implied, subtle, or complex cause-effect relationships in virtually any passage	Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage	Draw complex or subtle generalizations and conclusions about people, ideas, and so on, often by synthesizing information from different portions of the passage Understand and generalize about portions of a complex literary narrative

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

More Challenging Informational Passages refers to materials that tend to present concepts that are not always stated explicitly and that are accompanied or illustrated by more—and more detailed—supporting data, include some difficult context-dependent words, and are written in a somewhat more demanding and less accessible style.

Complex Informational Passages refers to materials that tend to include a sizable amount of data, present difficult concepts that are embedded (not explicit) in the text, use demanding words and phrases whose meaning must be determined from context, and are likely to include intricate explanations of processes or events.

Table C-3. ACT's College Readiness Standards — Writing

	Expressing Judgments	Focusing on the Topic	Developing a Position
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	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
5–6	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	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
7–8	Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt Show some recognition of the complexity of the issue in the prompt by • acknowledging counterarguments to the writer's position • providing some response to counter-arguments to the writer's position	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	Develop ideas by using some specific reasons, details, and examples Show some movement between general and specific ideas and examples
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 counter-arguments 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
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 counter-arguments 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

Table C-3. ACT's College Readiness Standards — Writing (continued)		
	Organizing Ideas	**Using Language**
3–4	Provide a discernible organization with some logical grouping of ideas in parts of the essay Use a few simple and obvious transitions Present a discernible, though minimally developed, introduction and conclusion	Show limited control of language by • correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes significantly impede understanding • using simple vocabulary • using simple sentence structure
5–6	Provide a simple organization with logical grouping of ideas in parts of the essay Use some simple and obvious transitional words, though they may at times be inappropriate or misleading Present a discernible, though underdeveloped, introduction and conclusion	Show a basic control of language by • correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes impede understanding • using simple but appropriate vocabulary • using a little sentence variety, though most sentences are simple in structure
7–8	Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas Use some simple and obvious, but appropriate, transitional words and phrases Present a discernible introduction and conclusion with a little development	Show adequate use of language to communicate by • correctly employing many of the conventions of standard English grammar, usage, and mechanics, but with some distracting errors that may occasionally impede understanding • using appropriate vocabulary • using some varied kinds of sentence structures to vary pace
9–10	Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas Present a somewhat developed introduction and conclusion	Show competent use of language to communicate ideas by • correctly employing most conventions of standard English grammar, usage, and mechanics, with a few distracting errors but none that impede understanding • using some precise and varied vocabulary • using several kinds of sentence structures to vary pace and to support meaning
11–12	Provide unity and coherence throughout the essay, often with a logical progression of ideas Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas Present a well-developed introduction and conclusion	Show effective use of language to clearly communicate ideas by • correctly employing most conventions of standard English grammar, usage, and mechanics, with just a few, if any, errors • using precise and varied vocabulary • using a variety of kinds of sentence structures to vary pace and to support meaning

Table C-4. ACT's College Readiness Standards — Mathematics

	Basic Operations & Applications	Probability, Statistics, & Data Analysis	Numbers: Concepts & Properties	Expressions, Equations, & Inequalities
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)	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	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	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	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	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	Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor	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
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	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	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
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	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	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
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	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	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

Table C-4. ACT's College Readiness Standards — Mathematics (continued)

	Graphical Representations	Properties of Plane Figures	Measurement	Functions
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	
20–23	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	Evaluate quadratic functions, expressed in function notation, at integer values
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	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	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
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)	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	Evaluate composite functions at integer values Apply basic trigonometric ratios to solve right-triangle problems
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	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	Use scale factors to determine the magnitude of a size change Compute the area of composite geometric figures when planning or visualization is required	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

Table C-5. ACT's College Readiness Standards — Science

	Interpretation of Data	Scientific Investigation	Evaluation of Models, Inferences, and Experimental Results
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) Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)		
16–19	Select two or more pieces of data from a simple data presentation Understand basic scientific terminology Find basic information in a brief body of text Determine how the value of one variable changes as the value of another variable changes in a simple data presentation	Understand the methods and tools used in a simple experiment	
20–23	Select data from a complex data presentation (e.g., a table or graph with more than three variables; a phase diagram) Compare or combine data from a simple data presentation (e.g., order or sum data from a table) Translate information into a table, graph, or diagram	Understand the methods and tools used in a moderately complex experiment Understand a simple experimental design Identify a control in an experiment Identify similarities and differences between experiments	Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model Identify key issues or assumptions in a model
24–27	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	Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models Determine whether given information supports or contradicts a simple hypothesis or conclusion, and why Identify strengths and weaknesses in one or more models Identify similarities and differences between models Determine which model(s) is(are) supported or weakened by new information Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion
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	Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model Determine whether new information supports or weakens a model, and why Use new information to make a prediction based on a model
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	Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models Determine whether given information supports or contradicts a complex hypothesis or conclusion, and why

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

Life Science/Biology	Physical Science/Chemistry, Physics	Earth & Space Science
• 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 volcanoes • Earth's atmosphere • Earth's resources • Fossils and geological time • Geochemical cycles • Groundwater • Lakes, rivers, oceans • Mass movements • Plate tectonics • Rocks, minerals • Solar system • Stars, galaxies, and the universe • Water cycle • Weather and climate • Weathering and erosion

Section D: ACT's WorkKeys Skills Included in Maryland's Grades 9-12 Core Learning Goals

Working with Charter States, national education organizations, educators, employers, and experts in employment and training requirements, ACT identified workplace skills that help individuals successfully perform a wide range of jobs. These skills form the basis of the WorkKeys assessments.

In this section (Section D), the WorkKeys Skills that are highlighted are those that are included in Maryland's Core Learning Goals. WorkKeys Skills not highlighted are those statements that include specific content, complexity and/or proficiency level descriptions that were not described in Maryland's Core Learning Goals.

Because Maryland educators are the experts on the Maryland Core Learning Goals, we would strongly encourage them to examine this document and offer their interpretations.

	WorkKeys Skills		
Level	**Reading for Information**	**Applied Mathematics**	**Locating Information**
3	Identify main ideas and clearly stated details Choose the correct meaning of a word that is clearly defined in the reading Choose the correct meaning of common, everyday and workplace words Choose when to perform each step in a short series of steps Apply instructions to a situation that is the same as the one in the reading materials	Solve problems that require a single type of mathematics operation (addition, subtraction, multiplication, and division) using whole numbers Add or subtract negative numbers Change numbers from one form to another using whole numbers, fractions, decimals, or percentages Convert simple money and time units (e.g., hours to minutes)	Find one or two pieces of information in a graphic Fill in one or two pieces of information that are missing from a graphic
4	Identify important details that may not be clearly stated Use the reading material to figure out the meaning of words that are not defined Apply instructions with several steps to a situation that is the same as the situation in the reading materials Choose what to do when changing conditions call for a different action (follow directions that include "if-then" statements)	Solve problems that require one or two operations Multiply negative numbers Calculate averages, simple ratios, simple proportions, or rates using whole numbers and decimals Add commonly known fractions, decimals, or percentages (e.g., ½, .75, 25%) Add three fractions that share a common denominator Multiply a mixed number by a whole number or decimal Put the information in the right order before performing calculations	Find several pieces of information in one or two graphics Understand how graphics are related to each other Summarize information from one or two straightforward graphics Identify trends shown in one or two straightforward graphics Compare information and trends shown in one or two straightforward graphics
5	Figure out the correct meaning of a word based on how the word is used Identify the correct meaning of an acronym that is defined in the document Identify the paraphrased definition of a technical term or jargon that is defined in the document Apply technical terms and jargon and relate them to stated situations Apply straightforward instructions to a new situation that is similar to the one described in the material Apply complex instructions that include conditionals to situations described in the materials	Decide what information, calculations, or unit conversions to use to solve the problem Look up a formula and perform single-step conversions within or between systems of measurement Calculate using mixed units (e.g., 3.5 hours and 4 hours 30 minutes) Divide negative numbers Find the best deal using one- and two-step calculations and then comparing results Calculate perimeters and areas of basic shapes (rectangles and circles) Calculate percentage discounts or markups	Sort through distracting information Summarize information from one or more detailed graphics Identify trends shown in one or more detailed or complicated graphics Compare information and trends from one or more complicated graphics
6	Identify implied details Use technical terms and jargon in new situations Figure out the less common meaning of a word based on the context Apply complicated instructions to new situations Figure out the principles behind policies, rules, and procedures Apply general principles from the materials to similar and new situations Explain the rationale behind a procedure, policy, or communication	Use fractions, negative numbers, ratios, percentages, or mixed numbers Rearrange a formula before solving a problem Use two formulas to change from one unit to another within the same system of measurement Use two formulas to change from one unit in one system of measurement to a unit in another system of measurement Find mistakes in items that belong at Levels 3, 4, and 5 Find the best deal and use the result for another calculation Find areas of basic shapes when it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations Find the volume of rectangular solids Calculate multiple rates	Draw conclusions based on one complicated graphic or several related graphics Apply information from one or more complicated graphics to specific situations Use the information to make decisions
7	Figure out the definitions of difficult, uncommon words based on how they are used Figure out the meaning of jargon or technical terms based on how they are used Figure out the general principles behind the policies and apply them to situations that are quite different from any described in the materials	Solve problems that include nonlinear functions and/or that involve more than one unknown Find mistakes in Level 6 items Convert between systems of measurement that involve fractions, mixed numbers, decimals, and/or percentages Calculate multiple areas and volumes of spheres, cylinders, or cones Set up and manipulate complex ratios or proportions Find the best deal when there are several choices Apply basic statistical concepts	