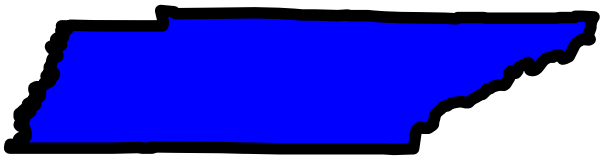

STATE MATCH

Tennessee Curriculum Standards

English/Language Arts, Mathematics, and Science
Grades 7–12

and

ACT®

EXPLORE, PLAN, and the ACT

May 2006

About This Report

EXECUTIVE SUMMARY

(pp. 1–2)

This portion summarizes the findings of the alignment between 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 Tennessee's Curriculum Standards. It also presents ACT's involvement in meeting NCLB requirements and describes additional critical information that ACT could provide to Tennessee.

SECTION A

(pp. 3–8)

This section provides tables by content area (English/Language Arts, Mathematics, and Science) listing the precise number of Tennessee Curriculum Standards measured by ACT's EPAS tests by grade level.

SECTION B

(pp. 9–97)

All Tennessee Curriculum Standards are listed here; each one highlighted is measured by ACT's EPAS tests. Tennessee standards listed here are from the Tennessee Curriculum Standards as presented on the Tennessee Department of Education's website in April 2006. Underlined science content indicates that the content topics are included in, but not directly measured by, ACT's EPAS Science Tests.

SECTION C

(pp. 99–108)

ACT's College Readiness Standards appear here. Highlighting indicates that a statement reflects one or more statements in the Tennessee Curriculum Standards. College Readiness Standards not highlighted are not addressed in the Tennessee Curriculum Standards.

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

Executive Summary

We at ACT believe our programs offer many advantages to Tennessee students and educators, and this report offers strong evidence for this belief. This alignment analysis clearly answers three 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)—measure Tennessee's Curriculum Standards?
2. Can ACT's EPAS test results be used to meet Tennessee's NCLB requirement?
3. Why should Tennessee choose ACT?

ACT'S TESTS MEASURE MANY IMPORTANT TENNESSEE CURRICULUM STANDARDS IN 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 measure many of Tennessee's English/Language Arts, Mathematics, and Science Curriculum Standards (with State Performance Indicator match totals appearing in Section A):

- English/Language Arts: 3 out of 5 Standards

  Almost all of English/Language Arts Standards are covered by ACT's English, Reading, and Writing tests.

- Mathematics: 59 out of 59 Standards

  All of Tennessee's Mathematics Standards are covered by ACT's Mathematics tests.

- Science: *Process* Standards: 4 out of 5
  (*Content* Standards: 73 out of 75)

  Almost all of Tennessee's Science standards are covered by ACT's Science tests.

  (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 Tennessee Science Curriculum Standards.

  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 Tennessee standards measured by ACT's tests), and are underlined rather than highlighted in Section B. Our goal 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 Tennessee's Curriculum Standards 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

ACT

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**

interested in working with Tennessee on developing any necessary augmentation.

2. NCLB requirement? Yes; states like Illinois intend to use ACT components as part of testing that will be 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 worked backwards to develop data-driven, empirically derived statements of what students typically know and are able to do in various score ranges on ACT's English, Reading, Writing, Mathematics, and Science tests. These statements provide specific details about students' college readiness and can be used to identify next steps for improvement.

In sum, the ACT's EPAS programs provide abundant data relevant to Tennessee's Curriculum Standards and to Tennessee students' readiness for college and work.

ACT

Section A: Number of Tennessee Curriculum Standards Measured by EXPLORE, PLAN, and the ACT

Table A-1. Number of Tennessee English/Language Arts Curriculum Standards Measured by EXPLORE, PLAN, and the ACT

Tennessee Standards*	Number of Tennessee State Performance Indicators (SPIs) Measured by ACT's tests	Aspects of Not-Measured Tennessee Standards
Reading	7th: 14 out of 28 8th: 12 out of 27 E1: 12 out of 14 E2: 9 out of 15 E3: 3 out of 17 E4: 6 out of 23	Formulate questions Distinguish between poetry and prose Identify common foreign phrases Rank a set of resources according to reliability Recognize propaganda Differentiate among verbal, situational, dramatic irony Identify an allusion Complete an analogy Differentiate between mood and tone in poetry Analyze/compare two or more literary selections Synthesize reading vocabulary into written and oral communication Participate in a variety of oral reading experiences Read independently Critique effectiveness of persuasive devices Investigate an author's background Contrast passages Defend credible sources Interpret graphics Locate and utilize credible resource materials
Writing	7th: 7 out of 15 8th: 13 out of 22 E1: 16 out of 22 E2: 19 out of 29 E3: 10 out of 21 E4: 8 out of 23	Complete a graphic organizer Supply a missing piece Select illustrations Distinguish the strongest or weakest point of an argument Select a rebuttal statement Use a variety of prewriting activities Respond to literary selections Create a written explanation for a selected problem Create documents appropriate for a work environment Gather information from the Internet Cite quotations Produce research projects
Elements of Language	7th: 8 out of 11 8th: 9 out of 11	Identify correctly or incorrectly spelled words Select appropriate use of underlining/ italicizing

ACT

Table A-1. Number of Tennessee English/Language Arts Curriculum Standards Measured by EXPLORE, PLAN, and the ACT		
Tennessee Standards*	**Number of Tennessee State Performance Indicators (SPIs) Measured by ACT's tests**	**Aspects of Not-Measured Tennessee Standards**
Viewing and Representing	E1: 0 out of 5 E2: 0 out of 4 E3: 0 out of 8 E4: 0 out of 8	Use, read, and view media/technology
Speaking and Listening	E1: 0 out of 3 E2: 0 out of 3 E3: 0 out of 10 E4: 0 out of 11	Express ideas orally Apply active listening
TOTALS 3 out of 5 Standards	7th: 29 out of 54 8th: 34 out of 60 E1: 28 out of 44 E2: 28 out of 51 E3: 13 out of 56 E4: 14 out of 65	

*Refer to Tennessee's English/Language Arts Curriculum Standards on pages 9–25

Table A-2. Number of Tennessee Mathematics Curriculum Standards Measured by EXPLORE, PLAN, and the ACT		
Tennessee Standards*	**Number of Tennessee Standards (Stds) and State Performance Indicators (SPIs) Measured by ACT's tests**	**Aspects of Not-Measured Tennessee Standards**
Grade 7	Stds: 5 out of 5 SPIs: 46 out of 47	Identify the results of transformations of two-dimensional figures
Grade 8	Stds: 5 out of 5 SPIs: 48 out of 48	
Foundations I	Stds: 5 out of 5 SPIs: 47 out of 47	
Foundations II	Stds: 5 out of 5 SPIs: 34 out of 34	
Algebra I	Stds: 5 out of 5 SPIs: 55 out of 56	Select the discriminant of a quadratic equation
Geometry	Stds: 5 out of 5 SPIs: 40 out of 40	
Integrated Mathematics I	Stds: 5 out of 5 SPIs: 73 out of 75	Represent algebraic expressions and operations using manipulatives Model steps for solving linear equations using manipulatives
Integrated Mathematics II	Stds: 5 out of 5 SPIs: 58 out of 61	Use manipulatives to explore Use tools to develop concepts Construct 3D objects using physical materials and manipulatives
Integrated Mathematics III	Stds: 5 out of 5 SPIs: 71 out of 74	Use delta notation Use matrices to find area of a triangle Use best measure of central tendency given a curve
Algebra II	Stds: 5 out of 5 SPIs: 39 out of 39	
Advanced Algebra with Trigonometry	Stds: 2 out of 2 SPIs: 22 out of 29	Model real-world phenomena Use discriminants and characterize solutions Explain advantages and disadvantages of using degrees vs. radians Derive Pythagorean identities
Discrete Mathematics with Stat & Prob	Stds: 3 out of 3 SPIs: 15 out of 18	Conduct tests for significance Create tessellations Design a study

ACT

Table A-2. Number of Tennessee Mathematics Curriculum Standards Measured by EXPLORE, PLAN, and the ACT		
Tennessee Standards*	**Number of Tennessee Standards (Stds) and State Performance Indicators (SPIs) Measured by ACT's tests**	**Aspects of Not-Measured Tennessee Standards**
PreCalculus	Stds: 4 out of 4 SPIs: 28 out of 39	Use appropriate technology to solve inequalities Write equations to tangents and normals to conic sections Apply the trigonometric form of complex number in calculations Prove DeMoivre's Theorem Find the sum of an infinite series that converges
TOTALS	Stds: 59 out of 59 SPIs: 576 out of 607	

*Refer to Tennessee's Mathematics Curriculum Standards on pages 26–57

Table A-3. Number of Tennessee Science Curriculum Standards Measured by EXPLORE, PLAN, and the ACT		
Tennessee Standards*	**Number of Tennessee Standards (Stds) and State Performance Indicators (SPIs) Measured by ACT's tests**	**Aspects of Not-Measured Tennessee Standards**
Scientific Research	Stds: 4 out of 5 SPIs: 13 out of 39	Demonstrate ethical practices Honor copyright laws Follow proper safety procedures Document in a journal Choose (and reference) appropriate source of information Employ a search engine on the web Work cooperatively Develop an awareness Reflect on classical problems Use graphing calculators/hand-held technology Demonstrate keyboarding skills Write an expository essay Design and implement an oral presentation Prepare a technical report
TOTALS	Stds: 4 out of 5 SPIs: 13 out of 39	**Science Process Standards**
Grade 7	Stds: (5) out of (5) SPIs: (26) out of (26)	
Grade 8	Stds: (7) out of (7) SPIs: (38) out of (38)	
Earth Science	Stds: (4) out of (4) SPIs: (61) out of (69)	Investigate history of space exploration Construct timeline Explore benefits of space technology to daily life Research careers
Ecology	Stds: (5) out of (6) SPIs: (46) out of (74)	Personal and civic responsibility Characterize developing countries Contrast waste management Develop a plan Design a house Research the history of agriculture
Environmental Science	Stds: (5) out of (6) SPIs: (54) out of (77)	Personal and civic responsibility Describe and discuss impact, health care, pros & cons Recognize diverse cultural issues about humans and their environment Predict shortages Develop a conservation plan Research careers

Table A-3. Number of Tennessee Science Curriculum Standards Measured by EXPLORE, PLAN, and the ACT		
Tennessee Standards*	**Number of Tennessee Standards (Stds) and State Performance Indicators (SPIs) Measured by ACT's tests**	**Aspects of Not-Measured Tennessee Standards**
Geology	Stds: (6) out of (6) SPIs: (83) out of (93)	Determine compass readings Use GPS Create a brochure Investigate technological advances Investigate careers
Life Science	Stds: (6) out of (6) SPIs: (50) out of (50)	
Physical Science	Stds: (4) out of (4) SPIs: (42) out of (42)	
Biology I	Stds: (6) out of (6) SPIs: (51) out of (51)	
Biology II	Stds: (6) out of (6) SPIs: (64) out of (67)	Investigate careers Research careers
Chemistry I	Stds: (4) out of (4) SPIs: (38) out of (38)	
Chemistry II	Stds: (3) out of (3) SPIs: (63) out of (64)	Describe societal implication of nuclear chemistry
Physics	Stds: (6) out of (6) SPIs: (70) out of (70)	
Anatomy and Physiology	Stds: (6) out of (6) SPIs: (95) out of (100)	Identify careers Research and debate an issue related to *in vitro* fertilization
TOTALS	Stds: (73) out of (75) SPIs:(781) out of (859)	**Science Content Standards**

*Refer to Tennessee's Science Curriculum Standards on pages 58–97

English/Language Arts

TENNESSEE Grade 7 English/Language Arts

Standards, Expectations, and State Indicators

Content Standard: 1.0. Reading

The student will develop the reading and listening skills necessary for word recognition, comprehension, interpretation, analysis, evaluation, and appreciation of print and non-print text.

Learning Expectations

1.01. Continue to develop oral language and listening skills.

1.02. Develop an understanding of the concepts of print.

1.03. Expand reading skills through phonemic awareness.

1.04. Use decoding strategies to read unfamiliar words.

1.05. Read to develop fluency, expression, accuracy, and confidence.

1.06. Expand reading vocabulary.

1.07. Employ pre-reading strategies to facilitate comprehension.

1.08. Use active comprehension strategies to derive meaning while reading and to check for understanding after reading.

1.09. Refine study skills and develop methods of research to enhance learning.

1.10. Develop skills to facilitate reading in the content areas.

1.11. Read independently for a variety of purposes.

1.12. Experience and explore the elements of various literary and media genres.

1.13. Develop and sustain a motivation for reading.

State Performance Indicators

The student is able to:

7.1.spi.1. derive information from the following text features: timelines, graphs, headings, and subheadings within context.

7.1.spi.2. determine the meaning of unknown words and/or multiple meaning words through the use of context clues.

7.1.spi.3. replace unknown words in context with appropriate synonyms or antonyms.

7.1.spi.4. make predictions about the outcome of a given passage.

7.1.spi.5. formulate clarifying questions for use before, during, or after reading.

7.1.spi.6. identify the main idea in a reading selection.

7.1.spi.7. distinguish between fact and opinion within context.

7.1.spi.8. decode unknown grade level words in context, using previously learned strategies, such as analysis of affixes, as aids in determining meaning.

7.1.spi.9. recognize first person point of view.

7.1.spi.10. recognize and use grade appropriate and/or content specific vocabulary within context.

7.1.spi.11. identify plot elements in the proper place on a graphic organizer.

7.1.spi.12. locate information using keywords and headings.

7.1.spi.13. distinguish between poetry and prose and between biography and autobiography.

7.1.spi.14. select the correct word or phrase to complete an analogy using synonyms, antonyms, categories, subcategories, whole/part, functions, verb forms, and rhymes.

7.1.spi.15. identify commonly used foreign phrases (e.g., bon voyage, mi casa es su casa, bon jour, hasta la vista).

7.1.spi.16. draw inferences from selected passages.

7.1.spi.17. identify the author's purpose for writing and/or the reader's purpose for reading.

7.1.spi.18. analyze the cause and effect relationship in a given passage.

7.1.spi.19. identify examples of propaganda techniques (i.e., bandwagon, loaded words, testimonials).

7.1.spi.20. determine the common characteristics of short stories, novels, poetry, drama, and non-fiction.

7.1.spi.21. recognize implied themes.

7.1.spi.22. identify similes, metaphors, personification, and hyperbole within context.

7.1.spi.23. analyze the effect within context of the sound devices of onomatopoeia, alliteration, accent, rhyme, and repetition.

7.1.spi.24. recognize and identify words within context that reveal particular time periods and cultures.

7.1.spi.25. identify at least two ways by which an author reveals character traits in a given passage.

7.1.spi.26. identify symbolism, flashback, and foreshadowing within context.

7.1.spi.27. rank a given set of resources according to reliability.

7.1.spi.28. identify examples of sound devices (e.g., rhyme, alliteration, slant rhyme, repetition, and internal rhyme) in context.

Content: 2.0. Writing

The student will develop the structural and creative skills of the writing process necessary to produce written language that can be read, presented to, and interpreted by various audiences.

Learning Expectations

2.01. Engage in prewriting using a variety of strategies.

2.02. Write for a variety of audiences and purposes.

2.03. Compose drafts of written works.

2.04. Show evidence of and determine appropriate revisions within the written draft.

2.05. Include editing before the completion of finished work.

2.06. Evaluate own and others' writing.

2.07. Experience numerous publishing opportunities.

2.08. Write in the expository mode.

2.09. Write frequently across all content areas.

2.10. Write expressively in order to develop an effective writing style.

2.11. Write in response to literature.

2.12. Write in a variety of modes and genres.

2.13. Locate and analyze information to prepare written works and presentations.

State Performance Indicators

The student is able to:

7.2.spi.1. complete a graphic organizer (i.e., clustering, listing, mapping, and webbing) with information from notes for a writing selection.

7.2.spi.2. select appropriate time-order or transitional words/phrases to enhance the flow of a writing sample.

7.2.spi.3. identify the purpose for writing (i.e., to inform, to describe, to explain, to persuade).

7.2.spi.4. identify the audience (formal/informal) for which text is written.

7.2.spi.5. select an appropriate concluding sentence for a well-developed paragraph.

7.2.spi.6. supply a missing piece of information in an outline.

7.2.spi.7. rearrange multi-paragraphed work in a logical and coherent order.

7.2.spi.8. identify individual written selections as technical, narrative, persuasive and /or descriptive in mode.

7.2.spi.9. select an appropriate thesis statement for a writing sample.

7.2.spi.10. select the best way to combine sentences to provide syntactic variety within context.

7.2.spi.11. identify the sentence(s) irrelevant to a paragraph's theme or flow.

7.2.spi.12. choose the supporting sentence that best fits the context and flow of ideas in a paragraph.

7.2.spi.13. select the most appropriate title for a passage.

7.2.spi.14. identify levels of reliability among resources (e.g., eyewitness account, newspaper account, supermarket tabloid account, and Internet source).

7.2.spi.15. select illustrations, explanations, anecdotes, descriptions, and/or facts to support key ideas.

Content Standard: 3.0. Elements of Language

The student will use standard English conventions and proper spelling as appropriate to speaking and writing.

Learning Expectations

3.01. Demonstrate knowledge of standard English usage.

3.02. Demonstrate knowledge of standard English mechanics.

3.03. Demonstrate knowledge of standard English spelling.

3.04. Demonstrate knowledge of correct sentence structure.

State Performance Indicators

The student is able to:

7.3.spi.1. identify the correct use of commas (i.e., compound sentences, coordinating conjunctions, introductory words, appositives, and interrupters) within context.

7.3.spi.2. recognize usage errors occurring within context (e.g., double negatives, troublesome words: to, too, two; their, there, they're; lie, lay; sit, set).

7.3.spi.3. identify the correct use of colons (i.e., in business letters, preceding a list of items) within context.

7.3.spi.4. choose the correct use of quotation marks and commas (i.e., in direct quotations, with explanatory material within the quote, proper use with end marks).

7.3.spi.5. identify the correct use of nouns (i.e., common/proper, singular/plural, possessives, direct/indirect objects, predicate) , pronouns (i.e., agreement, reflexive, interrogative, and demonstrative), verbs (i.e., action/linking, regular/irregular, agreement, perfect tenses, verb phrases), adjectives (i.e., common/proper, comparative and superlative forms, adjective clauses), adverbs (i.e., comparative and superlative forms), interjection and conjunctions (i.e., coordinating, correlative, and subordinating) within context.

7.3.spi.6. identify within context a variety of appropriate sentence-combining techniques (i.e., comma + coordinating conjunction, use of semicolon, introductory phrases and/or clauses).

7.3.spi.7. identify the correct use of prepositions and prepositional phrases within context.

7.3.spi.8. select the most appropriate method to correct a run-on sentence (i.e., conjunctions, semicolons, and periods to join or separate elements) within context.

7.3.spi.9. identify correctly or incorrectly spelled words in context.

7.3.spi.10. identify the correct use of appositives and appositive phrases and infinitives and infinitive phrases within context.

7.3.spi.11. select the appropriate use of underlining/italicizing with titles, specific words, numbers, and letters.

TENNESSEE Grade 8 English/Language Arts

Standards, Expectations, and State Indicators

Content Standard: 1.0. Reading

The student will develop the reading and listening skills necessary for word recognition, comprehension, interpretation, analysis, evaluation, and appreciation of print and non-print text.

Learning Expectations

1.01 Continue to develop oral language and listening skills.

1.02 Develop an understanding of the concepts of print.

1.03 Expand reading skills through phonemic awareness.

1.04 Use decoding strategies to read unfamiliar words.

1.05 Read to develop fluency, expression, accuracy, and confidence.

1.06 Expand reading vocabulary.

1.07 Employ pre-reading strategies to facilitate comprehension.

1.08 Use active comprehension strategies to derive meaning while reading and to check for understanding after reading.

1.09 Refine study skills and develop methods of research to enhance learning.

1.10 Develop skills to facilitate reading in the content areas.

1.11 Read independently for a variety of purposes.

1.12 Experience and explore the elements of various literary and media genres.

1.13 Develop and sustain a motivation for reading.

State Performance Indicators

The student is able to:

8.1.spi.1. formulate appropriate questions during the reading of text.

8.1.spi.2. choose the correct meaning/usage of multi-meaning words by replacing the word in context with an appropriate synonym or antonym.

8.1.spi.3. locate information using available text features (e.g., maps, charts, graphics, indexes, glossaries, tables of contents, and appendices).

8.1.spi.4. identify on a graphic organizer the points at which various plot elements occur.

8.1.spi.5. identify an appropriate title to reinforce the main idea of a passage or paragraph.

8.1.spi.6. determine cause-effect relationships in context.

8.1.spi.7. determine inferences from selected passages.

8.1.spi.8. recognize a reasonable prediction of future events of a passage.

8.1.spi.9. select information using keywords and headings.

8.1.spi.10. recognize and use grade appropriate and/or content specific vocabulary.

8.1.spi.11. determine an author's purpose for writing or a student's purpose for reading.

8.1.spi.12. identify an implied theme from a selection or related selections.

8.1.spi.13. use text features (e.g., sidebars, footnotes, and endnotes) to determine meaning.

8.1.spi.14. distinguish among different genres (e.g., poetry, drama, letters, ads, historical fiction, biographies, autobiographies, and essays) and their distinguishing characteristics.

8.1.spi.15. identify examples within context of similes, metaphors, alliteration, onomatopoeia, personification, and hyperbole.

8.1.spi.16. choose a logical word or phrase to complete an analogy, using scrambled words and homophones in addition to previously learned analogies.

8.1.spi.17. recognize and identify the techniques of propaganda (i.e., bandwagon, loaded words, and testimonials).

8.1.spi.18. recognize author's point of view (e.g., first person or third person, limited/ omniscient).

8.1.spi.19. determine how a story changes if the point of view is changed.

8.1.spi.20. recognize commonly used foreign phrases (e.g., bonjour, hasta la vista, bon voyage, mi casa es su casa, e pluribus unum, c'est la vie).

8.1.spi.21. identify examples of sound devices within context (e.g. rhyme, alliteration, assonance, slant rhyme, repetition, internal rhyme).

8.1.spi.22. recognize and identify words within context that reveal particular time periods and cultures.

8.1.spi.23. determine the influence of culture and ethnicity on the themes and issues of literary texts.

8.1.spi.24. identify how the author reveals character (e.g., physical characteristics, dialog, what others say about him, what he does).

8.1.spi.25. recognize literary elements that shape meaning within context (e.g., symbolism, foreshadowing, flashback, irony, mood and tone).

8.1.spi.26. identify instances of bias and stereotyping in print and non-print contexts.

8.1.spi.27. recognize the effect of stressed and unstressed syllables to aid in identifying the meaning of multiple meaning words.

Content Standard: 2.0. Writing

The student will develop the structural and creative skills of the writing process necessary to produce written language that can be read, presented to, and interpreted by various audiences.

Learning Expectations

2.01 Engage in prewriting using a variety of strategies.

2.02 Write for a variety of audiences and purposes.

2.03 Compose drafts of written works.

2.04 Show evidence of and determine appropriate revisions within the written draft.

2.05 Include editing before the completion of finished work.

2.06 Evaluate own and others' writing.

2.07 Experience numerous publishing opportunities.

2.08 Write in the expository mode.

2.09 Write frequently across all content areas.

2.10 Write expressively in order to develop an effective writing style.

2.11 Write in response to literature.

2.12 Write in a variety of modes and genres.

2.13 Locate and analyze information to prepare written works and presentations.

State Performance Indicators

The student is able to:

8.2.spi.1. complete a graphic organizer (i.e., clustering, listing, mapping, webbing) with information from notes for a writing selection.

8.2.spi.2. select appropriate time-order or transitional words/phrases to enhance the flow of a writing sample.

8.2.spi.3. identify the purpose for writing (i.e., to inform, to describe to explain, to persuade).

8.2.spi.4. identify the targeted audience for a selected passage.

8.2.spi.5. rearrange multi-paragraphed work in a logical and coherent order.

8.2.spi.6. identify sentences irrelevant to a paragraph's theme or flow.

***8.2.spi.7.** select, limit, and refine a topic.

***8.2.spi.8.** write well-organized and coherently developed paragraphs.

***8.2.spi.9.** reorganize paragraphs into well-organized and coherently developed essays.

***8.2.spi.10.** integrate all steps of the writing process: prewriting, drafting, revising, editing, and publishing.

8.2.spi.11. identify levels of reliability among resources (e.g., eyewitness account, newspaper account, supermarket tabloid account, Internet source).

8.2.spi.12. identify individual written selections as technical, narrative, persuasive, and /or descriptive in mode.

8.2.spi.13. select an appropriate thesis statement for a writing sample.

8.2.spi.14. select the most appropriate title for a selection.

8.2.spi.15. select illustrations, explanations, anecdotes, descriptions, and/or facts to in a paragraph.

8.2.spi.16. choose the supporting sentence that best fits the context and flow of ideas in a paragraph.

***8.2.spi.17.** write well-developed, organized and coherent essays in response to expository prompts.

***8.2.spi.18.** support key ideas with explanations, illustrations, anecdotes and descriptions, and facts.

***8.2.spi.19.** revise and edit writings for the elements of language.

***8.2.spi.20.** choose vivid words, active voice verbs, figurative language, imagery, colorful modifiers, and sensory details to enhance writings.

***8.2.spi.21.** compose clear and correctly punctuated complex sentences to enrich syntactic variety.

8.2.spi.21. select vivid words to strengthen a description (adjective or adverb) within a writing sample or a passage.

Content Standard: 3.0. Elements of Language

The student will use standard English conventions and proper spelling as appropriate to speaking and writing.

Learning Expectations

3.01 Demonstrate knowledge of standard English usage.

3.02 Demonstrate knowledge of standard English mechanics.

3.03 Demonstrate knowledge of standard English spelling.

3.04 Demonstrate knowledge of correct sentence structure.

State Performance Indicators

The student is able to:

8.3.spi.1. identify the correct use of commas (i.e., compound sentences, coordinating conjunctions, introductory words, appositives, and interrupters) within context.

8.3.spi.2. recognize usage errors (e.g., subject/verb agreement, pronoun case, double negatives, comparative/superlative forms, troublesome words: where, were; which, that; who, who, whom) occurring within context.

8.3.spi.3. identify the correct placement of prepositions and prepositional phrases within context.

8.3.spi.4. select the most appropriate method to correct a run-on sentence (i.e., conjunctions, semicolons, and periods to join or separate elements) within context.

8.3.spi.5. identify the correct use of nouns (i.e., common/proper, singular/plural, possessives, direct/indirect objects, predicate noun), pronouns (i.e., reflexive, interrogative, and demonstrative), verbs (i.e., action/linking, regular/irregular, agreement, perfect tenses, and verb phrases), adjectives (i.e., common/proper, comparative and superlative forms, adjective clauses), adverbs (i.e., comparative and superlative forms), interjections and conjunctions (i.e., coordinating, correlative, and subordinating) within context.

8.3.spi.6. identify within context a variety of appropriate sentence-combining techniques (i.e., comma + coordinating conjunction, use of semicolon, introductory phrases or clauses).

8.3.spi.7. identify the correct use of appositives and appositive phrases and infinitives and infinitive phrases within context.

8.3.spi.8. select the appropriate use of underlining/italicizing with titles, specific words, numbers, letters, and figures.

8.3.spi.9. identify correctly or incorrectly spelled words in context.

8.3.spi.10. recognize the appropriate use of gerund and participial phrases.

8.3.spi.11. select the correct pronoun/antecedent agreement for personal pronouns within context.

TENNESSEE English I

Standards, Expectations, and State Indicators

Content Standard: 1.0. Writing

The student will develop the structural and creative skills necessary to produce written language that can be read and interpreted by various audiences.

Learning Expectations

- Write to acquire knowledge, clarify thinking, synthesize information, improve study skills, gain confidence, and enhance lifelong communication.
- Write frequently for a variety of purposes such as narration, description, persuasion, exposition, and personal, creative expression.
- Identify and write for a variety of audiences.
- Recognize that language has several levels of usage determined by audience, purpose, and occasion.
- Approach writing tasks systematically and use elements of the writing process as appropriate.
- Practice a variety of prewriting activities to generate, focus and organize ideas.
- Use a variety of appropriate organizational strategies to develop writing on various topics.
- Develop organized writing containing focused, well-developed ideas.
- Demonstrate effective writing style by the use of vivid words, a variety of sentence structures, and appropriate transitions.
- Evaluate and revise writing to focus on purpose, organization, development, transitions, unity, and audience awareness.
- Recognize and demonstrate knowledge of standard English: usage, mechanics, spelling, and sentence structure.
- Identify and begin to use a variety of resources to revise and edit writing.
- Research information from various sources to prepare presentations or reports which use summarizing, paraphrasing, direct quotations, citation of sources, and bibliographic sources.
- Continue to respond actively and imaginatively to literature.
- Demonstrate an understanding of and respect for multicultural and ethnic diversity in language.

State Performance Indicators

The student is able to:

1.1.A. Use editing skills to correct comparative and superlative forms of adjectives or adverbs.

1.1.B. Use editing skills to correct singular and plural possessive pronouns.

1.1.C. Identify the targeted audience for a selected passage.

1.1.D. Select the most appropriate title for a passage.

1.1.E. Select from the following groups of words the correct one for the sense of the sentence: you're and your; it's and its; their, they're, and there.

1.1.F. Select the topic sentence in a paragraph.

1.1.G. Identify (from a sample) the stage of the writing process represented (using graphics showing the stages: prewriting, first draft, revision, editing, publishing).

1.1.H. Correct a sentence fragment by using sentence combining techniques within a writing sample.

1.1.I. Identify the use of commas with appositives and introductory words, phrases, or clauses.

1.2.A. Recognize correct subject/verb agreement with confusing intervening elements within a writing sample.

1.2.B. Correct run-on sentences by using a comma and coordinating conjunction, subordinate conjunction, or semicolon within a writing sample.

1.2.C. Determine the writer's purpose in a non-fiction writing sample (i.e., narration, description, persuasion, exposition, and personal, creative expression).

1.2.D. Evaluate the relevance of supporting sentences by deleting an irrelevant sentence in a passage.

1.2.E. Distinguish the strongest or weakest point of an argument within a passage.

1.2.F. Select the appropriate transitional word to connect sentences within a paragraph.

1.2.G. Select a vivid word to strengthen a description (verb, adjective, or adverb) within a writing sample or passage.

1.2.H. Determine the most effective order of sentences within a paragraph.

1.2.I. Select correct pronoun case usage in a sentence (e.g., compound elements such as "between you and me").

1.2.K. Select from the following pairs the correct word for the sense of the sentence: stationary and stationery, complement and compliment, principle and principal, accept and except, capitol and capital, affect and effect, where and were, to and too.

1.2.L. Recognize the correct placement of end marks with quotation marks.

1.2.M. Recognize correct usage of quotation marks in direct and indirect quotations.

1.3.A. Rearrange the order of supporting paragraphs within a writing sample given a specified organizational pattern (e.g., comparison/contrast, chronological).

1.3.B. Select correct pronoun/antecedent agreement using collective nouns or indefinite pronouns.

Content Standard: 2.0 Reading

The student will develop the reading skills necessary for word recognition, comprehension, interpretation, analysis, evaluation, and appreciation of the written text.

Learning Expectations

- Develop an understanding of and respect for multicultural, gender, and ethnic diversity in language use, patterns, and dialects.
- Discern reading strategies appropriate to text.
- Extend reading vocabulary.
- Use comprehension strategies to enhance understanding, to make predictions, and to respond to literature.
- Improve comprehension by interpreting, analyzing, synthesizing, and evaluating written text.
- Use oral reading in individual and group presentations.
- Read independently for a variety of purposes.
- Use cognitive strategies to evaluate text critically.
- Develop skills in making inferences and recognizing unstated assumptions.
- Discern the purposes, main ideas, biases, points of view, and persuasive devices found in various texts.
- Interpret ideas, recognize logical relationships, and make judgments based on sufficient evidence.
- Select resource material in order to apply it effectively.
- Read, interpret, and respond in a variety of ways to various genres.
- Identify and interpret literary elements and figurative language.
- Interact with text to form a personal interpretation.

State Performance Indicators

The student is able to:

2.1.A. Identify simile, metaphor, onomatopoeia, alliteration, or personification in poetry or prose.

2.1.B. Distinguish fact from opinion in a passage or writing sample.

2.2.A. Draw inferences from selected passages.

2.2.B. Determine the meaning of a word in context.

2.2.C. Pinpoint cause and effect relationship using a graphic organizer.

2.2.D. Differentiate among verbal, situational, and dramatic irony.

2.2.E. Identify an author's point of view (1st person or 3rd person limited, 3rd person omniscient).

2.2.F. Discern an implied main idea from a passage.

2.2.G. Identify how the author reveals character (what the author tells us, what other characters say about him/her, what the character does, what the character says, what the character thinks).

2.2.H. Select the correct paraphrase of a given passage.

2.3.A. Determine the significance/meaning of a symbol in poetry or prose.

2.3.B. Identify an allusion in poetry or prose.

2.3.C. Differentiate between mood and tone in poetry and prose.

2.3.D. Select a logical word or phrase to complete an analogy.

Content Standard: 3.0. Viewing and Representing

The student will use, read, and view media/technology and analyze content and concepts accurately.

Learning Expectations

- Access and demonstrate multiple technological reference sources.
- Develop media applications for a variety of audiences and purposes.
- Use media to view, to read, to write, to communicate, and to create.
- Analyze the impact of media on daily life.
- Research, organize, interpret, and present information from print and non-print media.
- Utilize multimedia to create, to display, and to explain information.
- Explore the advantages and limitations of the computer as a communication tool.
- Recognize the differences between using print and non-print media as a means of communication.
- Explain creative strategies used in the production of print and non-print media.

State Performance Indicators

The student is able to:

3.1.A. Draw an inference from a non-print medium.

3.2.A. Select the type of conflict represented in a non-print medium.

3.2.B. Determine which statement presents an opposing view from those stated on a web page.

3.2.C. Select the appropriate persuasive device in a given ad (e.g., testimonial, bandwagon, loaded words, misuse of statistics).

3.3.A. Evaluate the validity of web pages as sources of information.

Content Standard: 4.0. Speaking and Listening

The student will express ideas clearly and effectively in a variety of oral contexts and apply active listening skills in the analysis and evaluation of spoken ideas.

Learning Expectations

- Demonstrate skills in analysis, interpretation, and evaluation of literary works through spoken language.
- Demonstrate confidence and poise in various speaking situations.
- Follow and give oral directions.
- Utilize appropriate verbal and non-verbal feedback in a variety of situations.
- Demonstrate effective listening skills through note-taking.
- Demonstrate critical listening skills essential for comprehension and evaluation.

- Present oral summaries and/or analysis of material read or viewed
- Engage in problem solving through group discussions.
- Present and support ideas/opinions in group discussions.
- Develop an understanding of and respect for diversity in language use, patterns, and dialects across cultures, ethnic groups, geographic regions, and social roles.
- Demonstrate appropriate language structure, tone and voice control in oral communication.

State Performance Indicators

The student is able to:

4.1.A. Organize a series of note cards in the most effective order for an oral presentation.

4.2.A. Determine the appropriate preparation (e.g., length and timing, rate of speech, visual aids, diction) for an oral presentation to a specified audience or a special interest group.

4.3.A. Determine the most effective methods of engaging an audience during an oral presentation.

Content Standard: 1.0. Writing

The student will develop the structural and creative skills necessary to produce written language that can be read and interpreted by various audiences.

Learning Expectations

- Write to acquire knowledge, clarify thinking, synthesize information, improve study skills, gain confidence, and promote lifelong communication.
- Write frequently for a variety of purposes including narration, description, persuasion, exposition, and personal, creative expression.
- Identify and write for a variety of audiences.
- Recognize that language has several levels of usage determined by audience, purpose and occasion.
- Approach writing tasks systematically and use elements of the writing process as appropriate.
- Practice a variety of prewriting activities to generate, focus and organize ideas.
- Use a variety of appropriate organizational strategies to develop writing on various topics.
- Develop organized pieces of writing containing focused, well-developed ideas.
- Demonstrate effective writing style by the use of vivid words, a variety of sentence structures, and appropriate transitions.
- Evaluate and revise writing to focus on purpose, organization, development, transitions, unity, and audience awareness.
- Recognize and demonstrate appropriate use of standard English: usage, mechanics and standard spelling, and sentence structure.
- Identify and use a variety of resources to revise and edit writing.
- Research information to prepare presentations or reports which use summarizing, paraphrasing, direct quotations, citation of sources, and bibliographic entries.
- Continue to respond actively and imaginatively to literature.
- Demonstrate an understanding of and respect for multicultural and ethnic diversity in language.

State Performance Indicators

The student is able to:

1.1.A. Correct run-on sentences by using a comma and coordinating conjunction, a subordinate conjunction, or a semi-colon within a writing sample.

1.1.B. Select the sentence from a non-fiction writing sample that relates the writer's purpose (i.e., narration, description, persuasion, exposition, and personal, creative expression).

1.1.C. Evaluate the relevance of supporting sentences by deleting an irrelevant sentence in a passage.

1.1.D. Select the sentence that correctly uses the comparative and/or superlative forms of adjective and adverbs.

1.1.E. Select from the following groups of words the correct word for the sense of the sentence: you're and your; it's and its; their, they're and there.

1.1.F. Select from the following groups of words the correct word for the sense of the sentence: stationary and stationery, complement and compliment, principle and principal, accept and except, capitol and capital, affect and effect, where and were, to and too.

1.1.G. Select a vivid word (adjective or adverb) to strengthen a description or a vivid verb to strengthen a sentence within a writing sample or passage.

1.1.H. Use editing skills to correct singular and plural possessive nouns.

1.1.I. Select the appropriate transitional word to connect sentences within a paragraph.

1.2.A. Determine the most effective placement of information using a prewriting graphic organizer.

1.2.B. Identify the correct use of subordinate conjunctions to join clauses in order to avoid sentence fragments.

1.2.C. Recognize correct subject/verb agreement with confusing intervening elements within a writing sample or passage.

1.2.D. Select an additional sentence to add to an argument within a persuasive writing sample or passage.

1.2.E. Identify correct pronoun/antecedent agreement using collective nouns or indefinite pronouns.

1.2.F. Determine the most effective order of sentences within a paragraph.

1.2.G. Select the correct pronoun case usage in a sentence (e.g., compound elements such as "between you and me" or following "than" or "as").

1.2.H. Recognize a shift in either verb tense or point of view within a writing sample.

1.2.I. Recognize the correct placement of end marks and other marks of punctuation with quotation marks used in dialogue.

1.2.J. Select the thesis statement in a writing sample or passage.

1.2.K. Rearrange the order of supporting paragraphs within a writing sample given a specified organizational pattern (e.g., comparison/contrast, chronological).

1.2.L. Recognize the correct use of commas to set off nonessential elements in a sentence.

1.2.M. Select the transitional device that appropriately connects paragraphs within a writing sample.

1.3.A. Select a rebuttal statement that best refutes the writer's viewpoint.

1.3.B. Identify a statement that reveals the writer's biases, assumptions, or values within a writing sample.

1.3.C. Revise or identify sentences using effective parallelism within a writing sample.

Content Standard: 2.0. Reading

The student will develop the reading skills necessary for word recognition, comprehension, interpretation, analysis, evaluation, and appreciation of the written text.

Learning Expectations

- Develop an understanding of and respect for multicultural, gender, and ethnic diversity in language use, patterns, and dialects.
- Discern reading strategies appropriate to text.
- Extend reading vocabulary.
- Use comprehension strategies to enhance understanding, to make predictions, and to respond to literature.
- Improve comprehension by interpreting, analyzing, synthesizing, and evaluating written text.
- Use oral reading in individual and group presentations.
- Read independently for a variety of purposes.
- Use cognitive strategies to evaluate text critically.
- Develop skills in making inferences and recognizing unstated assumptions.
- Discern the purposes, main ideas, biases, points of view, and persuasive devices found in various texts.
- Interpret ideas, recognize logical relationships, and make judgments based on sufficient evidence.
- Select, evaluate, and adapt resource material in order to apply it effectively.
- Read, interpret, and respond in a variety of ways to various genres.
- Identify and interpret literary elements and figurative language.
- Interact with text to form a personal interpretation.

State Performance Indicators

The student is able to:

2.1.A. Discern an implied main idea from a passage.

2.1.B. Distinguish fact from opinion within a passage or writing sample.

2.1.C. Identify an author's point of view (1st person or 3rd person limited, 3rd person omniscient).

2.1.D. Identify simile, metaphor, onomatopoeia, alliteration, or personification in poetry or prose.

2.1.E. Identify how the author reveals character (what the author tells us, what other characters say about him/her, what the character does, what the character says, what the character thinks).

2.2.A. Draw inference(s) from a selected passage.

2.2.B. Determine the meaning of a word in context.

2.2.C. Differentiate among verbal, situational, and dramatic irony.

2.2.D. Pinpoint a cause-effect relationship using a graphic organizer.

2.2.E. Discover the common theme in a series of passages.

2.2.F. Select a logical word or phrase to complete an analogy.

2.2.G. Select the correct paraphrase of a given passage.

2.3.A. Identify an allusion in poetry or prose.

2.3.B. Differentiate between mood and tone in poetry or prose.

2.3.C. Determine the significance/meaning of a symbol in poetry or prose.

Content Standard: 3.0. Viewing and Representing

The student will use, read, and view media/technology and analyze content and concepts accurately.

Learning Expectations

- Access and demonstrate multiple technological reference sources.
- Develop media applications for a variety of audiences and purposes.
- Use media to view, to read, to write, to communicate, and to create.
- Analyze the impact of media on daily life.
- Research, organize, interpret, and present information from print and non-print media.
- Utilize multimedia to create, to display, and to explain information.
- Explore the advantages and limitations of the computer as a communication tool.
- Examine the differences between using print and non-print media as a means of communication.
- Explain creative strategies used in the production of print and non-print media.

State Performance Indicators

The student is able to:

3.1.A. Select the type of conflict in a non-print medium.

3.1.B. Select the appropriate persuasive device in a given ad (e.g., testimonial, bandwagon, loaded words, misuse of statistics).

3.2.A. Infer either the mood or the tone represented in a non-print medium.

3.3.A. Evaluate the validity of a variety of media sources (e.g., personal journal, interview, authorized biography, supermarket tabloids, magazines).

Content Standard: 4.0. Speaking and Listening

The student will express ideas clearly and effectively in a variety of oral contexts and apply active listening skills in the analysis and evaluation of spoken ideas.

Learning Expectations

- Demonstrate skills in analysis, interpretation, and evaluation of literary works through spoken language.
- Demonstrate confidence and poise in various speaking situations.
- Demonstrate effective listening skills through note-taking.

- Demonstrate critical listening skills essential for comprehension and evaluation.
- Utilize appropriate volume, pitch, rate, diction, inflection, gestures, and body language to facilitate communication incorporating appropriate language structure.
- Analyze audience and determine purpose in preparing oral presentations.
- Define and solve problems rationally and creatively through speaking, listening, and viewing.
- Utilize appropriate verbal and non-verbal feedback in a variety of situations.

State Performance Indicators

The student is able to:

4.1.A. Determine the appropriate preparation (e.g., length and timing, rate of speech, visual aids, diction) for an oral presentation to a specified audience or special interest group.

4.2.A. Determine methods of engaging an audience during an oral presentation.

4.3.A. Evaluate delivery techniques appropriate to a specified audience (emphasis, diction, body language, tone of voice).

Content Standard: 1.0. Writing

The student will develop the structural and creative skills necessary to produce written language that can be read and interpreted by various audiences.

Learning Expectations

1.01 Write to process knowledge, to clarify thinking, to synthesize and evaluate information, to improve study skills, to gain confidence, and to promote lifelong communication.

1.02 Write frequently in various modes of discourse.

1.03 Write for personal and imaginative expression.

1.04 Use a variety of strategies for business purposes.

1.05 Identify and write for a variety of audiences.

1.06 Recognize that language has several levels of diction determined by audience, purpose, and occasion.

1.07 Apply appropriate elements of the writing process: prewriting, drafting, revising, editing, and publishing.

1.08 Use a variety of prewriting activities to generate, focus, and organize ideas.

1.09 Use a variety of appropriate strategies to develop and support a thesis statement.

1.10 Construct coherent writing, maintaining a clear focus, well-developed ideas, syntactic variety, and effective transitions.

1.11 Develop an effective writing style by the use of appropriate voices, diction, syntactic variety, and tone.

1.12 Evaluate and revise writing to focus on purpose, organization, development, and style.

1.13 Edit writing to correct errors.

1.14 Apply effective research skills.

1.15 Avoid plagiarism by correctly using sources.

1.16 Research various sources to present information in a variety of formats.

1.17 Develop personal, imaginative, and analytical responses to literature.

1.18 Develop an ongoing awareness of personal writing growth through comparison of drafts, paragraphs of analysis, and letters of reflection.

State Performance Indicators

The student is able to:

- Create a written explanation to a selected topic/problem (e.g., character analysis, community issue, personal challenge).
- Write persuasively to present valid argument(s) from an established point of view.
- Write for a variety of purposes including persuasion, narration, description, and exposition.
- Create original works (e.g., journals, poetry, stories, scripts, letters, notes, personal narrative essays). Create documents appropriate for a work environment (e.g., memos, resumes, letters, applications, proposals, technical instructions).
- Address various readers (e.g., contest judges, publication editors, college admissions officers, peers).
- Demonstrate through a writing activity (e.g., letter, article, journal entry, position paper) a knowledge of appropriate levels of diction.
- Use elements of the writing process that are appropriate to the assigned task (e.g., timed writings, out-of-class compositions, published writings).
- Use a variety of prewriting activities (e.g., brainstorming, webbing, listing, discussing, clustering) appropriate to the assigned task.
- Support a thesis statement with documentation from the text and/or examples from personal experiences.
- Support key ideas with well-developed examples.
- Use transitional elements (words, phrases, and sentences) effectively.
- Vary sentence beginnings, lengths, and structures.
- Convey in a writing passage a deliberate style through word choice, specified point of view, tone, and sentence patterns.
- Practice various means of evaluation and revision (e.g., self-analysis, peer review, revision checklist, comparison of drafts).
- Proofread to edit writing in order to ensure standard grammar, usage, and mechanics.
- Use summaries, paraphrases, direct quotations, internal documentation, and works cited pages, as appropriate.
- Cite quotations, paraphrases, and summaries correctly in the research product.
- Gather information from the Internet, periodicals, books, CD ROMS, and non-print sources.
- Produce and present formal research projects (e.g., research papers, PowerPoint presentations, oral presentations).
- Respond to literature in a variety of formats (e.g., reading journals, response journals, dialectical journals, investigative papers, learning logs).
- Write reflections to analyze the processes used to create his/ her own work.

Content Standard: 2.0. Reading

The student will develop the reading skills necessary for word of the recognition, comprehension, interpretation, analysis, evaluation, and appreciation written text.

Learning Expectations

2.01 Develop an understanding of and respect for cultural, gender, and ethnic diversity in language use, patterns, and dialects.

2.02 Extend reading vocabulary.

2.03 Utilize a variety of interactive reading strategies appropriate to text.

2.04 Reflect on strategies used by the reader to make meaning from text.

2.05 Increase fluency in oral reading.

2.06 Read independently for a variety of purposes.

2.07 Analyze the use of figurative language in various texts.

2.08 Analyze the impact of literary elements in various texts.

2.09 Analyze persuasive devices found in various texts.

2.10 Read to interpret ideas, recognize relationships, and make judgments.

2.11 Recognize the influence of an author's background and experience on literary work.

2.12 Consult resource materials to increase understanding of the text.

2.13 Respond to reading selections by making connections.

State Performance Indicators

The student is able to:

- Respond to diversity in literary selections (e.g., dramatizations, writings, discussions, artistic representations).
- Analyze two or more literary selections for language use, patterns, and dialects (e.g., comparison, contrast, graphic organizers).
- Identify vocabulary necessary to the understanding of text.
- Apply strategies for decoding unfamiliar words.
- Synthesize reading vocabulary into written and oral communication.
- Apply reading strategies (e.g., SQ3R, DRTA, vocabulary self-collection).
- Assess the effectiveness of strategies used during the reading process (e.g., journaling, discussing, coding).
- Participate in a variety of oral reading experiences (e.g., choral reading, jump-in reading, paired reading).
- Read independently to gather information and to expand specific knowledge.
- Read independently for personal enjoyment.
- Critique the effectiveness of figurative language (e.g., metaphor, simile, allusion, hyperbole).
- Critique the significance of literary elements (e.g., plot, characterization, setting, theme, point of view, tone, irony).
- Critique the effectiveness of rhetorical devices in persuasion (e.g., logos, pathos, ethos).
- Use evidence from text to support interpretations, to understand relationships, and to validate judgments.
- Investigate an author's background to determine influences (e.g., time period, gender, biases, environment, ethnicity) demonstrated within the text.
- Locate and utilize credible resource materials to increase understanding of text.
- Apply text information to make connections (e.g., cultural, personal, cross-curricular, historical, literary).

Content Standard: 3.0. Viewing and Representing

The student will use, read, and view media/technology and analyze content and concepts accurately.

Learning Expectations

3.01 Access and demonstrate multiple technological reference sources.

3.02 Use media for a variety of audiences and purposes: to view, to experience, to read , to write, to communicate.

3.03 Evaluate the impact of media on daily life.

3.04 Evaluate varied media resources and information for accuracy and reliability.

3.05 Develop research and analytical skills by using print and non-print media.

3.06 Utilize media to create, display, and explain information.

3.07 Evaluate the differences between using print and non-print media as means of communication.

3.08 Explore production elements used in print and non-print media.

State Performance Indicators

The student is able to:

- Use electronic media (e.g., websites, databases, discussion boards, e-mails) and other audio-visual media to conduct research and to create and present research-based products.
- Create and present products incorporating multimedia components for specific audiences and purposes.
- Examine and respond to the effect(s) of media on the ideas, mores, and values of individuals, communities, and the world.
- Gauge the accuracy and reliability of any given set of resources.
- Use a variety of print and non-print media to research a topic and evaluate the information in order to create a presentation.
- Use a variety of media sources (e.g., PowerPoint, DVDs, CD-ROMs, audio and video cassettes) to create and present information.
- Compare and contrast the effectiveness of print and non-print media.
- Examine production elements (e.g., tables, diagrams, charts, graphs, drawings, maps, photographs, font, color, layout, graphics, camera angle, lighting) in both print and non-print media for the purpose of interpreting, clarifying, and communicating information.

Content Standard: 4.0. Speaking and Listening

The student will express ideas clearly and effectively in a variety of oral contexts and apply active listening skills in the analysis and evaluation of spoken ideas.

Learning Expectations

4.01 Use and/or demonstrate an understanding of effective communications skills in a variety of speaking situations.

4.02 Conduct pertinent research for oral presentation(s).

4.03 Consider and evaluate the perceptions of speakers and listeners.

4.04 Adjust the level of language usage to the audience and purpose.

4.05 Evaluate a variety of oral presentations.

4.06 Improve critical listening skills essential for comprehension.

4.07 Recognize the effects and implications of various dialects.

State Performance Indicators

The student is able to:

- Make presentation(s) using or showing an understanding of volume, pitch, rate, diction, inflections, gestures, and body language to facilitate communication in a variety of situations.
- Participate in group discussion by modeling effective interpersonal skills (e.g., restatement, clarification, active listening, pauses).
- Support, modify, or refute positions or opinions by citing accurate and reliable sources.
- Assess the viewpoints, judgments, and expectations of a speaker.
- Assess the viewpoints, judgments, and expectations for listeners.
- Evaluate speakers through the use of rubrics.
- Disseminate information on a specific topic, adjusting to the appropriate level of language usage (e.g., grammar, content, style, vocabulary) for a variety of audiences and purposes.
- Judge a variety of oral presentations (e.g., speeches, debates, and performances) by evaluating preparation, content, and delivery.
- Demonstrate comprehension through a variety of responses (e.g., notetaking, questioning, summarizing, restating, discussing).
- Identify dialects and their contributions to meaning.

Content Standard: 1.0. Writing

The student will develop the structural and creative skills necessary to produce written language that can be read and interpreted by various audiences.

Learning Expectations

1.01 Write to process knowledge, clarify thinking, synthesize and evaluate information, improve study skills, gain confidence, and promote lifelong communication.

1.02 Write frequently for a variety of purposes.

1.03 Write for personal and imaginative expression.

1.04 Use a variety of strategies for personal and business applications such as memos, resumes, letters, applications, proposals, and technical instructions.

1.05 Identify and write for a variety of audiences.

1.06 Recognize that language has several levels of diction determined by audience, purpose, and occasion.

1.07 Approach writing tasks systematically by using steps in the writing process: prewriting, drafting, revising, editing, and publishing.

1.08 Practice a variety of prewriting activities to generate, focus, and organize ideas.

1.09 Develop and support a thesis statement.

1.10 Construct coherent writing, maintaining a clear focus, well-developed ideas, syntactic variety, and effective transitions.

1.11 Demonstrate effective writing style by the use of appropriate voice, word choice, and tone.

1.12 Evaluate and revise writing to focus on purpose, organization, development, and style.

1.13 Edit writing to correct errors.

1.14 Apply effective research skills.

1.15 Avoid plagiarism by using sources correctly.

1.16 Research various sources to present information in a variety of formats.

1.17 Develop personal, imaginative, and analytical responses to literature.

1.18 Develop an ongoing awareness of personal writing growth through comparison of drafts, paragraphs of analysis, and letters of reflection.

State Performance Indicators

The student is able to:

- Create a written explanation for a selected topic/problem (e.g., character analysis, community issue, personal challenge).
- Write for a variety of purposes including persuasion, narration, description, and exposition.
- Create original works (e.g., journals, poetry, stories, scripts, letters, notes, personal narrative essays).
- Create documents appropriate for a work environment (e.g., memos, resumes, letters, applications, proposals, technical instructions).
- Address various readers (e.g., contest judges, publication editors, college admissions officers, peers).
- Rewrite prose passages using different levels of language (e.g., colloquialism, dialect, and jargon).
- Use elements of the writing process that are appropriate to the assigned task (e.g., timed writings, out-of-class compositions, published writings).
- Use a variety of prewriting activities (e.g., brainstorming, webbing, listing, discussing, clustering) appropriate to the assigned task.
- Develop cogent and convincing arguments to support valid thesis statements.
- Support a thesis statement with documentation from the text and/or examples from personal experiences.
- Support key ideas with well-developed examples.
- Use transitional elements (e.g., words, phrases, and sentences) effectively.
- Vary sentence beginnings, lengths, and structures.
- Convey in a writing passage a deliberate style through word choice, specified point of view, tone, and sentence patterns.
- Practice various means of evaluation and revision (e.g., self-analysis, peer review, revision checklist, comparison of drafts).
- Proofread to edit writing in order to ensure standard grammar, usage, and mechanics.
- Use summaries, paraphrases, direct quotations, internal documentation, and works cited pages, as appropriate.
- Gather information from the Internet, periodicals, books, CD-ROMs, and non-print sources.
- Cite quotations, paraphrases, and summaries correctly in the research product.
- Produce and present formal research projects (e.g., research papers, PowerPoint presentations, oral presentations).
- Respond to literature in a variety of formats (e.g., reading journals, response journals, dialectical journals, investigative papers, learning logs).
- Write reflections to analyze the processes used to create his/her own writing.

Content Standard: 2.0. Reading

The student will develop the reading skills necessary for word recognition, comprehension, interpretation, analysis, evaluation, and appreciation of written text.

Learning Expectations

2.01 Develop an understanding of and respect for multicultural, gender, and ethnic diversity in language use, patterns, and dialects, as well as for the development of the English language.

2.02 Extend reading vocabulary.

2.03 Utilize a variety of interactive reading strategies appropriate to text.

2.04 Improve comprehension by interpreting, analyzing, synthesizing, and evaluating written text.

2.05 Reflect on strategies used by the reader to make meaning from text.

2.06 Increase fluency in oral reading.

2.07 Read independently for a variety of purposes.

2.08 Determine the effectiveness of figurative language in various texts.

2.09 Determine the impact of literary elements on texts.

2.10 Analyze persuasive devices found in various texts.

2.11 Interpret ideas, recognize logical relationships, and make judgments based on sufficient evidence.

2.12 Recognize the influence of an author's background, biases, gender, environment, and experience on a literary work.

2.13 Consult resource materials to increase understanding of text.

2.14 Read, respond to, and interpret print and nonprint text.

2.15 Respond to reading selections by making connections.

State Performance Indicators

The student is able to:

- Respond to literary selections which reflect cultural, gender, and ethnic diversity in language use, patterns, and dialects, as well as the development of the English language.
- Compare and contrast literary selections for English language usage, patterns, and dialects over several time periods.
- Identify new vocabulary necessary to the understanding of text.
- Apply strategies for decoding unknown words.
- Analyze and synthesize reading vocabulary into written and oral responses.
- Evaluate vocabulary to determine its effectiveness within the framework of the text.
- Evaluate and determine appropriate interactive reading strategies.
- Apply reading strategies appropriate to literary selections.
- Demonstrate comprehension at higher levels through written and oral responses.
- Assess the effectiveness of strategies used during the reading process through journaling, discussing, coding, and other techniques.
- Participate in a variety of oral reading experiences to increase fluency.
- Read independently to respond to teacher/student-generated questions, to gather information, to present information, and to expand knowledge.
- Read independently for personal enjoyment.
- Analyze the effectiveness of figurative language (e.g., metaphors, similes, allusions, hyperbole) used by authors to create mental images.
- Analyze the effectiveness of literary devices (e.g., plot, characterization, setting, theme, point of view, tone, symbolism, irony) used in the text.
- Critique the effectiveness of persuasive devices (e.g., bandwagon, propaganda, emotional appeal, testimonial) used in various texts.
- Project character response based on prior knowledge gained from text.
- Use evidence from text to support summaries, inferences, conjectures, and predictions.
- Investigate an author's background to determine influences (e.g., historical, gender, biases) demonstrated within the text.
- Compare and contrast passages reflecting the effect of different authors' influences.
- Defend credible resource materials to increase understanding of text.
- Interpret and analyze graphics and other resource materials associated with text to clarify and enhance understanding.
- Apply text information to make connections (e.g., personal, historical, literary, and sensory).

Content Standard: 3.0. Viewing and Representing

The student will use, read, and view media/technology and analyze content and concepts accurately.

Learning Expectations

3.01 Access and demonstrate multiple technological reference sources.

3.02 Use media for a variety of audiences and purposes: to view, to experience, to read, to write, to communicate.

3.03 Use and evaluate media in order to disseminate information.

3.04 Evaluate varied media resources and information for accuracy, validity, and reliability.

3.05 Research, interpret, critique, and present information from print and nonprint media.

3.06 Utilize media to create, to display, and to explain information.

3.07 Evaluate production elements used in print and nonprint media.

3.08 Use graphics for the purpose of interpreting, clarifying and communicating information.

State Performance Indicators

The student is able to:

- Use electronic media (e.g., websites, databases, discussion boards, emails) and other audio-visual media to conduct research and to create and present research-based products.
- Create and present products incorporating multimedia components for specific audiences and purposes.

- Discern the advantages and limitations of a variety of media in order to create, to display, and to present information.
- Compare and/or contrast the accuracy, validity and reliability of a variety of media resources through their treatment of the same event.
- Use a variety of print and nonprint media to research a topic and evaluate the information in order to create a presentation.
- Use a variety of media sources (e.g., PowerPoint, DVDs, CD-ROMs, audio and video cassettes) to create and present information.
- Evaluate production elements in both print and nonprint media (e.g., font, color, layout, graphics, lighting, sound, camera angle) and analyze the effects.
- Prepare and/or utilize graphics (e.g., tables, diagrams, charts, graphs, drawings, maps, and photographs) for the purpose of interpreting, clarifying and communicating information.

Content Standard: 4.0. Speaking and Listening

The student will express ideas clearly and effectively in a variety of oral contexts and apply active listening in the analysis and evaluation of spoken ideas.

Learning Expectations

4.01 Use and/or demonstrate an understanding of appropriate volume, pitch, rate, diction, inflection, gestures, and body language to facilitate confident communication in a variety of speaking situations.

4.02 Demonstrate effective interpersonal skills in group discussions.

4.03 Use pertinent research for oral presentations.

4.04 Analyze, interpret, and evaluate print and nonprint texts through spoken language.

4.05 Evaluate viewpoints, judgments, and expectations from the perspectives of both speakers and listeners.

4.07 Evaluate a variety of oral presentations.

4.08 Demonstrate critical listening skills essential for comprehension and evaluation.

4.09 Define and solve problems rationally and creatively through speaking, listening, and viewing.

4.10 Recognize the effects and implications of various dialects.

4.11 Present a position and/or opinion clearly and persuasively by citing sources of information/research.

State Performance Indicators

The student is able to:

- Make a presentation using or showing an understanding of volume, pitch, rate, diction, inflection, gestures, and body language to facilitate confident communication in a variety of situations.
- Participate in group discussions by modeling effective interpersonal skills (leader, recorder, facilitator).
- Synthesize and incorporate print and nonprint texts in a variety of oral presentations.
- Synthesize and incorporate print and nonprint texts in a variety of oral presentations.
- Use rubrics to assess the viewpoints, judgments, and opinions of speakers and listeners.
- Disseminate information on a specific topic, adjusting to the appropriate level of language usage (grammar, content, style, vocabulary) for a variety of audiences and purposes.
- Use rubrics to evaluate a variety of oral presentations, including speeches, debates, and performances.
- Use rubrics to evaluate a variety of oral presentations.
- Critique a variety of oral presentations (e.g., take notes, complete a rubric, write a summary).
- Identify how the effects of dialect contribute to meaning.
- Support, modify, or refute positions or opinions by citing accurate and reliable sources.

TENNESSEE Grade 7 Mathematics

Standards, Expectations, Accomplishments, and State Indicators

Content Standard: 1.0. Number and Operation

The student will develop number and operation sense needed to represent numbers and number relationships verbally, symbolically, and graphically and to compute fluently and make reasonable estimates in problem solving.

Learning Expectations

1.1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

1.2. Understand operations and how they relate to one another.

1.3. Solve problems, compute fluently, and make reasonable estimates.

Accomplishments

7.1.1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

a. recognize the place value of a given digit;

b. develop meaning for perfect squares (e.g., 1, 4, 9, 16);

c. develop meaning for square roots;

d. use exponential notation;

e. use a variety of models to demonstrate the relationships within the real number system (e.g., Venn diagrams, webs);

f. represent equivalent numbers using a variety of forms (i.e., whole numbers, fraction, decimals, percents);

g. compare fractions, decimals, percents, and integers using the appropriate symbol (i.e., <, >, =);

h. connect whole numbers, fractions, decimals, percents, and integers to locations on the number line;

i. develop meaning for percents greater than 100 and less than one;

j. understand and use ratios and proportions to represent quantitative relationships;

k. develop meaning for opposites, reciprocals, and integers;

l. use concrete, pictorial, and symbolic representations for integers;

m. apply number theory concepts to solve problems (e.g., divisibility, factors, multiples, composite numbers, prime factorization, relatively prime).

7.1.2. Understand operations and how they relate to one another.

a. understand the meaning and effects of arithmetic operations with fractions and decimals;

b. use models to demonstrate meaning and effects of arithmetic operations with integers;

c. apply the associative and commutative properties of addition and multiplication to simplify computations with integers, fractions, and decimals;

d. apply order of operations when computing with whole numbers, decimals, and fractions;

e. understand and use the inverse relationships of addition and subtraction and multiplication and division to simplify computations and solve problems.

7.1.3. Solve problems, compute fluently, and make reasonable estimates.

a. select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil);

b. analyze procedures for computing with fractions, decimals, and integers;

c. use strategies to estimate the results of rational number computations in real-world situations;

d. judge the reasonableness of the results of rational number estimates and computations;

e. solve two-step real-world problems involving whole numbers, fraction, decimals, and percents;

f. develop methods for solving problems involving proportions (e.g., scaling, finding equivalent ratios).

State Performance Indicators

The student is able to:

7.1.spi.1. identify prime and composite numbers up to 50;

7.1.spi.2. compute efficiently and accurately with whole numbers, fractions, and decimals;

7.1.spi.3. represent numbers using a variety of equivalent forms (i.e., mixed numbers, fractions, decimals, percents, and integers);

7.1.spi.4. compare rational numbers using the appropriate symbol (<, >, =);

7.1.spi.5. identify the opposite and the reciprocal of a rational number;

7.1.spi.6. connect percents greater than 100 and percents less than one to real-world situations;

7.1.spi.7. apply order of operations when computing with whole numbers (no more than two parentheses and no exponents);

7.1.spi.8. solve one- and two-step real-world problems involving whole numbers, fractions, and decimals;

7.1.spi.9. use estimation strategies to select a reasonable solution to a computation involving rational numbers;

7.1.spi.10. select a reasonable solution to a real-world division problem in which the remainder must be considered;

7.1.spi.11. connect rational numbers to locations on the number line;

7.1.spi.12 use ratios to represent quantitative relationships.

Content Standard: 2.0. Algebra

The student will understand and generalize patterns as they represent and analyze quantitative relationships and change in a variety of contexts and problems using graphs, tables, and equations.

Learning Expectations

2.1. Understand patterns, relations, and functions.

2.2. Represent and analyze mathematical situations and structures using algebraic symbols.

2.3. Use mathematical models to represent and understand quantitative relationships.

2.4. Analyze change in various contexts.

Accomplishments

7.2.1. Understand patterns, relations, and functions.

a. represent, analyze, and extend geometric and numerical patterns;

b. develop understanding for arithmetic sequences;

c. use tables, graphs, and symbolic rules to generalize patterns in data;

d. apply and create function rules.

7.2.2. Represent and analyze mathematical situations and structures using algebraic symbols.

a. demonstrate understanding of different uses of variables;

b. represent mathematical statements and real-world situations using symbols;

c. translate one-variable verbal and written expressions into algebraic expressions;

d. evaluate algebraic expressions given the value of two or more variables;

e. connect formal and informal methods to solve one-step linear equations;

f. identify whole numbers that satisfy a given one-variable inequality;

g. model algebraic equations with manipulatives, technology, and pencil and paper;

h. solve real-world problems involving one-step linear equations;

i. explore relationships between symbolic expressions and graphs of lines.

7.2.3. Use mathematical models to represent and understand quantitative relationships.

a. create a scatterplot to represent data presented in tabular form;

b. describe the relationship between two quantities represented in a scatterplot.

7.2.4. Analyze change in various contexts.

a. describe how changes in one quantity or variable result in changes in another;

b. use unit rates to solve problems (e.g., miles per hour, words per minutes).

State Performance Indicators

The student is able to:

7.2.spi.1. extend geometric and numerical patterns;

7.2.spi.2. apply function rules;

7.2.spi.3. extend rate charts to solve real-world problems;

7.2.spi.4. generalize patterns in data represented in tables and graphs;

7.2.spi.5. represent mathematical statements and real-world situations using symbols;

7.2.spi.6. evaluate algebraic expressions for a given value of up to two variables;

7.2.spi.7. solve one-step linear equations;

7.2.spi.8. solve real-world problems involving one-step linear equations;

7.2.spi.9. identify whole numbers that satisfy a given one-variable one-variable linear inequality;

7.2.spi.10. select the scatterplot that represents the data in tabular form;

7.2.spi.11. interpret graphs which represent rates of change.

Content Standard: 3.0. Geometry

The student will develop an understanding of geometric concepts and relationships as the basis for geometric modeling and reasoning to solve problems involving one-, two-, and three-dimensional figures.

Learning Expectations

3.1. Analyze characteristics and properties of two- and three-dimensional geometric figures.

3.2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

3.3. Apply transformations and use symmetry to analyze mathematical situations.

3.4. Use visualization, spatial reasoning, and geometric modeling to solve problems.

Accomplishments

7.3.1. Analyze characteristics and properties of two- and three-dimensional geometric figures.

a. determine congruence of line segments, angles, and polygons by direct comparison of given attributes;

b. compare and classify triangles by angle size and length of sides;

c. compare and classify polygons by properties;

d. use appropriate mathematical language to describe similarity and congruence.

7.3.2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

a. plot a given set of points on the coordinate plane.

7.3.3. Apply transformations and use symmetry to analyze mathematical situations.

a. relate symmetry and congruence to reflections about a line.

7.3.4. Use visualization, spatial reasoning, and geometric modeling to solve problems.

a. use appropriate tools and methods to draw geometric objects with specified properties, (e.g., side lengths, angle measure);

b. build a three-dimensional object from a two-dimensional representation (net) of that object and vice versa;

c. use visualization and spatial reasoning to solve real-world problems.

State Performance Indicators

The student is able to:

7.3.spi.1. identify the results of transformations of two-dimensional figures (i.e., turns/rotations, flips/reflections, slides/translations).

7.3.spi.2. classify triangles by angle, size, and length of sides;

7.3.spi.3. determine congruence of line segments, angles, and polygons;

7.3.spi.4. classify polygons by properties;

7.3.spi.5. use ordered pairs to describe given points in a coordinate system;

7.3.spi.6. determine the measure of an angle of a triangle given the measures of the other two angles;

7.3.spi.7. apply spatial reasoning and visualization to solve real-world problems.

Content Standard: 4.0. Measurement

The student will become familiar with the units and processes of measurement in order to use a variety of tools, techniques, and formulas to determine and to estimate measurements in mathematical and real-world problems.

Learning Expectations

4.1. Understand measurable attributes of objects and the units, systems, and processes of measurement.

4.2. Apply appropriate techniques, tools, and formulas to determine measurements.

Accomplishments

7.4.1. Understand measurable attributes of objects and the units, systems, and processes of measurement.

a. understand both metric and customary systems of measurement;

b. convert from one unit to another within the same system;

c. understand, select, and use units of appropriate size and type to measure angles, perimeter, areas, surface area, and volume.

7.4.2. Apply appropriate techniques, tools, and formulas to determine measurements.

a. use a variety of strategies to estimate length, perimeter, circumference, area, and volume;

b. select and apply techniques and tools to accurately measure length, perimeter, area, volume, and angles to appropriate levels of precision;

c. develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles;

d. develop strategies to find area of complex shapes;

e. develop strategies to determine the surface area and volume of selected prisms and cylinders;

f. construct tables and graphs to represent rates of change.

State Performance Indicators

The student is able to:

7.4.spi.1. apply formulas to determine the areas of rectangles and triangles;

7.4.spi.2. determine the distance between two points on the x- or the y-axis in Quadrant I;

7.4.spi.3. convert from one unit to another within the same system;

7.4.spi.4. select units of appropriate size and type to measure angles, perimeter, area, surface area, and volume;

7.4.spi.5. apply formulas to determine the area of parallelograms, trapezoids, and circles;

7.4.spi.6. estimate length, perimeter, circumference, area, and volume using a variety of strategies;

7.4.spi.7. find or estimate the area of irregular and complex shapes;

7.4.spi.8. solve problems involving scale factors using ratios and proportions.

Content Standard: 5.0. Data Analysis & Probability

The student will understand and apply basic statistical and probability concepts in order to organize and analyze data and to make predictions and conjectures.

Learning Expectations

5.1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer questions.

5.2. Select and use appropriate statistical methods to analyze data.

5.3. Develop and evaluate inferences and predictions that are based on data.

5.4. Understand and apply basic concepts of probability.

Accomplishments

7.5.1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer questions.

a. formulate questions, design studies, and collect real-world data;

b. construct, interpret, and use multiple-bar graphs, multiple-line graphs, and circle graphs displaying real-world data.

7.5.2. Select and use appropriate statistical methods to analyze data.

a. find, use, and interpret measures of center and spread (e.g., mean, interquartile range);

b. recognize misleading representations of data;

c. discuss and understand the relationship between data sets and their graphical representations (e.g., bar graphs, line graphs, circle graphs, histograms, stem-and-leaf plots, box plots, and scatterplots).

7.5.3. Develop and evaluate inferences and predictions that are based on data.

a. make conjectures and predictions based on data;

b. make conjectures to formulate new questions for future studies.

7.5.4. Understand and apply basic concepts of probability.

a. connect the symbolic representation of a probability to an experiment;

b. construct a tree diagram to determine all possible outcomes of a simple event.

State Performance Indicators

The student is able to:

7.5.spi.1. interpret bar and line graphs to answer questions and solve real-world problems.

7.5.spi.2. interpret circle graphs displaying real-world data;

7.5.spi.3. determine the mean for a data set;

7.5.spi.4. determine the median for a data set;

7.5.spi.5. make predictions based on data;

7.5.spi.6. use a tree diagram or organized list to determine all possible outcomes of a simple compound event;

7.5.spi.7. connect data sets and their graphical representation (i.e., bar graphs, stem-and-leaf plots, box plots, and scatterplots);

7.5.spi.8. use proportional thinking to make conjectures about results of experiments and simulations;

7.5.spi.9. connect the symbolic representation of a probability to an experiment.

Content Standard: 1.0. Number and Operation

The student will develop number and operation sense needed to represent numbers and number relationships verbally, symbolically, and graphically and to compute fluently and make reasonable estimates in problem solving.

Learning Expectations

1.1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

1.2. Understand operations and how they relate to one another.

1.3. Solve problems, compute fluently, and make reasonable estimates.

Accomplishments

8.1.1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

a. recognize the place value of a given digit;

b. use exponents to express a monomial written in expanded form;

c. determine the square root of perfect squares;

d. use a variety of models to demonstrate the relationships within the real number system (e.g., Venn diagrams, webs);

e. work flexibly with fractions, decimals, and percents to solve problems;

f. compare and order fractions, decimals, and percents;

g. connect whole numbers, fractions, decimals, percents and integers to locations on the number line;

h. develop meaning for percents greater than 100 and less than one;

i. use appropriate mathematical language and symbols to express numerical relationships (e.g., <, >, =, ≥);

j. understand and use ratios and proportions to represent quantitative relationships;

k. recognize and use exponential, scientific, and calculator notation to represent large numbers in real-world situations;

l. demonstrate understanding of opposites, reciprocals, and integers;

m. identify the opposite of a rational number;

n. use concrete, pictorial, and symbolic representations of integers;

o. apply number theory concepts to solve problems (e.g., divisibility, factors, multiples, composite numbers, prime factorization, relatively prime).

8.1.2. Understand operations and how they relate to one another.

a. understand the meaning and effects of arithmetic operations with fractions, decimals, and integers;

b. apply the associative and commutative properties of addition and multiplication to simplify computations with integers, fractions, and decimals;

c. use the distributive property to simplify computations with integers, fractions, and decimals;

d. apply order of operations in computing with rational numbers;

e. understand and use the inverse relationships of addition and subtraction, multiplication and division, and squaring and finding square roots to simplify computations and solve problems.

8.1.3. Solve problems, compute fluently, and make reasonable estimates.

a. select and use appropriate methods and tools for computing with whole numbers, fractions, decimals, percents, and integers in problem-solving situations (e.g., mental computation, estimation, calculators, computers, paper and pencil);

b. develop and analyze procedures for computing with fractions, decimals, and integers;

c. develop and use strategies to estimate the results of rational number computations in real-world situations;

d. judge the reasonableness of the results of rational number estimates and computations;

e. solve one-step real-world problems involving whole numbers, fractions, decimals, and percents;

f. raise rational numbers to whole number powers;

g. solve multi-step real-world problems involving whole numbers, fractions, decimals, and percents;

h. develop, analyze, and explain methods for solving problems involving proportions (e.g., scaling, finding equivalent ratios);

i. calculate rates involving cost per unit to determine the best buy.

State Performance Indicators

The student is able to:

8.1.spi.1. identify the opposite and the reciprocal of a rational number;

8.1.spi.2. compare rational numbers using the appropriate symbol (<, >, =);

8.1.spi.3. use ratios and proportions to represent real-world situations (i.e., scale drawings, probability);

8.1.spi.4. determine the approximate locations of rational numbers on a number line;

8.1.spi.5. determine the square roots of perfect squares (< 169);

8.1.spi.6. work flexibly with fractions, decimals, and percents to solve one- and two-step word problems;

8.1.spi.7. compute efficiently and accurately with whole numbers, fractions, decimals, and percents;

8.1.spi.8. use estimation strategies to select a reasonable solution to a real-world problem involving computing with rational numbers;

8.1.spi.9. calculate rates involving cost per unit to determine the best buy.

8.1.spi.10. use exponential, scientific, and calculator notation to represent large numbers in real-world situations;

8.1.spi.11. apply order of operations in computing with rational numbers using no more than two parentheses and exponents 1 and 2.

Content Standard: 2.0. Algebra

The student will understand and generalize patterns as they represent and analyze quantitative relationships and change in a variety of contexts and problems using graphs, tables, and equations.

Learning Expectations

2.1. Understand patterns, relations, and functions.

2.2. Represent and analyze mathematical situations and structures using algebraic symbols.

2.3. Use mathematical models to represent and understand quantitative relationships.

2.4. Analyze change in various contexts.

Accomplishments

8.2.1. Understand patterns, relations, and functions.

a. represent, analyze, and generalize a variety of patterns with tables, graphs, words, and when possible symbolic rules;

b. develop understanding for arithmetic and geometric sequences;

c. relate and compare different forms of representation for a relationship;

d. identify functions as linear or nonlinear;

e. compare and contrast properties of functions from tables, graphs, or equations.

8.2.2. Represent and analyze mathematical situations and structures using algebraic symbols.

a. formulate multi-step equations that represent relationships and real-world situations;

b. develop meaning for intercept and slope;

c. use symbolic algebra to represent situations and solve problems;

d. use a variety of forms to represent linear relationships;

e. recognize and generate equivalent forms for simple algebraic expressions;

f. evaluate a first-degree algebraic expression given values for two or more variables;

g. solve one- and two-step linear equations involving integers;

h. use a variety of methods to solve real-world problems involving multi-step linear equations (e.g., manipulatives, technology, pencil and paper);

i. apply given formulas to solve real-world problems;

j. solve one-step linear inequalities;

k. identify the graph of a linear equation;

l. identify the graphical representation of the solution to a one-variable linear inequality;

m. develop understanding for particular values of patterns, relationships, and functions (e.g., x- and y-intercepts, slope, maximum and minimum values).

8.2.3. Use mathematical models to represent and understand quantitative relationships.

a. use a variety of representations to solve real-world problems (e.g., graphs, tables, equations).

8.2.4. Analyze change in various contexts.

a. compare linear relationships to non-linear relationships;

b. develop meaning for rate of change in real-world situations.

State Performance Indicators

The student is able to:

8.2.spi.1. generalize a variety of patterns with symbolic rules;

8.2.spi.2. evaluate a first-degree algebraic expression given values for two or more variables;

8.2.spi.3. represent situations and solve real-world problems using symbolic algebra;

8.2.spi.4. connect symbolic expressions and graphs of lines;

8.2.spi.5. generate equivalent forms for simple algebraic expressions;

8.2.spi.6. solve one- and two-step linear equations involving integers;

8.2.spi.7. apply given formulas to solve real-world problems;

8.2.spi.8. interpret graphs which represent rates of change;

8.2.spi.9. formulate multi-step equations that represent relationships and real-world situations;

8.2.spi.10. solve one-step linear inequalities;

8.2.spi.11. connect the appropriate graph to a linear equation.

Content Standard: 3.0. Geometry

The student will develop an understanding of geometric concepts and relationships as the basis for geometric modeling and reasoning to solve problems involving one-, two-, and three-dimensional figures.

Learning Expectations

3.1. Analyze characteristics and properties of two- and three-dimensional geometric figures.

3.2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

3.3. Apply transformations and use symmetry to analyze mathematical situations.

3.4. Use visualization, spatial reasoning, and geometric modeling to solve problems.

Accomplishments

8.3.1. Analyze characteristics and properties of two- and three-dimensional geometric figures.

a. describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;

b. understand relationships among the angles (e.g., complementary, supplementary, interior, exterior, vertical, corresponding);

c. solve problems using angle relationships (e.g., complementary, supplementary, interior, exterior, vertical, corresponding);

d. determine the measure of an angle of a triangle given the measures of the other two angles;

e. understand relationships among the angles and side lengths of similar geometric figures;

f. determine congruence of line segments, angles, and polygons by direct comparison of given attributes;

g. develop understanding of the Pythagorean theorem.

8.3.2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

a. graph points in the coordinate system.

8.3.3. Apply transformations and use symmetry to analyze mathematical situations.

a. describe sizes, positions, and orientations of shapes under transformations (e.g., rotations, translations, reflections, dilations);

b. relate symmetry and congruence to reflections about a line.

8.3.4. Use visualization, spatial reasoning, and geometric modeling to solve problems.

a. use appropriate tools and methods to draw geometric objects with specified properties, (e.g., side lengths, angle measure);

b. use two-dimensional representations of three-dimensional objects to visualize;

c. use visualization and spatial reasoning to solve real-world problems;

d. recognize and apply geometric ideas and relationships such as tessellations in areas outside the mathematics classroom (e.g., art, science, everyday life).

State Performance Indicators

The student is able to:

8.3.spi.1. classify types of two- and three-dimensional geometric figures using their defining properties;

8.3.spi.2. use ordered pairs to describe given points in a coordinate system;

8.3.spi.3. identify relationships among angles (i.e., complementary, supplementary, interior, exterior, vertical, corresponding);

8.3.spi.4. recognize similar geometric figures;

8.3.spi.5. determine the measure of an angle of a triangle given the measures of the other two angles;

8.3.spi.6. apply relationships among angles and side lengths of similar geometric figures;

8.3.spi.7. apply spatial reasoning and visualization to solve real-world problems;

8.3.spi.8. apply geometric ideas and relationships in areas outside the mathematics classroom (i.e., art, science, everyday life);

8.3.spi.9. solve problems using angle relationships (i.e., complementary, supplementary, interior, exterior, vertical, corresponding).

Content Standard: 4.0. Measurement

The student will become familiar with the units and processes of measurement in order to use a variety of tools, techniques, and formulas to determine and to estimate measurements in mathematical and real-world problems.

Learning Expectations

4.1. Understand measurable attributes of objects and the units, systems, and processes of measurement.

4.2. Apply appropriate techniques, tools, and formulas to determine measurements.

Accomplishments

8.4.1. Understand measurable attributes of objects and the units, systems, and processes of measurement.

a. understand both metric and customary systems of measurement;

b. understand relationships among units and convert from one unit to another within the same system;

c. understand, select, and use units of appropriate size and type to measure angles, perimeter, areas, surface area, and volume.

8.4.2. Apply appropriate techniques, tools, and formulas to determine measurements.

a. use a variety of strategies to estimate length, perimeter, circumference, area, and volume;

b. select and apply techniques and tools to accurately measure length, perimeter, area, volume, and angles to appropriate levels of precision;

c. apply formulas and/or other strategies to solve problems involving perimeter, circumference of circles, and the area of triangles, parallelograms, trapezoids, and circles;

d. find area of complex and irregular shapes;

e. apply given formulas to find volume of selected prisms and cylinders;

f. compare and contrast the volumes of a variety of geometric solids;

g. solve problems involving rate/time/distance (i.e., d = rt);

h. solve problems involving scale factors using ratio and proportion;

i. solve real-world problems using the Pythagorean Theorem;

j. construct tables and graphs to represent rates of change;

k. find measures using proportional relationships and properties of similar figures;

l. determine the measure of angles by applying angle relationships (e.g., complementary, supplementary, interior, exterior, vertical, corresponding).

State Performance Indicators

The student is able to:

8.4.spi.1. select units of appropriate size and type to measure angles, perimeter, area, surface area, and volume;

8.4.spi.2. convert from one unit to another within the same system;

8.4.spi.3. estimate length, perimeter, circumference, area, and volume using a variety of strategies;

8.4.spi.4. apply formulas to find the area of triangles, parallelograms, and trapezoids;

8.4.spi.5. solve real-world problems involving rate/time/distance (i.e., d = rt);

8.4.spi.6. apply formulas to find the circumference and area of circles;

8.4.spi.7. estimate or find the area of irregular and complex shapes;

8.4.spi.8. solve problems involving scale factors using ratios and proportions;

8.4.spi.9. solve real-world problems using the Pythagorean Theorem (no radicals).

Content Standard: 5.0. Data Analysis & Probability

The student will understand and apply basic statistical and probability concepts in order to organize and analyze data and to make predictions and conjectures.

Learning Expectations

5.1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer questions.

5.2. Select and use appropriate statistical methods to analyze data.

5.3. Develop and evaluate inferences and predictions that are based on data.

5.4. Understand and apply basic concepts of probability.

Accomplishments

8.5.1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer questions.

a. formulate questions, design studies, and collect real-world data for investigations using a variety of collection methods (e.g., random sampling, simulations);

b. select, create, and use appropriate graphical representations of real-world data (e.g., histograms, box plots, scatterplots).

8.5.2. Select and use appropriate statistical methods to analyze data.

a. find, use, and interpret measures of center and spread (e.g., mean, interquartile range);

b. develop meaning for frequency, distribution, and outliers;

c. discuss and understand the relationship between data sets and their graphical representations (e.g., bar graphs, line graphs, circle graphs, histograms, stem-and-leaf plots, box plots, scatterplots).

8.5.3. Develop and evaluate inferences and predictions that are based on data.

a. make conjectures and predictions based on data;

b. recognize misleading presentations of data;

c. develop meaning for lines of best fit;

d. determine an appropriate sample to test a hypothesis;

e. make conjectures to formulate new questions for future studies.

8.5.4. Understand and apply basic concepts of probability.

a. develop meaning of mutually exclusive events;

b. connect the symbolic representation of a probability to an experiment;

c. use a variety of methods to compute probabilities for compound events (e.g., multiplication, organized lists, tree diagrams, area models);

d. distinguish between theoretical and experimental probability;

e. find the probability of dependent and independent events.

State Performance Indicators

The student is able to:

8.5.spi.1. identify an appropriate sample to test a given hypothesis.

8.5.spi.2. interpret appropriate graphical representations of data (i.e., histograms, box plots, scatterplots);

8.5.spi.3. determine the mean of a given set of real-world data;

8.5.spi.4. connect data sets and their graphical representations (i.e., histograms, stem-and-leaf plots, box plots, scatterplots);

8.5.spi.5. make conjectures and predictions based on data;

8.5.spi.6. connect the symbolic representation of a probability to an experiment;

8.5.spi.7. determine the median of a given set of real-world data (even number of data);

8.5.spi.8. recognize misleading presentations of data.

TENNESSEE Foundations I

Standards, Expectations, and State Indicators

Content Standard: 1.0. Number and Operations

Students will develop number and operation sense needed to represent numbers and number relationships verbally, symbolically, and graphically and to compute fluently and make reasonable estimates in problem solving.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the subsets, elements, properties, and operations of the rational number system;

1.2. connect physical, graphical, verbal, and symbolic representations of rational numbers;

1.3. order and compare rational numbers;

1.4. informally describe and model the concept of additive and multiplicative inverses (e.g., opposites, reciprocals) in real life problem situations;

1.5. apply number theory concepts (e.g., primes, composites, factors, divisibility ,and multiples) in mathematical problem situations;

1.6. use rational numbers to represent real-world applications (e.g., probability, proportionality);

1.7. use mathematical notations appropriately;

1.8. select and apply an appropriate method (i.e., mental arithmetic, paper and pencil, or technology) for computing with rational numbers, and evaluate the reasonableness of results;

1.9. apply estimation strategies in computation and in problem solving.

Student Performance Indicators

The student is able to:

- represent rational numbers in a variety of ways using concrete objects, pictures, the number line, and symbols;
- compute fluently with whole numbers, fractions, decimals, and percent;
- compare rational numbers using the appropriate symbol (<, >, =);
- work flexibly with fractions, decimals, and percents in one- or two-step word problems;
- represent quantitative relationships using ratios and proportions;
- identify numbers less than 100 as prime or composite;
- give the prime factorization for a number less than 100;
- determine the greatest common factor and the least common multiple for up to three numbers;
- apply order of operations in computing with rational numbers, using no more than two parentheses and exponents 1 and 2;
- calculate rates involving cost per unit to determine the best buy;
- demonstrate an understanding of percent in solving real-world problems;
- describe relationships among operations;
- use estimation strategies to select a reasonable solution to a real-world problem involving rational number computation;
- develop, analyze, and explain methods for solving problems involving proportions (i.e., scaling, finding equivalent ratios);
- express a monomial written in expanded form using exponents;
- identify the opposite and the reciprocal of a given rational number;
- determine square roots of perfect squares (<169).

Content Standard: 2.0. Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and solve real-world problems using appropriate representations.

Learning Expectations

The student will:

2.1. recognize, extend, and create geometric, spatial, and numerical patterns;

2.2. solve problems in number theory, geometry, probability and statistics, and measurement and estimation using algebraic thinking;

2.3. communicate the meaning of variables in algebraic expressions and equations;

2.4. apply the concept of variable in simplifying algebraic expressions and solving equations;

2.5. interpret graphs that depict real-world phenomena;

2.6. model real-world phenomena using graphs.

Student Performance Indicators

The student is able to:

- extend geometric, spatial, and numeric patterns;
- generalize a variety of patterns with symbolic rules;
- represent situations and solve real-world problems using symbolic algebra;
- generate equivalent forms for simple algebraic expressions;
- solve one-step linear equations involving integers;
- evaluate a first-degree algebraic expression given values for up to two variables;
- apply given formulas to solve real-world problems;
- use a variety of representations to solve real-world problems (i.e., graphs, tables, equations);
- connect linear equations and the appropriate graphs of lines;

- explain the meaning of intercept, slope, and rate of change in real-world problems.

Content Standard: 3.0. Geometry

Students will investigate, model, and apply geometric properties and relationships.

Learning Expectations

The student will:

3.1. apply geometric properties, formulas, and relationships to solve real-world problems;

3.2. communicate position using spatial sense with two-dimensional coordinate systems;

3.3. demonstrate an understanding of the properties and construction of geometric figures, including angles, parallel lines, perpendicular lines, triangles, circles, and quadrilaterals.

Student Performance Indicators

The student is able to:

- use ordered pairs to describe given points in a coordinate system;
- apply the given formula to determine the area or perimeter of a rectangle;
- find the missing length of a side, given two similar triangles;
- classify a quadrilateral, given its properties, as a square, a rectangle, a rhombus, a parallelogram, and/or a trapezoid;
- calculate the area of a circle, a triangle, a parallelogram, a rhombus, or a trapezoid given the appropriate formula;
- apply the Pythagorean Theorem in problem solving;
- determine and justify the missing angle measures, given the measure of one angle, when two parallel lines are cut by a transversal.

Content Standard: 4.0. Measurement

Students will become familiar with the units and processes of measurement in order to use various tools, techniques, and formulas to determine and estimate measurements in problem solving.

Learning Expectations

The student will:

4.1. apply appropriate techniques, tools, and formulas to determine measurements;

4.2. communicate the concepts and strategies being to estimate measurements;

4.3. apply measurement concepts and relationships in geometric problem-solving situations.

Student Performance Indicators

The student is able to:

- select units of appropriate size and type to measure angles, perimeter, area, surface area, and volume;
- use concepts of length, area, and volume to estimate and solve real-world problems (i.e., parallelograms, triangles, right rectangular prisms, circles, right cylinders);
- solve real-world problems involving rate/time/distance (i.e., d = rt);
- use estimation to make predictions and determine reasonableness of results;
- choose appropriate techniques and tools to measure quantities in order to meet specifications for precision and accuracy;
- estimate to find the area of irregular and complex shapes.

Content Standard: 5.0. Data Analysis & Probability

Students will understand and apply basic statistical and probability concepts in order to organize and analyze data and to make predictions.

Learning Expectations

The student will:

5.1. choose, construct, and analyze appropriate graphical representations for a data set including pie charts, histograms, stem and leaf plots, and scatterplots;

5.2. interpret a set of data using the appropriate measure of central tendency (mean, median, mode);

5.3. determine experimental and theoretical probabilities for simple experiments.

Student Performance Indicators

The student is able to:

- determine the mean, median, mode, and range for a given set of data;
- determine the probability of an event (i.e., rolling a die or spinning a spinner);
- construct and interpret bar, circle, and line graphs of real-world data;
- determine the number of possible outcomes for simple experiments using lists, tree diagrams, or the multiplication counting principle;
- determine the median from a given stem-and-leaf plot;
- make predictions based on data;
- develop meaning for lines of best fit.

Content Standard: 1.0. Number and Operations

Students will recognize, represent, model, and apply real numbers and operations verbally, physically, symbolically, and graphically and will compute fluently and make reasonable estimates in problem solving.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the subsets, elements, properties, and operations of the real number system;

1.2. demonstrate an understanding of the relative size of rational and irrational numbers;

1.3. connect physical, graphical, verbal, and symbolic representations of real numbers;

1.4. informally describe and model the concept of inverse (e.g., opposites, reciprocals, and squares and square roots);

1.5. demonstrate an understanding of division involving zero;

1.6. describe, model, and apply inverse operations;

1.7. apply number theory concepts (e.g., primes, factors, divisibility and multiples) in mathematical problem situations;

1.8. connect physical, graphical, verbal, and symbolic representations of absolute value;

1.9. use real numbers to represent real-world applications (e.g., rate of change, probability, and proportionality);

1.10. select and apply an appropriate method (i.e., mental arithmetic, paper and pencil, or technology) for computing with real numbers, and evaluate the reasonableness of results;

1.11. communicate the concepts and strategies being used in estimation and computation;

1.12. perform operations on simple algebraic expressions, and informally justify the procedures chosen;

1.13. use estimation to make predictions and determine reasonableness of computational results;

1.14. use mathematical notations appropriately.

State Performance Indicators

The student is able to:

- choose the correct prime factorization of a two-digit composite whole number;
- compare a fraction to a decimal using less than, greater than, and equals symbols;
- multiply a fraction by a multiple of its denominator (denominator less than or equal to 25);
- apply order of operations to evaluate numerical expressions (whole numbers only; no exponents or grouping symbols;
- identify the opposite of any rational number;
- select the best estimate for the coordinate of a given point on a number line (rationals);
- choose an equivalent exponential form of a one-variable monomial given in factored form (only first-degree variables with positive integral coefficients);
- multiply an integer by a one-variable binomial;
- select a reasonable solution for a real-world division problem in which the remainder must be considered;
- apply order of operations to evaluate numerical expressions containing whole numbers, exponents, and no more than two sets of grouping symbols;
- select ratios and proportions to represent real-world problems such as scale drawings and samplings (all ratios are positive integers to positive integers).

Content Standard: 2.0. Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and solve real-world problems using appropriate materials and representations.

Learning Expectations

The student will:

2.1. recognize, extend, and create geometric, spatial, and numerical patterns;

2.2. analyze mathematical patterns related to algebra and geometry in real-world problem solving;

2.3. solve problems in number theory, geometry, probability and statistics, and measurement and estimation using algebraic thinking and symbolism (attention given to solving linear equations);

2.4. communicate the meaning of variables in algebraic expressions, equations, and inequalities;

2.5. interpret the results of algebraic procedures;

2.6. apply the concept of variable in simplifying algebraic expressions, solving equations, and solving inequalities;

2.7. interpret graphs that depict real-world phenomena;

2.8. model real-world phenomena using graphs.

State Performance Indicators

The student is able to:

- extend a pattern of geometric figures;
- extend a numerical pattern using only whole numbers;
- solve a one-step linear equation with a variable on only one side of the equation (integral coefficients and constants);
- solve a two-step linear equation with a variable on only one side of the equation (integral coefficients and constants);
- translate a one-variable verbal expression into an algebraic expression (no more than two operations);
- evaluate a first-degree algebraic expression given the values for the variables (up to three variables);

- select the appropriate linear graph that models a real-world situation or vice versa;
- select the number line graph that models a given one-step linear inequality (variables may not have negative coefficients);
- simplify a first-degree algebraic expression by combining like terms (integral coefficients and constants).

Content Standard: 3.0. Geometry

Students will investigate, model, and apply geometric properties and relationships.

Learning Expectations

The student will:

3.1. analyze relationships among corresponding parts of similar or congruent geometric figures;

3.2. apply geometric properties, formulas, and relationships to solve real-world problems;

3.3. use inductive reasoning to make conjectures;

3.4. communicate position using spatial sense with two-dimensional coordinate system;

3.5. demonstrate an understanding of transformations of geometric figures;

3.6. apply the Pythagorean Theorem in problem solving;

3.7. name, analyze, and describe the properties of various polygons.

State Performance Indicators

The student is able to:

- determine the perimeter of any geometric figure;
- identify the coordinates for a given point;
- find the missing length of a side given two similar triangles;
- use the Pythagorean Theorem to determine the length of a missing side of a right triangle (no radicals).

Content Standard: 4.0. Measurement

Students will become familiar with the units and processes of measurement in order to use various tools, techniques, and formulas to determine and estimate measurements in problem solving.

Learning Expectations

The student will:

4.1. communicate the concepts and strategies used to measure and to estimate measurements;

4.2. use concepts of length and area, including surface area and volume, to estimate and solve real-world problems (e.g., parallelograms, triangles, right rectangular prisms, circles, right cylinders, spheres, and pyramids);

4.3. apply measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.4. choose appropriate techniques and tools to measure quantities in order to meet specifications for precision and accuracy;

4.5. demonstrate an understanding of rates and other derived and indirect measurements (e.g., velocity, miles per hr, rpm, and cost per unit).

State Performance Indicators

The student is able to:

- apply the given formula to determine the area of a rectangular figure with rational dimensions.
- calculate the cost per unit to determine the best buy (no more than four samples).
- choose the correct area representation of the product of an integer and a one-variable first-degree binomial.

Content Standard: 5.0. Data Analysis & Probability

Students will interpret a given set of data, including analyzing the use, misuse, and abuse of data; choose, construct, and analyze appropriate graphical representations for a data set; use technology in data collection and analysis; and apply theoretical and experimental probability to analyze the likelihood of an event.

Learning Expectations

The student will:

5.1. interpret a set of data using the appropriate measure of central tendency (mean, median, mode) and the appropriate measure of dispersion (e.g., quartiles, range);

5.2. choose, construct, and analyze appropriate graphical representations for a data set including pie charts, histograms, stem-and-leaf plots, scatterplots, and box plots;

5.3. apply appropriate technology in data collection and analysis;

5.4. apply theoretical and experimental probability to analyze the likelihood of an event;

5.5. use simulations to estimate probability;

5.6. analyze the validity of statistical conclusions and the use, misuse, and abuse of data;

5.7. apply counting principles of permutations and combinations using appropriate technology.

State Performance Indicators

The student is able to:

- determine the mean of a given set of data (no more than five one- or two-digit numbers);
- determine the number of possible outcomes for a simple experiment using a list, tree diagram, or the multiplication counting principle;
- determine the probability of a single event (i.e., rolling a die or using a spinner);
- interpret bar graphs representing real-world data;
- interpret circle graphs (pie charts) representing real-world data;
- determine the median from a given stem-and-leaf plot;
- determine the median of a given set of real-world data (even number of data).

Content Standard: 1.0. Number and Operations

Students will recognize, represent, model, and apply real numbers and operations verbally, physically, symbolically, and graphically.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the subsets, properties, and operations of the real number system;

1.2. demonstrate an understanding of the relative size of rational and irrational numbers;

1.3. articulate, model, and apply the concept of inverse (e.g., opposites, reciprocals, and powers and roots);

1.4. describe, model, and apply inverse operations;

1.5. apply number theory concepts (e.g., primes, factors, divisibility and multiples) in mathematical problem solving;

1.6. connect graphical and symbolic representations of absolute value;

1.7. use real numbers to represent real-world applications (e.g., slope, rate of change, probability, and proportionality);

1.8. use a variety of notations appropriately (e.g. exponential, functional, square root);

1.9. select and apply an appropriate method (i.e., mental mathematics, paper and pencil, or technology) for computing with real numbers, and evaluate the reasonableness of results;

1.10. perform operations on algebraic expressions and informally justify the procedures chosen;

1.11. perform operations on matrices in real-world problem solving (i.e., addition, subtraction, and scalar multiplication).

State Performance Indicators

The student is able to:

- select the best estimate for the coordinate of a given point on a number line (only rational);
- identify the opposite of a rational number;
- determine the square root of a perfect square less than 169;
- use exponents to simplify a monomial written in expanded form without the use of parenthesis;
- apply order of operations when computing with integers using no more than two sets of grouping symbols and exponents 1 and 2;
- select a reasonable solution for a real-world division problem in which the remainder must be considered;
- order a given set of rational numbers (both fraction and decimal notations);
- identify the reciprocal of a rational number;
- add and subtract algebraic expressions;
- multiply two polynomials with each factor having no more than two terms;
- use estimation to determine a reasonable solution for a tedious arithmetic computation;
- select ratios and proportions to represent real-world problems (e.g. scale drawings, sampling, etc.);
- apply the concept of slope to represent rate of change in a real-world situation.

Content Standard: 2.0. Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and functions using appropriate materials and representations in real world problem solving.

Learning Expectations

The student will:

2.1. recognize, analyze, extend, and create a variety of patterns;

2.2. use algebraic thinking to generalize a pattern by expressing the pattern in functional notation;

2.3. solve linear systems using a variety of techniques;

2.4. communicate the meaning of variables in algebraic expressions, equations, and inequalities;

2.5. identify and represent a variety of functions;

2.6. apply and interpret rates of change from graphical and numerical data;

2.7. analyze graphs to describe the behavior of functions;

2.8. interpret results of algebraic procedures;

2.9. apply the concept of variable in simplifying algebraic expressions, solving equations, and solving inequalities;

2.10. interpret graphs that depict real-world phenomena;

2.11. model real-world phenomena using functions and graphs;

2.12. articulate and apply algebraic properties in symbolic manipulation;

2.13. analyze relationships which can and which cannot be represented by a function;

2.14. graph inequalities and interpret graphs of inequalities;

2.15. describe the domain and range of functions and articulate restrictions imposed either by the operations or by the real-life situations which the functions represent;

2.16. describe the transformation of the graph that occurs when coefficients and/or constants of the corresponding linear equations are changed;

2.17. find and represent solutions of quadratic equations.

State Performance Indicators

The student is able to:

- extend a geometric pattern;
- extend a numerical pattern;
- translate a verbal expression into an algebraic expression or vice versa;

- evaluate a first degree algebraic expression given values for one or more variables;
- solve one- and two-step linear equations using integers (with integral coefficients and constants);
- select the algebraic notation which generalizes the pattern represented by data in a given table;
- translate a verbal sentence into an algebraic equation or vice versa;
- select the graph that represents a given linear function expressed in slope-intercept form;
- solve multi-step linear equations (more than two steps, variables on one side of the equation with no use of parentheses);
- solve multi-step linear equations (more than two steps, with variables on both sides of the equation with no use of parentheses);
- solve multi-step linear equations (more than two steps, with one set of parentheses on each side of the equation);
- select the linear graph that models the given real-world situation described in a narrative (no data set given);
- select the linear graph that models the given real-world situation described in a tabular set of data or vice versa;
- evaluate an algebraic expression given values for one or more variables using grouping symbols and/or exponents less than four;
- determine the slope from the graph of a linear equation (no labeled points);
- apply the concept of rate of change to solve real-world problems;
- select the appropriate graphical representation on the coordinate plane of a given linear inequality (given in standard form or slope-intercept form);
- select the non-linear graph that models the given real-world situation or vice versa;
- identify the graphical representation of the solution to a one variable inequality on a number line;
- solve multi-step linear inequalities in real-world situations;
- recognize the graphical transformation that occurs when coefficients and/or constants of the corresponding linear equations are changed;
- determine the domain and/or range of a function represented by the graph of real-world situations;
- select the system of equations that could be used to solve a given real-world problem;
- find the solution to a quadratic equation given in standard form (integral solutions and a leading coefficient of one);
- select the solution to a quadratic equation given solutions represented in graphical form (integral solutions and a leading coefficient of one);
- select one of the factors (e.g., x + 3) of a quadratic equation (integral solutions and a leading coefficient of one);
- select the discriminant of a quadratic equation (integral solutions and a leading coefficient of one).

Content Standard: 3.0. Geometry

The student will investigate, model, and apply geometric properties and relationships.

Learning Expectations

The student will:

3.1. apply geometric properties, formulas, and relationships to solve real-world problems;

3.2. solve problems using the midpoint formula;

3.3. apply right triangle relationships including the Pythagorean Theorem and the distance formula;

State Performance Indicators

The student is able to:

- identify ordered pairs in the coordinate plane;
- apply the given Pythagorean Theorem to a real life problem illustrated by a diagram (no radicals in answer);
- apply proportion and the concepts of similar triangles to find the length of a missing side of a triangle;
- calculate the distance between two points given the Pythagorean Theorem and the distance formula.

Content Standard: 4.0. Measurement

The student will apply appropriate tools and units of measurement to produce reasonable results.

Learning Expectations

The student will:

4.1. use concepts of length, area, and volume to estimate and solve real-world problems;

4.2. apply and communicate measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.3. demonstrate an understanding of rates and other derived and indirect measurements (e.g., velocity, miles per hour, revolutions per minute, cost per unit);

4.4. make decisions about units, scales, and measurement tools that are appropriate for problem situations involving measurement;

4.5. analyze precision, accuracy, tolerance, and approximate error in measurement situations.

State Performance Indicators

The student is able to:

- estimate the area of irregular geometric figures on a grid;
- calculate rates involving cost per unit to determine the best buy (no more than four samples);
- apply the given formula to determine the area or perimeter of a rectangle;

- apply the given formula to find the area of a circle, the circumference of a circle, or the volume of a rectangular solid;
- select the area representation for a given product of two one-variable binomials with positive constants and coefficients.

Content Standard: 5.0. Data Analysis & Probability

The student will collect, organize, represent, and interpret data and model situations to determine theoretical and experimental probabilities.

Learning Expectations

The student will:

5.1. collect, represent, and describe linear and nonlinear data sets developed from the real world;

5.2. make predictions from a linear data set using a line of best fit;

5.3. interpret a set of data using the appropriate measure of central tendency;

5.4. choose, construct, and analyze appropriate graphical representations for a data set;

5.5. understand the concept of random sampling;

5.6. apply counting principles of permutations and combinations using appropriate technology;

5.7. model situations to determine theoretical and experimental probabilities.

State Performance Indicators

The student is able to:

- determine the mean (average) of a given set of real-world data (no more than five two-digit numbers);
- interpret bar graphs representing real-world data;
- interpret circle graphs (pie charts) representing real-world data;
- choose the matching linear graph given a set of ordered pairs;
- make a prediction from the graph of a real-world linear data set;
- determine the median for a given set of real-world data (even number of data);
- compute the probability of a simple compound event (2 independent events, no more than 6 possibilities per event).

Content Standard: 1.0. Number and Operations

Students will recognize, order, represent, and graph rational and irrational numbers, including absolute value notation.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the relative size of rational and irrational numbers;

1.2. choose and use appropriate notations for rational and irrational numbers, including graphic representations;

1.3. demonstrate an understanding of absolute value.

State Performance Indicators

The student is able to:

- order a set of rational and irrational numbers;
- find an integral power of a positive rational number (exponents 1–3);
- use absolute value to express the distance between two points on a number line and vice versa;
- simplify a radical (radicand less than 1000);
- match a given irrational number to the appropriate point on a number line and vice versa (e.g., $\sqrt{2}$, $\sqrt{30}$, pi).

Content Standard: 2.0. Algebra

Students will recognize, extend, create, and analyze a variety of geometric, spatial, and numerical patterns; solve real-world problems related to algebra and geometry; and use properties of various geometric figures to analyze and solve problems.

Learning Expectations

The student will:

2.1. recognize, extend, and create geometric, spatial, and numerical patterns;

2.2. analyze mathematical patterns related to algebra and geometry in real-world problem solving;

2.3. solve problems connecting geometry with number theory, probability and statistics, and measurement and estimation using algebraic thinking and symbolism;

2.4. apply coordinate geometry to analyze and solve problems;

2.5. apply ratio and proportion to problems involving similar figures.

State Performance Indicators

The student is able to:

- extend or find missing element(s) in a geometric pattern;
- solve multistep linear equations to find length, width, perimeter, and area of geometric figures;
- apply the concept of rate of change to solve a real-world problem given a pattern of data;
- determine the slope given a graph of a linear equation and vice versa;
- determine the distance, midpoint, or slope when given the coordinates of two points (answers must be given as decimals to the nearest hundredth);
- determine the equation of a line parallel or perpendicular to a given line, from given information (e.g., equations of lines, graphs of lines, or two points);
- apply ratio and proportion to solve real-world problems involving polygons (e.g., scale drawings, similar figures);
- apply the triangle inequality property to determine which sets of side lengths determine a triangle;
- determine the perimeter, area, or volume given the ratio of two similar polygons or rectangular solids;
- apply the Triangle Sum Theorem or Exterior Angle Theorem to determine the measures of the angles of a given triangle with the angle measures expressed algebraically;
- determine the equation of a circle given coordinates or the graph of the circle (e.g., the center, the endpoints of the diameter).

Content Standard: 3.0. Geometry

Students will investigate, model, and apply geometric properties and relationships and use indirect reasoning to make conjectures; deductive reasoning to draw conclusions; and both inductive and deductive reasoning to establish the truth of statements.

Learning Expectations

The student will:

3.1. analyze relationships among corresponding parts of similar or congruent geometric figures;

3.2. apply geometric properties of solids, polygons, and circles to solve real-world problems;

3.3. justify conclusions and solve problems using deductive reasoning;

3.4. use inductive reasoning to make conjectures and solve problems;

3.5. communicate position using spatial sense with two- and three-dimensional coordinate systems;

3.6. demonstrate an understanding of transformations of geometric figures (i.e., translations, rotations, dilations, and reflections);

3.7. apply right triangle relationships including the Pythagorean Theorem, the distance formula, and trigonometric ratios;

3.8. describe geometric objects and recognize minimal conditions necessary to define the geometric objects;

3.9. apply reflexive, transitive, and symmetric properties when appropriate;

3.10. demonstrate understanding of geometric properties of congruence, similarity, perpendicularity, and parallelism;

3.11. recognize and articulate relationships among families of geometric figures (e.g., quadrilaterals, prisms);

3.12. use logic and proof to establish the validity of conjectures and theorems.

State Performance Indicators

The student is able to:

- identify corresponding parts of similar and congruent geometric figures given a diagram;
- determine the length of a missing side in a right triangle when given two sides (answers must be given as simplified radicals);
- identify properties of plane figures from information given in a diagram;
- identify chords, inscribed angles, or central angles of circles given a diagram;
- determine congruence or similarity relations between triangles or quadrilaterals given a diagram;
- determine whether a plane figure has been translated, dilated, reflected, or rotated given a diagram and vice versa;
- solve problems involving complementary, supplementary, congruent, vertical, or adjacent angles given angle measures expressed algebraically;
- determine the trigonometric ratio for a right triangle needed to solve a real-world problem given a diagram;
- find a missing side length in a 30-60-90 or 45-45-90 degree triangle without rationalizing the denominator;
- apply properties of quadrilaterals to solve a real-world problem given a diagram (opposite sides and angles, consecutive sides and angles, or diagonals);
- solve real-world problems involving measures of interior or exterior angles of regular polygons;
- identify the appropriate segment of a triangle given a diagram and vice versa (i.e., median, altitude, angle bisector, perpendicular bisector);
- determine which three-dimensional solid is represented by a given net and vice versa (two-dimensional drawing);
- determine the area of indicated regions involving circles, squares, rectangles, and/or triangles;
- justify triangle congruence given a diagram (i.e., ASA, SSS, AAS, SAS, or Hypotenuse/ Leg);
- determine if a triangle is a right triangle given the length of all the sides of a triangle;
- solve problems involving the properties of arcs, chords, tangents, or secants;
- find the area of a sector of a circle given a diagram.

Content Standard: 4.0. Measurement

Students will apply appropriate units of measurement; develop effective estimation and computation strategies for solving real world problems involving length, area, and volume; and choose appropriate techniques and tools to measure quantities in order to meet specifications for precision, accuracy, and tolerance.

Learning Expectations

The student will:

4.1. use concepts of length, area, and volume to estimate and solve real-world problems;

4.2. apply measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.3. choose appropriate techniques and tools to measure quantities in order to meet specifications for precision, accuracy, and tolerance.

State Performance Indicators

The student is able to:

- determine the perimeter or area of a triangle or rectangle when the dimensions are given as first degree binomials in one variable;
- solve real world problems involving perimeter or area of three or four sided plane figures;
- determine the volume or surface area of a rectangular solid or cylinder in a real-world situation;
- determine whether a reading falls within an acceptable tolerance range.

Content Standard: 5.0. Data Analysis & Probability

The student will investigate, explore, and apply geometric representations to calculate theoretical probability; and will use data from geometric figures to investigate relationships.

Learning Expectations

The student will:

5.1. apply geometric representations to calculate theoretical probability;

5.2. use data analysis to investigate geometric relationships.

State Performance Indicators

The student is able to:

- make a prediction from a geometric representation of a real-world data set;
- determine the probability of an event represented as a subset of the area of a two-dimensional geometric figure.

Content Standard: 1.0. Number and Operations

Students will recognize, represent, model, and apply real numbers and operations verbally, physically, symbolically, and graphically.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the elements, subsets, properties, and operations of rational numbers;

1.2. demonstrate understanding of positive integer exponents and perform operations with expressions involving exponents;

1.3. connect physical, graphical, verbal, and symbolic representations of rational numbers;

1.4. connect physical, graphical, verbal, and symbolic representations of absolute value;

1.5. articulate, model, and apply the concept of inverse (i.e., opposites and reciprocals);

1.6. describe, model, and apply inverse operations;

1.7. perform operations on algebraic expressions and informally justify the procedures chosen;

1.8. apply matrix addition, subtraction, and scalar multiplication in real-world problems (e.g., inventory), using appropriate technology;

1.9. use a variety of notations appropriately (e.g., exponential, functional, square root);

1.10 select and apply an appropriate method (i.e., mental arithmetic, paper and pencil, or technology) for computing with real numbers, and use estimation to evaluate the reasonableness of the result.

Student Performance Indicators

The student is able to:

- select the best estimate for the coordinate of a given point on a number line (only rational);
- identify the opposite of a rational number;
- determine the square root of a perfect square less than 169;
- use exponents to simplify a monomial written in expanded form;
- apply order of operations when computing with integers using no more than two sets of grouping symbols and exponents 1 and 2;
- select a reasonable solution for a real-world division problem in which the remainder must be considered;
- compare and contrast the GCF and LCM of a set of numbers;
- probe the relationships among various subsets of the real number system;
- compare and contrast the GCF and LCM of a set of algebraic expressions;
- order a given set of rational numbers (both fraction and decimal notations);
- identify the reciprocal of a rational number;
- add and subtract algebraic expressions;
- multiply two polynomials with each factor having no more than two terms;
- use estimation to determine a reasonable solution for a tedious arithmetic computation;
- select ratios and proportions to represent real-world problems (e.g. scale drawings, sampling);
- perform operations on matrices using appropriate technology (addition, subtraction, and scalar multiplication);
- apply the concept of slope to represent rate of change in a real-world situation;
- scrutinize approximate values of real numbers such as pi and the square root of two.

Content Standard: 2.0. Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and functions using appropriate materials and representations in real world problem solving.

Learning Expectations

The student will:

2.1. communicate the meaning of variables in algebraic expressions, equations, and inequalities;

2.2. identify dependent and independent variables in real-world situations;

2.3. apply the concept of variable in simplifying algebraic expressions, solving equations, and solving inequalities;

2.4. represent the solution set linear equations and inequalities in one variable symbolically, graphically, and verbally;

2.5. interpret graphs that depict real-world phenomena;

2.6. model real-world phenomena using graphs;

2.7. represent functions with equations, graphs, tables, and words;

2.8. understand and apply slope as rate of change;

2.9. solve real-world problems represented by linear functions and interpret the slope and intercepts;

2.10. solve systems of two equations in two unknowns using a variety of techniques;

2.11. recognize and extend numerical, geometric, and spatial patterns;

2.12. describe the domain and range of functions imposed either by operations or by real-life situations that the functions represent;

2.13. describe the transformation of the graph that occurs when coefficients and/or constants of the corresponding linear equation are changed;

2.14. generalize numerical, geometric patterns verbally and symbolically.

Student Performance Indicators

The student is able to:

- extend a geometric pattern;
- extend a numerical pattern;
- translate a verbal expression into an algebraic expression;
- evaluate a first degree algebraic expression given values for one or more variables;
- solve one- and two-step linear equations using integers (with integral coefficients and constants);
- select the algebraic notation which generalizes the pattern represented by data in a given table;
- translate a verbal sentence into an algebraic equation;
- select the graph that represents a given linear function expressed in slope-intercept form;
- solve multi-step linear equations (more than two steps, variables on only one side of the equation);
- solve multi-step linear equations (more than two steps, with variables on both sides of the equation);
- solve multi-step linear equations (more than two steps, with one set of parentheses on each side of the equation);
- select the linear graph that models the given real-world situation described in a narrative (no data set given);
- select the linear graph that models the given real-world situation described in a tabular set of data;
- evaluate an algebraic expression given values for one or more variables using grouping symbols and/or exponents less than four;
- determine the slope (rate of change) from the graph of a linear equation (no labeled points);
- apply the concept of rate of change to solve real-world problems;
- select the appropriate graphical representation of a given linear inequality;
- select the non-linear graph that models the given real-world situation or vice versa;
- identify the graphical representation of the solution to a one variable inequality on a number line;
- produce an equation to describe the relationship between data sets;
- explore patterns including Pascal's Triangle and a Fibonacci sequence;
- solve a system of two linear equations using the graphing, elimination, and substitution methods;
- defend the selection of a method for solving a system of equations;
- represent algebraic expressions and operations using manipulatives;
- model the steps for solving simple linear equations using manipulatives;
- write an equation that symbolically expresses a problem solving situation;
- justify correct results of algebraic procedures;
- distinguish between a function and other relationships;
- solve multi-step linear inequalities in real-world situations;
- analyze "families of functions" using technology;
- determine the domain and/or range of a function represented by the graph of real-world situations;
- select the system of equations that could be used to solve a given real-world problem;
- find the solution to a quadratic equation given in standard form (integral solutions and a leading coefficient of one).

Content Standard: 3.0. Geometry

Students will investigate, model, and apply geometric properties and relationships.

Learning Expectations

The student will:

3.1. apply inductive reasoning in making conjectures, then test conjectures and/or determine a counterexample;

3.2. apply properties of special pairs of angles (e.g. supplementary, complementary, vertical, and adjacent);

3.3. articulate relationships of angles formed when parallel lines are cut by a transversal;

3.4. apply the concept of slope to parallel and perpendicular lines;

3.5. solve real world problems involving length, perimeter, and circumference;

3.6. apply the properties of congruence and similarity to solve problems;

3.7. apply the Pythagorean Theorem and the distance formula;

3.8. use appropriate measurement techniques and tools in investigating properties of polygons (triangle angle properties, angles of polygons, and triangle inequalities).

Student Performance Indicators

The student is able to:

- describe real-world uses of geometric formulas and relationships;
- discuss issues related to estimating areas of irregular-shaped figures for real-world uses (i.e., fencing, painting, laying carpet, purchasing wallpaper or border);
- identify ordered pairs in the coordinate plane;
- apply the given Pythagorean Theorem to a real life problem illustrated by a diagram (no radicals in answer);
- apply proportion and the concepts of similar triangles to find the length of a missing side of a triangle;

- calculate the distance between two points given the Pythagorean Theorem and the distance formula;
- determine the height of an object that is difficult to measure by using the properties of similar triangles.

Content Standard: 4.0. Measurement

The student will choose appropriate techniques and tools to measure quantities in order to meet specifications for precision and accuracy.

Learning Expectations

The student will:

4.1. choose appropriate techniques and tools to measure quantities in order to meet specifications for precision and accuracy;

4.2. use concepts of length, area, and volume to estimate and solve real-world problems;

4.3. apply measurement concepts, relationships, and formulas in algebraic and geometric problem-solving situations;

4.4. use estimation to make predictions and determine reasonableness of results;

4.5. demonstrate an understanding of rates and other derived and indirect measurements (e.g. velocity, miles per hour, revolutions per second, and cost per unit).

Student Performance Indicators

The student is able to:

- estimate the area of irregular geometric figures on a grid;
- calculate rates involving cost per unit to determine the best buy (no more than three samples);
- apply the given formula to determine the area or perimeter of a rectangle;
- apply the given formula to find the area of a circle, the circumference of a circle, or the volume of a rectangular solid;
- defend estimates of the perimeter and/or area of rectangles and triangles;
- select the area representation for a given product of two one-variable binomials with positive constants and coefficients;
- describe how changes in the dimensions of figures affect perimeter, area, and volume.

Content Standard: 5.0. Data Analysis & Probability

[no statement at this level]

Learning Expectations

The student will:

5.1. collect, represent, and describe linear and nonlinear data sets developed from the real world using appropriate technology;

5.2. choose, construct, and analyze appropriate graphical representations for a data set;

5.3. interpret data using the appropriate measure of central tendency for the data set;

5.4. determine the measures of dispersion of a data set including range and quartiles;

5.5. apply basic counting principles, introducing factorial notation; apply experimental and theoretical probability with simulations where appropriate;

5.6. make predictions from a linear data set using a line of best fit.

Student Performance Indicators

The student is able to:

- determine the mean (average) of a given set of real-world data (no more than five two-digit numbers);
- interpret bar graphs representing real-world data;
- interpret circle graphs (pie charts) representing real-world data;
- graph real-world data using a variety of representations;
- choose the matching linear graph given a set of ordered pairs;
- make a prediction from the graph of a real-world linear data set;
- determine the median for a given set of real-world data (even number of data);
- apply counting principles of permutations or combinations in real-world situations;
- debate possible conclusions that can be supported by the data;
- make predictions from real-world data using a line of best fit.

Content Standard: 1.0. Number and Operations

Students will recognize, represent, model, and apply real numbers and operations verbally, physically, symbolically, and graphically.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the elements, properties and operations of real numbers;

1.2. demonstrate an understanding of the relative size of rational and irrational numbers;

1.3. connect physical, graphical, verbal, and symbolic representations of real numbers;

1.4. articulate, model and apply the concept of inverse (powers and roots);

1.5. demonstrate an understanding of absolute value;

1.6. recognize the existence of imaginary numbers;

1.7. select and apply an appropriate method (i.e., mental arithmetic, paper and pencil, or technology) for computing with real numbers, and evaluate the reasonableness of results;

1.8. apply matrix operations to solve real-world problems, using appropriate technology.

Student Performance Indicators

The student is able to:

- approximate pi given a table of values for the circumference and diameter of circles;
- order a set of rational and irrational numbers;
- find an integral power of a positive rational number (exponents 1–3);
- use absolute value to express the distance between two points on a number line and vice versa;
- simplify a radical (radicand less than 1000);
- match a given irrational number to the appropriate point on a number line and vice versa (e.g., $\sqrt{2}$, $\sqrt{30}$, pi);
- use radicals and decimal approximations of irrational numbers to indicate calculated lengths or distances;
- represent irrational numbers as lengths of lines in the coordinate plane (e.g., $\sqrt{5}$ is the length of the diagonal of a rectangle with base 1 and height 2).

Content Standard: 2.0. Algebra

Students will recognize, extend, create, and analyze a variety of geometric, spatial, and numerical patterns; solve real-world problems related to algebra and geometry; and use properties of various geometric figures to analyze and solve problems.

Learning Expectations

The student will:

2.1. solve systems of three equations and three unknowns using a variety of techniques including inverse matrices with technology;

2.2. describe the domain and range of a function;

2.3. represent real-world problems involving sets, their intersections, union, and complements using Venn diagrams;

2.4. apply Venn diagrams in problem solving;

2.5. solve quadratic equations and inequalities using appropriate methods;

2.6. solve radical equations using appropriate methods;

2.7. graph absolute value functions and quadratic functions with emphasis on transformations;

2.8. solve real-world problems modeled by absolute value or quadratic functions;

2.9. recognize the conic sections from given information;

2.10. recognize, extend, and create numerical, geometric, and spatial patterns;

2.11. generalize patterns verbally and symbolically using function notation.

Student Performance Indicators

The student is able to:

- extend or find missing element(s) in geometric patterns and situations (e.g., Fibonacci sequence and Golden Ratio);
- solve multistep linear equations to find length, width, perimeter, and area of geometric figures;
- apply the concept of rate of change to solve a real-world problem given a pattern of data;
- determine the slope given a graph of a linear equation and vice versa;
- determine the distance, midpoint, or slope when given the coordinates of two points (answers must be given as decimals to the nearest hundredth);
- determine the equation of a line parallel or perpendicular to a given line, from given information (e.g., equations of lines, graphs of lines, or two points);
- apply ratio and proportion to solve real-world problems involving polygons (e.g., scale drawings, similar figures);
- apply the triangle inequality property to determine which sets of side lengths determine a triangle;
- determine the perimeter, area, or volume given the ratio of two similar polygons or rectangular solids;
- apply the Triangle Sum Theorem or Exterior Angle Theorem to determine the measures of the angles of a given triangle with the angle measures expressed algebraically;

- determine the equation of a circle given coordinates or the graph of the circle (e.g., the center, the endpoints of the diameter);
- use manipulatives to determine relationships between linear, square, or cubic measures when one of the measures of the object has changed and represent algebraically;
- apply the line of best fit given real-world data from geometric figures using technology (e.g., finding the interior angle sum of polygons when given the number of sides; find the circumference of circles when given the diameter);
- recognize complete and incomplete networks;
- graph plane figures on a coordinate plane and solve problems algebraically.

Content Standard: 3.0. Geometry

Students will investigate, model, and apply geometric properties and relationships and use indirect reasoning to make conjectures; deductive reasoning to draw conclusions; and both inductive and deductive reasoning to establish the truth of statements.

Learning Expectations

The student will:

3.1. demonstrate an understanding of geometric transformations (i.e., reflection, translation, rotation, and dilation);

3.2. apply deductive reasoning using postulates and theorems to prove conclusions from given hypotheses;

3.3. determine the truth of an implication, its converse, inverse, and contrapositive;

3.4. apply right triangle properties, including geometric mean, The Pythagorean Theorem, special right triangles, and the trigonometric ratios;

3.5. derive the distance formula for the distance between two points in a rectangular coordinate system;

3.6. apply concepts related to similar and congruent triangles;

3.7. apply properties of circles, arcs, chords, tangents, or secants to solve problems;

3.8. apply the distance and midpoint formulas in solving problems;

3.9. solve real-world problems involving area with two- and three-dimensional shapes;

3.10 use coordinates to describe position in two and three dimensions.

Student Performance Indicators

The student is able to:

- identify corresponding parts of similar and congruent geometric figures given a diagram;
- determine the length of a missing side in a right triangle when given two sides (answers must be given as simplified radicals);
- identify properties of plane figures from information given in a diagram;
- identify chords, inscribed angles, or central angles of circles given a diagram;
- determine congruence or similarity relations between triangles or quadrilaterals given a diagram;
- determine whether a plane figure has been translated, dilated, reflected, or rotated given a diagram and vice versa;
- solve problems involving complementary, supplementary, congruent, vertical, or adjacent angles given angle measures expressed algebraically;
- determine the trigonometric ratio for a right triangle needed to solve a real-world problem given a diagram;
- find a missing side length in a 30-60-90 or 45-45-90 degree triangle without rationalizing the denominator;
- apply properties of quadrilaterals to solve real-world problems given a diagram (opposite sides and angles, consecutive sides and angles, or diagonals);
- solve real-world problems involving measures of interior or exterior angles of regular polygons;
- identify the appropriate segment of a triangle given a diagram and vice versa (i.e. median, altitude, angle bisector, perpendicular bisector);
- determine which three-dimensional solid is represented by a given net and vice versa (two-dimensional drawing);
- determine the area of indicated regions involving circles, squares, rectangles, and/or triangles;
- justify triangle congruence given a diagram (i.e., ASA, SSS, AAS, SAS, or Hypotenuse/ Leg);
- determine if a triangle is a right triangle given the length of all the sides of a triangle;
- investigate and apply the properties of angles, arcs, chords, tangents, and/or secants using technology or manipulatives; find the area of a sector of a circle given a diagram;
- use inductive and deductive reasoning to make conjectures, draw conclusions, and solve problems;
- recognize and articulate relationships among families of geometric figures (e.g., quadrilaterals, prisms);
- use coordinates to communicate the location of a three-dimensional figure that has been rotated or reflected;
- write and defend indirect and direct proofs;
- use logical reasoning to solve problems in the real world;
- use manipulatives to explore the geometric mean of similar triangles;
- use appropriate tools or technology to develop geometric and spatial concepts;
- construct three-dimensional objects using physical materials and manipulatives;

- compare and construct quadrilateral properties using a variety of models (e.g., Venn diagrams, family trees, manipulative mobiles).

Content Standard: 4.0. Measurement

Students will apply appropriate units of measurement; develop effective estimation and computation strategies for solving real world problems involving length, area, and volume; and choose appropriate techniques and tools to measure quantities in order to meet specifications for precision, accuracy, and tolerance.

Learning Expectations

The student will:

4.1. choose appropriate techniques and tools to measure quantities in order to meet specifications for tolerance;

4.2. perform operations on algebraic expression and informally justify the procedures chosen;

4.3. use concepts of length, area, and volume to estimate and solve real-world problems;

4.4. apply measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.5. use estimation to make predictions and determine reasonableness of results;

4.6. demonstrate an understanding of rates and other derived and indirect measurements (e.g. velocity, miles per hr, revolutions per minute, cost per unit);

4.7. apply geometric properties in constructions using a variety of tools (e.g. paper folding, geometric software, reflections tools).

Student Performance Indicators

The student is able to:

- determine the perimeter or area of a triangle or rectangle when the dimensions are given as first degree binomials in one variable;
- determine the measure of an angle using a protractor;
- solve real world problems involving perimeter or area of three or four sided plane figures;
- determine the volume or surface area of a rectangular solid or cylinder in a real-world situation;
- construct bisectors of angles and line segments, perpendicular lines, congruent line segments and angles, and perpendicular bisectors using a variety of methods (e.g., patty paper, technology);
- determine whether a reading falls within an acceptable tolerance range;
- choose appropriate techniques and tools to measure quantities in order to meet specification for precision, accuracy, and tolerance;
- locate the irrational numbers $\sqrt{2}$ and $\sqrt{3}$ on a number line by using the Pythagorean relationship and a straightedge and compass, manipulatives, or technology;
- solve problems involving surface area of pyramids, cones, and spheres.

Content Standard: 5.0. Data Analysis & Probability

Students will investigate, explore, and apply geometric representations to calculate theoretical probability; and will use data from geometric figures to investigate relationships.

Learning Expectations

The student will:

5.1. demonstrate an understanding of different sampling methods and when each is appropriate;

5.2. use simulations to demonstrate probability experiments;

5.3. use a variety of techniques to determine equations of best fit for quadratic data sets;

5.4. analyze the validity of statistical conclusions;

5.5. determine the probability of an event;

5.6. determine the probability of mutually exclusive events.

Student Performance Indicators

The student is able to:

- make a prediction from a geometric representation of a real-world data set;
- determine the probability of an event represented as a subset of the area of a two-dimensional geometric figure;
- collect and analyze data to make conjectures about geometric relationships.

Content Standard: 1.0. Number and Operations

Students will recognize, represent, model, and apply real numbers and operations verbally, physically, symbolically, and graphically.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the laws of exponents, including integral and rational exponents;

1.2. demonstrate an understanding of the elements, subsets, and properties of the complex number system;

1.3. select and apply an appropriate method (i.e., mental arithmetic, paper and pencil, or technology) for computing with real numbers, and evaluate the reasonableness of results;

1.4. perform operations on algebraic expression and justify the procedures chosen;

1.5. perform operations on complex numbers of the form a + bi.

Student Performance Indicators

The student is able to:

- order a given set of real numbers;
- identify the reciprocal of a real number; probe the relationships among various subsets of the real-number system;
- explore various representations of absolute value on a number line;
- multiply two polynomials with each factor having no more than two terms;
- perform basic operations using complex numbers (i.e., addition, subtraction, and multiplication);
- identify the exponential form of a logarithmic expression and vice versa;
- simplify expressions with rational and negative exponents;
- add, subtract, and multiply algebraic expressions;
- compare and contrast the GCF and the LCM of a set of algebraic expressions;
- add, subtract, and perform scalar multiplication on matrices using appropriate technology;
- use the inverse nature of powers and roots;
- perform basic operations on rational algebraic expressions;
- determine the conjugate of a complex number;
- use delta notation to represent the rate of change in a real-world situation
- justify the procedures chosen when performing operations on algebraic expressions and equations;
- use factorial notation for coefficients in a binomial expansion;
- determine the multiplicative inverse of a complex number;
- formulate the representation of a series using sigma notation.

Content Standard: 2.0. Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and functions using appropriate materials and representations in real-world problem solving, and will demonstrate an understanding of the behavior of a variety of functions and their graphs.

Learning Expectations

The student will:

2.1. perform operations on functions, including composition, and determine the effects of the composition on the domain and range;

2.2. demonstrate an understanding of the inverse of a function, and determine if the inverse is a function;

2.3. identify and describe the characteristics of families of functions;

2.4. articulate the results of varying parameters of a parent function;

2.5. solve polynomial equations and inequalities using appropriate technology;

2.6. solve absolute value equations and inequalities;

2.7. graph polynomial, exponential, and logarithmic and rational functions;

2.8. solve exponential, logarithmic, and rational equations using appropriate methods and technology;

2.9. solve real-world problems modeled by polynomial, exponential, logarithmic, and periodic functions;

2.10. solve problems involving linear programming;

2.11. demonstrate an understanding of recursive and explicit definitions of functions and sequences;

2.12. recognize the difference between continuous and discrete situations;

2.13. apply sigma notation with arithmetic and geometric series;

2.14. represent a sequence using a list, graph, symbols, and words;

2.15. determine an equation of a conic section from its graph.

Student Performance Indicators

The student is able to:

- translate a verbal sentence into an algebraic equation and vice versa;
- select the algebraic equation that generalizes the pattern represented by data in a given table;

- solve multi-step (more than two steps) linear equations (one set of parentheses on each side of the equations and/or variables on both sides);
- select the graph that represents a given linear function expressed in slope-intercept form;
- select the graph that models a given real-world situation (i.e., linear and non-linear);
- explain what the changes in slope of a non-linear graph represent in a real-world situation;
- analyze mathematical patterns related to algebra and geometry in real-world problem solving;
- identify the graphical representation of the solution to a one-variable inequality on a number line;
- select functional notation to generalize a given numeric pattern;
- solve one-variable linear equations with rational expressions;
- select the graph of a two-variable inequality;
- determine the domain of polynomial, rational, square root, exponential and logarithmic functions;
- determine the range of a wide variety of functions given a graph;
- solve a system of linear equations with 2 variables (e.g. substitution, elimination, Cramer's Rule, and graphing);
- apply properties of logarithms to simplify a logarithmic expression;
- identify matrices that model given real-world situations;
- use a variety of methods to solve linear systems in two and three variables (e.g., elimination, substitution, Cramer's Rule, matrices, and graphing);
- explain the restrictions on the variable in a radical equation;
- choose an appropriate method to find the roots of a quadratic equation (e.g., completing the square, quadratic formula, factoring, or graphing calculator);
- solve quadratic inequalities;
- determine the inverse of a logarithmic function given its graph;
- evaluate the graph of a function to determine if it is periodic;
- sketch a system of linear inequalities and determine the maximum or minimum value of the related function;
- justify the procedures chosen when performing operations on algebraic expressions and equations;
- find the maximum or minimum value given the graph of the feasible region of the real world linear programming application;
- determine all the roots of a higher order polynomial (i.e., Descartes' Rule of Signs, Rational Root Theorem, and Synthetic Division).

Content Standard: 3.0. Geometry

[no statement at this level]

Learning Expectations

The student will:

3.1. apply and justify properties of quadrilaterals and circles;

3.2. solve real world problems involving volume of geometric solids;

3.3. demonstrate an understanding of the Platonic Solids;

3.4. demonstrate an understanding of uniqueness through indirect proofs;

3.5. apply transformational matrices to transform geometric figures in a rectangular coordinate system.

Student Performance Indicators

The student is able to:

- apply the given Pythagorean Theorem to real-world problems;
- predict the graphical transformation that occurs when coefficients and/or constants of given function are changed (no trigonometric or logarithmic functions);
- apply proportion and the concepts of similar triangles to solve real world problems;
- estimate the irrational solution of a real-world problem using the Pythagorean Theorem;
- describe the transformation that has changed a "parent function" to the given related function (e.g., right shift of 3 units, reflection in the x-axis;
- apply the distance formula to obtain the equation of a circle in order to solve real-world problems;
- use deductive reasoning to draw conclusions;
- use matrices to find the area of a triangle on a coordinate plane;
- investigate and explore the conic sections.

Content Standard: 4.0. Measurement

[no statement at this level]

Learning Expectations

The student will:

4.1. use concepts of length, area, and volume to estimate and solve real-world problems;

4.2. apply measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.3. use estimation to make predictions and determine reasonableness of results;

4.4. demonstrate an understanding of rates and other derived and indirect measurements (e.g. velocity, miles per hr, rpm, cost per unit).

Student Performance Indicators

The student is able to:

- select the appropriate unit of measure given the real world situation;
- select the area representation for a given product of two binomials;

- apply the given formula to find area and circumference of circles, area and perimeter of polygons, and volume of regular solids;
- use appropriate measurements in collecting data for a real world situation;
- solve real world problems given logarithmic and exponential formulas (e.g. pH scale, Richter scale.).

Content Standard: 5.0. Data Analysis & Probability

Students will collect, organize, represent, and interpret data; make and evaluate inferences and predictions; present and evaluate arguments based on data analysis; and model situations to determine theoretical and experimental probabilities.

Learning Expectations

The student will:

5.1. describe and apply the normal distribution and its properties;

5.2. use z-scores to compare normally distributed data sets;

5.3. use a variety of techniques to determine equations of best fit for nonlinear data sets;

5.4. calculate and interpret z-scores;

5.5. apply the properties of conditional probability;

5.6. determine binomial probabilities using appropriate methods;

5.7. make inferences about a data set using appropriate measures of central tendency and dispersion, including variance and standard deviation;

5.8. calculate expected value to make judgments about real-life situations.

Student Performance Indicators

The student is able to:

- make a prediction from the graph of a real-world data set;
- determine the measures of central tendency for a given set of real-world data;
- choose the matching linear graph when given a set of ordered pairs representing real-world data;
- analyze student-collected data to make predications or generalizations;
- categorize the correlation of a scatterplot using real-world data (i.e., positive, negative, strong, or weak);
- determine the number of possible outcomes for a given experiment (i.e., the multiplication counting principle, permutations, or combinations);
- determine the theoretical probability of a simple event for a given situation;
- use simulations to help predict the probability of a given situation;
- determine the theoretical probability of a compound event (i.e., dependent or independent, union and intersection);
- determine the theoretical probability of mutually exclusive events for a given situation;
- analyze theoretical or experimental probability to determine the likelihood of an event;
- analyze data using linear and quadratic functions using the appropriate technology;
- analyze the validity of statistical conclusions and the use, misuse, and abuse of data;
- identify the mean and the standard deviation given the graph of a normal distribution;
- find the equation for the line of best fit given a scatterplot depicting real-world data;
- use the measure of central tendency which best represents the given real-world data set given a distribution curve.

TENNESSEE Algebra II

Standards, Expectations, and State Indicators

Content Standard: 1.0. Number and Operations

Students will recognize, represent, model, and apply real numbers and operations and will demonstrate an understanding of properties and operations of the complex number system.

Learning Expectations

The student will:

1.1. demonstrate an understanding of the subsets, elements, properties, and operations of the complex number system;

1.2. connect physical, graphical, verbal, and symbolic representations of real numbers;

1.3. articulate, model, and apply the concept of inverse (e.g. opposites, reciprocals, and powers and roots);

1.4. describe, model, and apply inverse operations;

1.5. connect physical, graphical, verbal, and symbolic representations of absolute value;

1.6. use a variety of notations appropriately (e.g. logarithmic, factorial, sigma, delta, radical);

1.7. perform operations on algebraic expressions and informally justify the procedures chosen.

State Performance Indicators

The student is able to:

- order a given set of real numbers;
- identify the reciprocal of a real number;
- multiply two polynomials with each factor having no more than two terms;
- perform basic operations using complex numbers (i.e., addition, subtraction, and multiplication);
- select a graph that represents an absolute value equation on a coordinate plane;
- identify the exponential form of a logarithmic expression and vice versa;
- simplify expressions with rational and negative exponents;
- add, subtract, and multiply algebraic expressions;
- determine the conjugate of a complex number.

Content Standard: 2.0. Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and functions using appropriate materials and representations in real-world problem solving, and will demonstrate an understanding of the behavior of a variety of functions and their graphs.

Learning Expectations

The student will:

2.1. analyze mathematical patterns related to algebra and geometry in real-world problem solving;

2.2. use algebraic thinking to generalize a pattern by expressing the pattern in functional notation;

2.3. solve linear systems using a variety of techniques, including matrices;

2.4. communicate the meaning of variables in algebraic expressions, equations, and inequalities;

2.5. manipulate the algebraic functions with constants and analyze graphs to describe the behavior of functions;

2.6. apply the concept of rate of change;

2.7. identify and represent a variety of functions (e.g. linear, quadratic, cubic);

2.8. identify, describe, and articulate the characteristics and the parameters of a parent function;

2.9. interpret results of algebraic procedures;

2.10. apply the concept of variable in simplifying algebraic expressions, solving equations, and solving inequalities;

2.11. interpret graphs that depict real-world phenomena;

2.12. model real-world phenomena using functions and graphs;

2.13. describe the domain and range of functions and articulate restrictions imposed either by the operations or by the real-life situations which the functions represent;

2.14. use linear programming to solve real-world problems.

State Performance Indicators

The student is able to:

- translate a verbal sentence into an algebraic equation and vice versa;
- select the algebraic equation that generalizes the pattern represented by data in a given table;
- solve multi-step (more than two steps) linear equations (one set of parentheses on each side of the equations and/or variables on both sides);
- select the graph that represents a given linear function expressed in slope-intercept form;
- select the graph that models a given real-world situation (i.e., linear and non-linear);
- identify the graphical representation of the solution to a one-variable inequality on a number line;
- select functional notation to generalize a given numeric pattern;
- solve one-variable linear equations with rational expressions;
- select the graph of a two-variable inequality;
- determine the domain of polynomial, rational, square root, exponential and logarithmic functions;
- determine the range of a wide variety of functions given a graph;
- solve a system of linear equations with 2 variables (e.g. substitution, elimination, Cramer's Rule, and graphing);
- apply properties of logarithms to simplify a logarithmic expression;

- identify matrices that model given real-world situations;
- determine the inverse of a logarithmic function given its graph.

Content Standard: 3.0. Geometry

Students will investigate, model, and apply geometric properties and relationships.

Learning Expectations

The student will:

3.1. apply geometric properties, formulas, and relationships to solve real-world problems;

3.2. justify conclusions using deductive reasoning;

3.3. use inductive reasoning to make conjectures;

3.4. communicate position using spatial sense with two- and three-dimensional coordinate systems;

3.5. perform a given transformation and predict the results of the transformation.

State Performance Indicators

The student is able to:

- apply the given Pythagorean Theorem to real-world problems;
- predict the graphical transformation that occurs when coefficients and/or constants of given function are changed (no trigonometric or logarithmic functions);
- apply proportion and the concepts of similar triangles to solve real world problems;
- describe the transformation that has changed a "parent function" to the given related function (e.g., right shift of 3 units, reflection in the x-axis).

Content Standard: 4.0. Measurement

The student will understand and be able to apply the units, systems and processes of measurement.

Learning Expectations

The student will:

4.1. apply measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.2. apply appropriate techniques, tools, and formulas to determine measurements.

State Performance Indicators

The student is able to:

- select the area representation for a given product of two binomials;
- apply the given formula to find area and circumference of circles, area and perimeter of polygons, and volume of regular solids;
- solve real world problems given logarithmic and exponential formulas (e.g., pH scale, Richter scale).

Content Standard: 5.0. Data Analysis & Probability

The student will collect, organize, represent, and interpret data; make and evaluate inferences and predictions; present and evaluate arguments based on data analysis; and model situations to determine theoretical and experimental probabilities.

Learning Expectations

The student will:

5.1. understand concept of randomness in sampling;

5.2. apply appropriate technology in data collection and analysis;

5.3. apply counting principles of permutations and combinations using appropriate technology;

5.4. apply theoretical and experimental probability to analyze the likelihood of an event;

5.5. collect, represent, and describe linear and nonlinear data sets developed from real world;

5.6. make predictions from a data set using curve fitting with appropriate technology;

5.7. make inferences about a data set using appropriate measures of central tendency and dispersion;

5.8. describe and apply the normal distribution and its properties;

5.9. identify mutually exclusive and non-mutually exclusive events;

5.10. analyze the probability of dependent events and of independent events;

5.11. use simulations to estimate probability;

5.12. choose, construct, and analyze appropriate graphical representations for a data set;

5.13. analyze the validity of statistical conclusions and the use, misuse, and abuse of data.

State Performance Indicators

The student is able to:

- make a prediction from the graph of a real-world data set;
- determine the measures of central tendency for a given set of real-world data;
- choose the matching linear graph when given a set of ordered pairs representing real-world data;
- categorize the correlation of a scatterplot using real-world data (i.e., positive, negative, strong, or weak);
- determine the number of possible outcomes for a given experiment (i.e. the multiplication counting principle, permutations, or combinations);
- determine the theoretical probability of a simple event for a given situation;
- determine the theoretical probability of a compound event (i.e., dependent or independent, union and intersection);
- find the equation for the line of best fit given a scatterplot depicting real-world data.

Content Standard: 1.0. Algebra

Students will extend algebraic concepts to model and solve problems in real-world situations by using a variety of functions, equations, and inequalities

Learning Expectations

The student will:

1.1. represent situations that involve variable quantities with expressions, equations, inequalities, and matrices;

1.2. use appropriate methods and technologies to represent and characterize the solutions for a variety of equations, inequalities, and systems of equations and systems of inequalities;

1.3. demonstrate understanding of sequences and series.

Student Performance Indicators

The student is able to:

- represent (graphically, algebraically, verbally, and numerically) and analyze a variety of functions (polynomial, rational, exponential, and logarithmic) and their characteristics;
- graph a variety of functions using transformations;
- solve a variety of equations using appropriate methods;
- solve linear, quadratic, and polynomial inequalities using appropriate methods;
- solve real-world problems modeled by rational, polynomial, exponential, and logarithmic functions;
- use data analysis techniques to model real-world phenomena using functions;
- demonstrate an understanding of operations on matrices;
- solve real-world problems involving networks, finite graphs, and geometric transformations;
- recognize the difference between continuous and discrete situations;
- demonstrate an understanding of recursive and explicit definitions of functions and sequences;
- use sigma notation to represent arithmetic and geometric series;
- represent a sequence using a list, graph, symbols, and words;
- solve problems using permutations and combinations;
- apply the Binomial Theorem to expansion of binomials;
- use the discriminants of quadratic equations to characterize the nature of the solutions to the equations and the x-intercepts of the graphs of the equations;
- write equations for conic sections and identify characteristics of the related graphs;
- recognize direct- and inverse-variation situations and solve real-world problems involving variation;
- graphs equations of the forms $y = kx$, $y = kx^2$, $y = k/x$ and $y = k/x^2$.

Content Standard: 2.0. Trigonometry

Students will demonstrate an understanding of trigonometric functions and apply them to problem situations and real-world phenomena.

Learning Expectations

The student will:

2.1. apply trigonometry concepts and applications to problem situations;

2.2. connect trigonometric and circular functions;

2.3. interpret trigonometric functions represented graphically.

Student Performance Indicators

The student is able to:

- define the trigonometric functions using the unit circle;
- determine values of the trigonometric functions for special angles using the unit circle and the symmetry of the circle;
- graph the trigonometric functions;
- understand amplitude, period, phase shift, and vertical shift and apply to graphing trigonometric functions;
- use trigonometric functions with appropriate technology to model periodic phenomena;
- verify trigonometric identities graphically and by substitution;
- solve trigonometric equations graphically;
- use degrees and radians interchangeably to represent angle measure in problems and explain the advantages/disadvantages of a particular choice;
- solve real-world problems applying the trigonometric ratios, the Law of Sines, and the Law of Cosines;
- apply the trigonometric formulas for finding the areas of triangles and circular sectors and segments;
- derive the Pythagorean Identities.

TENNESSEE Discrete Mathematics with Statistics & Probability
Standards, Expectations, and State Indicators

Content Standard: 1.0. Discrete Mathematics

Students will investigate meaningful problems individually or in cooperative groups, while using appropriate technology, to apply discrete structures to represent and solve problems.

Learning Expectations

The student will:

1.1. use discrete structures to represent problem situations;

1.2. apply inductive and deductive reasoning to discrete problem situations;

1.3. apply discrete ideas and structures to solve a variety of problems.

Student Performance Indicators

The student is able to:

- apply discrete ideas to solve real-world problems (i.e., election theory, group ranking, and estate planning);
- demonstrate an understanding of the elements, subsets, properties, operations of sets;
- use valid forms of deductive reasoning and logic to make and evaluate arguments;
- represent and solve problems using discrete structures such as finite graphs, matrices, and sequences (e.g., Leslie Model, Leontief Model, Markov Chain, and cryptographic techniques);
- use vertex-edge graphs to solve network problems such as finding circuits, critical paths, minimum spanning trees, and adjacency matrices;
- analyze and use discrete ideas such as induction, iteration, and recurrence relations to solve problems from such fields as Chaos Theory, Map Problems, and fractals;
- create tessellations using reflection, rotation, and translation.

Content Standard: 2.0. Probability

Students will expand basic concepts of probability and apply those concepts to represent and solve problems.

Learning Expectations

The student will:

1.1. demonstrate an understanding of probability distributions;

1.2. apply experimental and theoretical probability in problem solving.

Student Performance Indicators

The student is able to:

- apply number theory topics such as the Fundamental Theorem of Arithmetic, lowest common denominator, greatest common factor, etc. to solve problems using modular arithmetic;
- create and interpret discrete probability distributions;
- use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty;
- derive and use formulas to calculate combinations and permutations;
- understand and apply the concept of a random variable to generate and interpret probability distributions including binomial, uniform, normal, and Chi Square; apply game theory to problem solving.

Content Standard: 3.0 Statistics

Students will select and use appropriate representations and statistical methods to analyze data collected from real-world situations.

Learning Expectations

The student will:

3.1. formulate questions and design appropriate studies;

3.2. select and use appropriate representations to summarize data;

3.3. select and use appropriate statistics to analyze data.

Student Performance Indicators

The student is able to:

- design a statistical experiment to study a problem, conduct the experiment, and communicate and interpret the outcomes;
- understand and apply measures of central tendency, variability, and correlation to summarize data and draw inferences from real-world situations;
- understand sampling and recognize its role in statistical claims;
- conduct and interpret tests for significance using appropriate statistics;
- use curve fitting to make predictions from data;
- construct and draw inferences from charts, tables, and graphs that summarize data from real-world situations.

TENNESSEE PreCalculus

Standards, Expectations, and State Indicators

Content Standard: 1.0. Models for Real-World Phenomena

Students will model and analyze real-world phenomena using techniques from algebra and data analysis.

Learning Expectations

The student will:

1.1. select and use appropriate algebraic functions to model real-world situations;

1.2. select and use appropriate techniques from data analysis to model real-world phenomena.

Student Performance Indicators

The student is able to:

- model real-world phenomena using techniques of data analysis;
- recognize and apply mathematical models of linear, quadratic, exponential, logarithmic, and trigonometric functions;
- use scatterplot residuals, and/or correlation coefficients to determine whether a model is appropriate;
- apply equations and graphs of conic sections to model real-world phenomena;
- use models when appropriate to draw conclusions or make predictions.

Content Standard: 2.0. Algebraic Functions

Students will extend the concepts of function from earlier courses to a wider variety of functions and their graphs and real-world applications.

Learning Expectations

The student will:

2.1. represent a variety of functions graphically;

2.2. use a variety of methods to analyze and interpret functions;

2.3. determine the slope and equations of lines tangent to curves;

2.4. apply functions in problem situations.

Student Performance Indicators

The student is able to:

- sketch the graphs of the basic functions (linear, quadratic, cubic, square root, absolute value, reciprocal, trigonometric, exponential, logarithmic, and greatest integer);
- graph transformations and combinations of transformations for all basic functions;
- analyze functions, such as by decomposing into simpler functions;
- determine if a function is even, odd, or neither;
- use an appropriate technology to solve inequalities;
- demonstrate an understanding of the concept of the limit of a function;
- apply the limit of a function to find the slope of a line tangent to a curve;
- write equations of tangents and normals to conic sections;
- apply limits to develop the concept of continuity and identify intervals of increase and decrease;
- locate critical points on the graphs of polynomial functions and determine if each critical point is a minimum, a maximum, or a point of inflection;
- determine an equation of a rational function from a written description;
- define and use the logarithmic function as the inverse of the exponential function;
- sketch the graphs of exponential and logarithmic functions;
- solve exponential and logarithmic equations modeling real-world problems (e.g. growth and decay).

Content Standard: 3.0. Trigonometric Functions

[no statement at this level]

Learning Expectations

The student will:

3.1. apply trigonometry concepts and applications to model and solve problems;

3.2. use trigonometric concepts to represent, apply, and operate with complex numbers;

3.3. solve trigonometric equations and inequalities algebraically or graphically;

3.4. interpret transformations of trigonometric functions.

Student Performance Indicators

The student is able to:

- define six circular functions;
- sketch graphs of the six trigonometric functions involving period change, amplitude change, phase shift, and/or vertical shift;
- use trigonometric functions to model periodic phenomena;
- use graphs to develop and verify trigonometric identities;
- find values of inverse trigonometric functions, applying appropriate domain and range restrictions;
- solve trigonometric equations and inequalities either algebraically or using graphing technology.
- derive the Law of Sines and the Law of Cosines and apply them to solve problems involving triangles and vectors;
- derive and apply the formulas for the area of a triangle and the sector of a circle;

- understand the relationship between measurements in radians and degrees;
- apply radian measures in problems related to linear and angular velocity;
- understand and apply vectors to solve real world problems;
- represent complex numbers in both rectangular and polar form;
- apply the trigonometric form of complex number in calculations;
- prove and apply DeMoivre's Theorem to find roots and powers of complex numbers.

Content Standard: 4.0. Sequences and Series

Students will develop the concept of limit by examining infinite sequences and series.

Learning Expectations

The student will:

4.1. represent sequences and series;

4.2. determine, when possible, the sums of infinite series.

Student Performance Indicators

The student is able to:

- demonstrate an understanding of sequences by representing them recursively and explicitly;
- use sigma notation to represent a series;
- determine whether a given series converges or diverges;
- find the sum of an infinite series that converges;
- find the sum of an infinite geometric series;
- use the Binomial Theorem to expand binomials.

TENNESSEE Grade 7 Science
Standards, Expectations, and State Indicators

LIFE SCIENCE

Content Standard: 1.0. Cell Structure and Function

The student will investigate the structure and function of plant and animal cells.

Learning Expectations

1.1. Recognize the differences among cells, tissues, organs, and systems.

1.2. Differentiate between the structures and functions of plant and animal cells.

1.3. Recognize that cell division occurs in sequential stages.

1.4. Know that materials move into and out of cells.

State Performance Indicators

The student is able to:

7.1.spi.1. recognize basic structures that most cells share (i.e., nucleus, cytoplasm, cell membrane, cell wall, ribosome, mitochondria, chloroplast, vacuole, lysosome).

7.1.spi.2. identify major cell organelles and their functions.

7.1.spi.3. distinguish between plant and animal cells.

7.1.spi.4. sequence a series of diagrams depicting the movement of chromosomes during mitosis.

7.1.spi.5. determine the relationships among cells, tissues, organs, and systems given a diagram and identify the function of organ systems.

7.1.spi.6. predict the movement of substances through osmosis or diffusion across the cell membrane, given solutions of different concentrations.

Content Standard: 3.0. Food Production and Energy for Life

The student will study the basic parts of plants, investigate how plants produce food, and discover that plants and animals use food to sustain life.

Learning Expectations

3.2. Distinguish between photosynthesis and respiration.

3.3. Describe the movement of oxygen and carbon dioxide between living things and the environment.

State Performance Indicators

The student is able to:

7.3.spi.1. determine what plants need to make food.

7.3.spi.2. identify photosynthesis as the food making process in plants.

7.3.spi.3. select the structures that animals use to obtain oxygen.

7.3.tpi.4. classify animals according to their means of obtaining oxygen.

7.3.spi.5. select the illustration that depicts the movement of oxygen and carbon dioxide between living things and their environment.

7.3.spi.6. identify the reactants and products of photosynthesis and respiration.

7.3.spi.7. associate the processes of photosynthesis and respiration with appropriate cellular organelles.

7.3.spi.8. interpret a diagram depicting the oxygen-carbon dioxide cycle.

Content Standard: 4.0. Heredity and Reproduction

The student will understand the basic principles of inheritance.

Learning Expectations

4.1. Recognize the difference between sexual and asexual reproduction.

State Performance Indicators

The student is able to:

7.4.spi.1. match a flower part with its reproductive function.

7.4.spi.2. distinguish between sexual and asexual methods of reproduction.

7.4.spi.3. recognize advantages and disadvantages of sexual and asexual reproduction.

7.4.spi.4. recognize a variety of pollination methods and associated floral adaptations.

EARTH AND SPACE SCIENCE

Content Standard: 8.0. Atmospheric Cycles

The student will investigate the relationships among atmospheric conditions, weather, and climate.

Learning Expectations

8.1. Interpret the relationship between weather and the water cycle.

8.2. Investigate the relationship between the collection of weather data and its interpretation.

8.3. Explore how changes in oceanic and atmospheric conditions affect climate.

8.4. Explore careers related to meteorology.

= Standards measured by ACT's Science tests
_____ = Standards content sampled by ACT's Science tests

State Performance Indicators

The student is able to:

7.8.spi.1. determine how temperature affects evaporation and condensation in the atmosphere.

7.8.spi.2. identify the detailed features of the water cycle given a diagram (i.e. evaporation, condensation, precipitation, run-off, transpiration.)

7.8.spi.3. analyze data and make predictions about weather given a scenario.

7.8.spi.4. interpret weather data using a weather map.

PHYSICAL SCIENCE

Content Standard: 12.0. Structure and Properties of Matter

The student will investigate the characteristic properties of matter.

Learning Expectations

12.1. Distinguish among elements, compounds, and mixtures.

12.2. Identify and measure the simple properties of common substances.

12.3. Understand that the periodic table is used as a tool for grouping elements.

State Performance Indicators

The student is able to:

7.12.spi.1. determine the measurable properties of matter and appropriate metric units (i.e. weight, mass, volume, density, size (length, width, height), temperature.)

7.12.spi.2. distinguish between elements, compounds, and mixtures (i.e., Na, Cl, NaCl, C, O_2, CO_2, H_2, H_20).

7.12.spi.3. classify substances as elements or compounds from their symbols or formulas.

7.12.spi.4. compare the motion and arrangement of molecules in solids, liquids, and gases.

= Standards measured by ACT's Science tests

_____ = Standards content sampled by ACT's Science tests

TENNESSEE Grade 8 Science
Standards, Expectations, and State Indicators

LIFE SCIENCE

Content Standard: 2.0. Interactions Between Living Things and Their Environment

The student will investigate how living things interact with one another and with non-living elements of their environment.

Learning Expectations

2.3. Identify the major biomes of the world.

State Performance Indicators

The student is able to:

8.2.spi.1. distinguish among commensalism, parasitism, and mutualism.

8.2.spi.2. identify the earth's major biomes.

8.2.spi.3. choose the appropriate biome for an organism, given a description.

8.2.spi.4. identify biotic and abiotic factors in a biome.

Content Standard: 4.0. Heredity and Reproduction

The student will understand the basic principles of inheritance.

Learning Expectations

4.2. examine differences between dominant and recessive traits.

4.3. investigate the relationship among DNA, genes, chromosomes, and the genetic code of life.

4.4. explore careers related to biotechnology.

State Performance Indicators

The student is able to:

8.4.spi.1. differentiate between complete and incomplete metamorphosis.

8.4.spi.2. distinguish between sexual and asexual methods of reproduction.

8.4.spi.3. differentiate between dominant and recessive traits.

8.4.spi.4. predict the genotypes of offspring in a monohybrid cross using a Punnett Square.

8.4.spi.5. select models or illustrations that are representations of DNA.

8.4.spi.6. associate a change in a DNA molecule with a mutation.

8.4.spi.7. identify types of genetic engineering (i.e. gene splicing and cloning) and evaluate the impact of genetic engineering on society.

Content Standard: 5.0. Diversity and Adaptation Among Living Things

The student will understand that living things have characteristics that enable them to survive in their environment.

Learning Expectations

5.2. Identify characteristics used by scientists to classify organisms into different categories.

State Performance Indicators

The student is able to:

8.5.spi.1. identify similarities and differences among organisms.

8.5.spi.2. classify plants and animals into groups according to their features.

8.5.spi.3. infer the relatedness of different organisms.

8.5.spi.4. use a simple classification key to identify an unknown organism.

8.5.spi.5. determine the genus and species of an organism using a dichotomous key.

EARTH AND SPACE SCIENCE

Content Standard: 9.0. Earth Features

The student will understand that the earth has many geological features that are constantly changing.

Learning Expectations

9.1. Understand the characteristics of the earth's layers and the locations of major plates.

9.2. Describe the forces and processes that shape the earth.

State Performance Indicators

The student is able to:

8.9.spi.1. label a cross section of the earth.

8.9.spi.2. identify the major plates of the world.

8.9.spi.3. recognize the relationship between continental drift and plate tectonics.

8.9.spi.4. deduce plate movements as the major cause of geological events.

Content Standard: 10.0. Earth Resources

The student will investigate the properties, uses, and conservation of the earth's resources.

Learning Expectations

10.1. Investigate the characteristics of minerals and their uses.

10.2. Describe the rock cycle.

10.3. Investigate how human activities affect the earth's land, oceans, and atmosphere.

= Standards measured by ACT's Science tests
_____ = Standards content sampled by ACT's Science tests

10.4. Examine various types of energy resources and their importance to man.

10.5. Analyze approaches to conserving energy and natural resources.

State Performance Indicators

The student is able to:

8.10.spi.1. identify factors that cause rocks to break down.

8.10.spi.2. distinguish between renewable and nonrenewable resources.

8.10.spi.3. identify various energy sources.

8.10.spi.4. distinguish among sedimentary, igneous, and metamorphic rocks and interpret a simple rock cycle diagram.

8.10.spi.5. infer that human activities may be helpful or harmful to the environment.

8.10.spi.6. identify rocks and minerals given a table of physical properties.

PHYSICAL SCIENCE

Content Standard: 11.0. Forces and Motion

The student will investigate the effects of force on the movement of objects.

Learning Expectations

11.1. Distinguish between speed and velocity.

11.2. Demonstrate an understanding of Newton's three laws of motion.

11.3. Identify factors that influence gravitational force between objects.

11.4. Identify simple machines and their uses.

State Performance Indicators

The student is able to:

8.11.spi.1. recognize that forces cause changes in speed and/or the direction of motion.

8.11.spi.2. identify simple machines.

8.11.spi.3. recognize the relationship between mass, force and acceleration.

8.11.spi.4. identify the relationship between the mass of objects, the distance between them and the amount of gravitational attraction

8.11.spi.5. choose the most appropriate simple machine to use for a specific task.

8.11.spi.6. identify Newton's three laws of motion and relate the first two laws to the concepts of inertia and momentum.

8.11.spi.7. solve problems pertaining to distance, speed, velocity, and time, given illustrations, diagrams, graphs, or scenarios.

Content Standard: 13.0. Interactions of Matter

The student will investigate the interactions of matter.

Learning Expectations

13.1. Understand the differences between acids and bases and how indicators are used.

13.2. Differentiate between physical and chemical changes.

13.3. Understand what a chemical equation represents.

State Performance Indicators

The student is able to:

8.13.spi.1. distinguish between physical and chemical changes.

8.13.spi.2. identify a substance as an acid or a base, given its pH.

8.13.spi.3. recognize that the mass of the reactants is the same as the mass of the products, given simple chemical equations

8.13.spi.4. determine how temperature and concentration might affect the rate of a chemical reaction.

8.13.spi.5. classify a reaction as exothermic or endothermic.

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_____ = Standards content sampled by ACT's Science tests

TENNESSEE Earth Science

Standards, Expectations, and State Indicators

Content Standard: 1.0. Earth System

The student will investigate the origin, composition, and structure of the universe.

Learning Expectations

The student will:

1.1. explore the theories of the origin of the universe and its vastness.

1.2. examine the components of the solar system.

1.3. examine the sun, earth, moon relationships and their gravitational effects.

1.4. investigate the exploration of space.

Performance Indicators

The student is able to:

- identify the components of the universe: galaxies, solar systems, stars, planets, meteors, comets, and asteroids.
- understand the seasons and the phases of the moon.
- draw the position of the sun, earth, and moon during eclipses and lunar phases.
- predict tidal conditions based on the position of the earth and moon.
- investigate the history of space exploration.
- discuss the theories of the origin of the universe: Big Bang and Oscillating/Pulsating.
- construct a model of our solar system with emphasis on ratio and proportions of both distance and size of planets.
- explain the evolution of a star through all stages of its potential development.
- classify galaxies according to their shapes.
- explore the role of astronomical events in Earth history (e.g., asteroid/meteor impacts, solar flares, and comets).
- investigate the relationship between the length of the day and the inclination and relative position of the sun to the earth (seasons).
- interpret a tide chart using an almanac or the Internet.
- describe the relationship between mass and gravity.
- construct a historical timeline of man's changing perceptions and knowledge regarding astronomy.
- explore recent developments in space exploration.
- explore the benefits of space technology in our everyday lives.
- compare and contrast earth to other planets in our solar system.
- research Tennessee's contribution to earth and space science.
- research a career related to Earth systems such as: astronomer, astronaut, planetary geologist, aerospace engineer, and astrophysicist.

Content Standard: 2.0 Energy in the Earth System

The student will explore issues associated with energy use in the Earth system.

Learning Expectations

The student will:

2.1. investigate energy sources.

2.2. explore energy transfer pathways.

2.3. evaluate alternative energy sources.

Performance Indicators

The student is able to:

- differentiate among the forms of energy (light, heart, mechanical, and chemical).
- illustrate the three types of energy transfer (radiation, conduction, and convection) and give examples.
- describe energy resources (e.g., fossil fuels, solar, geothermal, nuclear, wind, and hydroelectric).
- distinguish between renewable and nonrenewable resources and their conservation.
- investigate the sun as the major source of the Earth's energy.
- explore the three primary sources of internal energy: gravitational energy from the earth's original formation, friction, and radioactive decay.
- reflect upon a teacher demonstration of energy conservation (e.g., driving a nail into a board or mixing vinegar and baking soda).
- diagram and evaluate pathways of energy transfer to demonstrate the law of conservation of energy.
- relate the transfer of energy through the geologic cycles: mantle convection, wind, and ocean currents.
- describe the impact of energy transfer on human activity (hurricanes, crops growing—photosynthesis, volcanic eruptions, tsunamis).
- compare and contrast alternative energy sources and their environmental impact.
- research careers that relate to energy in the earth system such as nuclear engineer, chemical engineer, environmental engineer, geochemical scientist, materials engineer, geologists, meteorologist, and hydrologist.
- debate issues related to energy sources, resources, and local impact.

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Content Standard: 3.0. Cycles in the Earth System

The student will investigate the principal features of the cycles in the Earth system.

Learning Expectations

The student will:

3.1. explain the components of the tectonic cycle.

3.2. investigate the rock cycle.

3.3. analyze the hydrologic cycle.

3.4. interpret and assimilate data related to the atmospheric cycle.

3.5. differentiate between the geo-chemical (Earth system) cycles.

3.6. evaluate the role of living organisms within the Earth system cycles.

3.7. investigate maps.

Performance Indicators

The student is able to:

- explore continental drift/plate tectonics theory using models.
- distinguish between minerals and rocks.
- distinguish among sedimentary, igneous, and metamorphic rocks.
- diagram the rock cycle including the processes.
- label the parts of the hydrologic cycle, given a diagram.
- collect and interpret basic weather data from meteorological instruments (thermometer, rain gauge, dry/wet thermometer, and barometer).
- demonstrate physical and chemical weathering.
- recognize the basic geochemical cycles: oxygen/carbon dioxide cycle, nitrogen cycle, and carbon cycle.
- distinguish between diverging and converging plate boundaries using a labeled diagram of mantle convection currents.
- explain and map the relationship between plate tectonics to mountain building, volcanoes, and earthquakes.
- identify mineral samples using simple property tests (hardness, luster, streak, cleavage/fracture and perhaps specific gravity, acid, shape, and taste).
- identify rock samples as sedimentary, igneous, or metamorphic.
- identify uses of rocks and minerals.
- describe the role of water (i.e. weathering, groundwater, river systems, glaciers, and oceans) in the evolution of landform processes.
- analyze weather data and make simple predictions using weather maps.
- understand the interrelationships among the geochemical cycles: a fixed amount of each stable element cycles through the earth systems (the law of conservation of mass).
- recognize the interrelationships of geologic processes and human activity (e.g., floods, earthquakes, volcanoes, acid rain, and global warming).
- write an essay on how geology affects your everyday life.
- read and interpret topographic maps.
- construct the geological cycle for a physiographic region or geologic time period in Tennessee.
- investigate careers that relate to geology, such as mineralogist, geologist, meteorologist, volcanologist, gemologist, seismologist, paleontologist, and others.

Content Standard: 4.0. Geologic History

The student will explore the geologic history of the Earth.

Learning Expectations

The student will:

4.1. interpret and evaluate the nature of geologic time.

4.2. investigate the evolution of Earth.

4.3. interpret and evaluate the evidence for biological evolution in the fossil record.

4.4. demonstrate the effect of the environment on the formation and extinction of species.

Performance Indicators

The student is able to:

- explain the law of uniformitarianism.
- recognize that fossils are found in sedimentary rock.
- construct mock fossils.
- compare and contrast fossils to modern organisms.
- recognize the difference between absolute and relative time (i.e. using a family tree.)
- recognize that fossils contained in sedimentary rock provide clues to life forms, changes in those life forms, and environmental changes.
- examine the fossil record to determine the adaptations of organisms.
- cite and explain the evidence for plate tectonics (fossil record, mountain ranges, rock strata, paleomagnetism, paleoclimates, and configuration of the continents.)
- compare and contrast the mechanisms for determining the advance of geologic history: relative and absolute dating.
- construct and interpret a geologic timetable for the evolution of Earth and the history of life.
- differentiate the relative age of various fossils in sedimentary rock, given a diagram of rock strata.
- interpret the sequence of rock strata using superposition, cross cutting relationships, inclusions, the fossil record, and absolute data techniques.

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_____ = Standards content sampled by ACT's Science tests

- create a diorama that depicts the ancient environment or habitat in which a given fossil existed.
- predict how environmental changes affect the development of new species or extinction of an existing species, given a written scenario.
- describe what a geologic time traveler might see in the future of Tennessee.

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TENNESSEE Ecology

Standards, Expectations, and State Indicators

Content Standard: 1.0. Ecological Principles

The student will investigate factors that influence and are influenced by the natural environment.

Learning Expectations

The student will:

1.1. understand the structure and function of ecosystems.

1.2. explore the major biomes of the earth and the biodiversity associated with these biomes.

1.3. analyze and interpret population dynamics.

1.4. relate earth processes to ecosystem dynamics.

1.5. understand interdependence in ecosystems.

1.6. explore factors affecting the vulnerability of a species to extinction.

State Performance Indicators

The student is able to:

- illustrate that energy for life is provided by the sun that is captured by plants through photosynthesis.
- draw a food web, given organisms and their role in the environment.
- trace the flow of energy and the cycling of matter between living systems and the physical environment.
- explore the biodiversity in various biomes.
- explain how variations within a species affects the likelihood of survival.
- discuss ways that populations can change over time.
- describe the effect of natural disasters on ecosystems.
- explain the chemical components of biological processes such as photosynthesis, respiration, nitrogen fixation, or decomposition.
- trace energy flow in an ecosystem.
- illustrate that the abundance and distribution of living organisms are limited by available energy and certain forms of matter.
- investigate a specific biome and make a class presentation.
- read and interpret population graphs and list the factors that might result in the trend represented in the graphs.
- analyze the relationship of habitat change to plant and animal population density.
- describe succession in ecosystems.
- investigate the effect of varying one factor in a mini-ecosystem.
- investigate how an experimental population changes over time.
- create a model or a cross-sectional drawing that shows surface-and groundwater flows in a local water site.
- construct food webs for organisms in an ecoregion in Tennessee.

Content Standard: 2.0 Human Population Dynamics

The student will understand the nature of human population dynamics.

Learning Expectations

The student will:

2.1. examine factors affecting human population dynamics.

2.2. consider the consequences of human population growth.

2.3. investigate approaches that address overpopulation.

State Performance Indicators

The student is able to:

- recognize that the world population has changed significantly.
- characterize countries as well developed or poorly developed, and identify countries that are approaching population stability.
- give examples of the major causes of the population explosion.
- list economical and ecological consequences of population growth.
- describe what is meant by demographic transition.
- analyze the sustainability of current trends in world population growth and natural resource consumption using the concept of carrying capacity.
- compare population profiles for different countries.
- describe the economic impact of population growth.
- discuss how health care and education can affect the birth rate.
- discuss how a shift from a largely rural society to a predominantly urban one influences perceptions of the environment.
- recognize diverse cultural views about the relationship between humans and their environment.
- summarize actions individuals can take toward producing a stable world population.
- analyze demographic data for relationships.

Content Standard: 3.0. Natural Resources

The student will survey non-energy natural resources and their conservation.

Learning Expectations

The student will:

3.1. explore the types, uses, and history of non-energy renewable and nonrenewable resources.

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3.2. investigate methods of conservation of common non-energy resources.

3.3. determine the impact of waste production and management on the environment.

State Performance Indicators

The student is able to:

- list examples of renewable and nonrenewable resources.
- describe major historic eras of human history.
- identify ways that society conserves and wastes resources.
- recognize that there are limits to the use of natural resources.
- evaluate the use and future status of the major renewable and nonrenewable nonenergy resources.
- predict the effect of shortages of major non-energy resources.
- evaluate conservation methods for natural resources
- compare and contrast the impact of waste management methods on resource reserves.
- analyze an industry or government that attempts to reduce waste production.
- investigate an environmental problem that was caused by industry or government.
- develop a plan for the conservation of a specific natural resource.

Content Standard: 4.0. Energy

The student will analyze energy use and its environmental consequences.

Learning Expectations

The student will:

4.1. explore both conventional and alternative energy sources.

4.2. understand the types of energy related pollution.

4.3. compare various methods of energy conservation.

State Performance Indicators

The student is able to:

- list examples of renewable and nonrenewable energy sources.
- compare and contrast energy sources in terms of their impact on the environment.
- discuss the pros and cons of utilizing alternative energy sources.
- list steps that individuals and corporations can take to conserve energy.
- describe how flowing water and wind can be used to generate electricity.
- evaluate the consequences of continued reliance on fossil fuels.
- formulate a plan for converting to renewable energy sources while conserving current energy sources.
- describe how solar energy can be used as a home energy supply.
- describe how geothermal energy can be utilized by mankind.
- evaluate nuclear power as a means of energy production.
- compare different means of generating electricity in terms of efficiency and production of unwanted heat energy.
- design a house that would be virtually independent of fossil fuels for electricity and heating.

Content Standard: 5.0. Human Interaction with the Environment

The student will trace the interaction of humans with their environment.

Learning Expectations

The student will:

5.1. understand causes, environmental effects, and methods for controlling pollution.

5.2. investigate the environmental impact on human health.

5.3. explore the relative sustainability of various practices in the areas of watershed management, agriculture, solid waste management, wastewater management, and development.

State Performance Indicators

The student is able to:

- investigate environmental careers that relate to pollution, environmental health, and/or sustainability, such as environmental engineer, environmental toxicologist, water quality manager, environmental toxicologist, epidemiologist, environmental analyst, endocrinologist, city planner, extension agent, farmer, land developer, and public health inspector.
- investigate the effects of acid rain on the environment.
- compare and contrast pollution problems in different places in TN or in the US, given data.
- conduct and interpret the results of various water quality tests.
- apply the concept of trade-off to the analysis of issues related to prevention, control, and remediation of pollution, given a scenario.
- enumerate potential health effects of exposure to various environmental hazards.
- identify appropriate risk-reduction actions, given an exposure-risk scenario.
- compare the costs and benefits of Integrated Pest Management (IPM).
- compare and contrast past and present agricultural practices, including current Best Management Practices, in terms of their environmental impact.

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- evaluate the impact of various human activities on watersheds and suggest possible mitigation measures to protect these areas.
- explain the chemistry associated with various pollution problems.
- describe how the concentration of harmful substances can increase at successive levels in a food chain.
- research the history of agriculture, including changes in technologies, values and attitudes, legislation, and local and global interactions.
- conduct a study of a local watershed.

Content Standard: 6.0. Personal and Civic Responsibility

The student will conduct activities that illustrate environmental responsibility and stewardship.

Learning Expectations

The student will:

6.1. evaluate and articulate his/her own personal views concerning the environment.

6.2. recognize his/her rights and responsibilities as a citizen in maintaining a healthy environment.

State Performance Indicators

The student is able to:

- analyze the effects of his/her personal actions on the environment.
- identify ways that he or she can contribute to environmental quality in his or her community.
- support a position on a critical environmental issue.
- describe the potential impact of citizen participation on issues related to the environment and their community.
- conduct an environmental activity that provides a solution to an environmental problem.
- develop an action plan for addressing an environmental issue and to participate thoughtfully and effectively in environmental decision-making.

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TENNESSEE Environmental Science
Standards, Expectations, and State Indicators

Content Standard: 1.0. Ecological Principles

The student will investigate factors that influence and are influenced by the natural environment.

Learning Expectations

The student will:

1.1. understand the structure and function of ecosystems.

1.2. explore the major biomes of the earth and the biodiversity associated with these biomes.

1.3. analyze and interpret population dynamics.

1.4. relate earth processes to ecosystem dynamics.

1.5. understand interdependence in ecosystems.

1.6. explore factors affecting the vulnerability of a species to extinction.

State Performance Indicators

The student is able to:

- categorize organisms as producers, consumers, or decomposers, given a description of their environment.
- identify commensalism, parasitism, and mutualism, given a scenario with examples.
- construct and interpret graphs associated with an organism's needs within a habitat.
- recognize that energy for life is provided by the sun and is captured by plants through photosynthesis.
- label the parts of a the hydrological cycle.
- draw a food web, given organisms and their role in the environment.
- select animals or plants indigenous to an environment by examining pictures or scenarios.
- determine the biome in which an animal or plant lives, given a description.
- trace the flow of energy and the cycling of matter between living systems and the physical environment.
- explore the biodiversity of various biomes.
- explain how variations within a species affects the likelihood of survival.
- discuss ways that populations can change over time.
- trace energy flow in ecosystems.
- illustrate that the abundance and distribution of living organisms are limited by available energy and certain forms of matter.
- research a specific biome and make a class presentation.
- read and interpret a population graph.
- describe succession in ecosystems.
- relate climate to biome type.
- identify possible causes of extinction.
- observe examples of interdependence in a mini-ecosystem.
- analyze the relationship of habitat changes to plant and animal population density.
- construct food webs for organisms in an ecoregion of Tennessee.

Content Standard: 2.0 Human Population Dynamics

The student will understand the nature of human population dynamics.

Learning Expectations

The student will:

2.1. examine factors affecting human population dynamics.

2.2. consider the consequences of human population growth.

2.3. investigate approaches that address overpopulation.

State Performance Indicators

The student is able to:

- compare ancient populations to present populations.
- analyze the role of agriculture in relation to human population growth.
- identify the major causes of the population explosion.
- describe the economic impact of population growth.
- discuss how health care and education affect population growth rates.
- list the ecological consequences of continued population growth.
- discuss the pros and cons of lowering reproductive rates as a possible solution to the population problem.
- compare population profiles for different countries.
- recognize diverse cultural views about the relationship between humans and their environment.
- summarize actions individuals can take toward producing stable world population.

Content Standard: 3.0. Natural Resources

The student will survey non-energy natural resources and their conservation.

Learning Expectations

The student will:

3.1. explore the types, uses, and history of non-energy renewable and nonrenewable resources.

3.2. investigate methods of conservation of common non-energy resources.

3.3. determine the impact of waste production and management on the environment.

= Standards measured by ACT's Science tests
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State Performance Indicators

The student is able to:

- list examples of renewable and nonrenewable resources.
- describe major eras of human history.
- evaluate the benefits and drawbacks of man's use of mineral resources.
- list ways that society conserves and wastes resources.
- distinguish between layers of soil using characteristics such as composition, texture, and plant and animal influences.
- interpret the effectiveness of various conservation strategies on air, water, and soil.
- research how technological advances have impacted the environment, such as fertilizers, freon, and acid rain.
- recognize that there are limits to the use of natural resources.
- evaluate the use and status of the major renewable and nonrenewable non-energy resources.
- predict the effect of shortages of major mineral resources.
- evaluate conservation methods for natural resources.
- compare and contrast the impact of waste management methods on resource reserves.
- develop a plan for the conservation of a specific natural resource.

Content Standard: 4.0. Energy

The student will analyze energy use and its environmental consequences.

Learning Expectations

The student will:

4.1. explore both conventional and alternative energy sources.

4.2. understand the types of energy related pollution.

4.3. compare various methods of energy conservation.

State Performance Indicators

The student is able to:

- list examples of renewable and nonrenewable energy sources.
- list examples of various energy resources and describe their origins.
- interpret the difference amount and kind of energy resources used in an area from provided graphs.
- research and report on the importance of energy conservation.
- discuss fossil fuel exploration, reserves, and production.
- research careers that relate to energy, heat, or electricity.
- compare and contrast energy sources in terms of their impact on the environment.
- discuss the pros and cons of utilizing alternative energy sources.
- list steps that individuals and corporations can take to conserve energy.
- demonstrate how solar energy can be used as a home energy supply.
- describe how geothermal energy can be utilized by mankind.
- evaluate nuclear power as a means of energy production.
- describe how flowing water and wind can be used to generate electricity.
- evaluate the consequences of continued reliance on fossil fuels.
- compare the energy efficiency of major appliances.

Content Standard: 5.0. Human Interaction with the Environment

The student will trace the interaction of humans with their environment.

Learning Expectations

The student will:

5.1. understand the causes, environmental effects, and methods for controlling pollution.

5.2. investigate the environmental impact on human health.

5.3. explore the relative sustainability of various practices in the areas of watershed management, agriculture, solid waste management, wastewater management, and development.

State Performance Indicators

The student is able to:

- investigate environmental careers that relate to pollution, environmental health, and/or sustainability, such as environmental engineer, environmental toxicologist, water quality manager, environmental toxicologist, epidemiologist, environmental analyst, endocrinologist, city planner, extension agent, farmer, land developer, and public health inspector.
- compare and contrast pollution problems in different places in TN or in the US, given data.
- identify sources of contaminated runoff, given a map with land uses indicated.
- research the causes and potential environmental effects of specific air and water pollution problems, given access to governmental websites and other resources.
- identify potential health effects of exposure to various environmental hazards, including radon, UV radiation, ground-level ozone, and cigarette smoke.
- suggest risk-reduction actions for potentially hazardous substances.

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_____ = Standards content sampled by ACT's Science tests

- compare and contrast various practices in terms of their relative sustainability and economic, societal and environmental impact.
- evaluate and identify conservation measures in the home and create a personal conservation plan.
- identify the effects of ozone depletion and Global Warming.
- interpret data on ground level ozone, acid rain, and stratospheric ozone, given color-coded maps.
- construct an appropriate Integrated Pest Management plan, given a pest problem scenario.
- compare and contrast different agricultural practices in terms of their environmental impact.

Content Standard: 6.0. Personal and Civic Responsibility

The student will understand his/her personal and civic responsibility concerning issues related to the environment.

Learning Expectations

The student will:

6.1. evaluate and articulate his/her own personal views concerning the environment.

6.2. recognize his/her rights and responsibilities as a citizen in maintaining a healthy environment.

State Performance Indicators

The student is able to:

- analyze the effects of his/her personal actions on the environment.
- identify ways that he/she can contribute to environmental quality in their community.
- articulate a position on a critical environmental issue.
- describe the potential impact of citizen participation on issues related to the environment and their community.
- develop an action plan for addressing an environmental issue and participate thoughtfully and effectively in environmental decision-making.

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Content Standard: 1.0. Maps

The student will develop map interpretation skills for topographic and geologic features.

Learning Expectations

The student will:

1.1. read and interpret topographic maps.

1.2. investigate rock types, time periods, and faults from geologic maps.

1.3. investigate technologies used to map various features.

1.4. apply maps to solve land-use problems and for planning.

State Performance Indicators

The student is able to:

- identify longitude and latitude lines.
- investigate the concept of scale as it applies to maps.
- identify basic map symbols and legends.
- define common rock types.
- define elevation.
- determine latitude and longitude of specific map points.
- determine scaled map distances.
- determine elevations of specific points from a topographic map.
- recognize basic topographic map symbols from a legend/key.
- construct a 3-D representation of a topographical map or construct contour lines from a 3-D model.
- construct a profile from a topographic map.
- identify landforms and direction of stream flow using a topographic map.
- interpret basic rock types, time periods, and faults from geologic maps.
- determine and measure compass readings from selected sites.
- identify practical applications for map interpretation skills.
- investigate methods of remote sensing for measuring and monitoring the earth's crust.
- use a GPS instrument to identify latitude, longitude, and elevation of a location.
- create a topographic map of a landform from collected data.
- successfully navigate an orienteering course.

Content Standard: 2.0 Matter and Minerals

The student will explore matter and how it relates to the formation of minerals.

Learning Expectations

The student will:

2.1. investigate the atom as the basic building block of all matter.

2.2. apply the periodic table as a learning tool.

2.3. investigate the structure, geometry, and shape of crystals.

2.4. distinguish between physical and chemical properties of minerals.

2.5. investigate the location, abundance, and use of minerals.

State Performance Indicators

The student is able to:

- classify a substance as being made of atoms or molecules given its chemical symbol or formula.
- select groups of elements as being reactive or nonreactive metals, nonmetal, or gases, given the periodic table.
- recognize that water is the major solvent that releases minerals from the earth.
- evaluate the benefits and drawbacks of man's use of mineral resources given a scenario.
- identify characteristics of all minerals (e.g., naturally occurring, inorganic, solid, definite structure, and composition).
- recognize or create a representative model of an atom, using the periodic table.
- build models of the six major crystal systems.
- recognize that the crystal form of minerals depends upon atomic size, method of bonding, and the environment.
- identify mineral samples using simple property tests (hardness, luster, streak, cleavage/fracture, specific gravity, and other special properties) and a mineral table.
- explore the role of gems as minerals and their value to man.
- create a presentation on minerals including a description (specific gravity, crystalline system, chemical formula, physical properties, etc,) an illustration, mining techniques, occurrences, and uses.
- classify minerals (silicates, native elements, carbonates, and sulfates), using chemical formulas.
- create a brochure on the mineral resources of Tennessee.
- investigate technological advances related to minerals including their excavation and use (mining and removal techniques).

= Standards measured by ACT's Science tests
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Content Standard: 3.0. Rocks and the Rock Cycle

The student will investigate the three rock classes and the rock cycle.

Learning Expectations

The student will:

3.1. identify and differentiate among the three rock classes.

3.2. examine the processes responsible for forming the three rock classes.

3.3. examine characteristics within each rock class.

3.4. analyze and interpret the rock cycle.

State Performance Indicators

The student is able to:

- distinguish among sedimentary, igneous, and metamorphic rocks.
- diagram the rock cycle including the processes involved in the formation of each rock class.
- recognize that rocks are composed of minerals.
- identify rock uses.
- distinguish between intrusive (plutonic) and extrusive (volcanic) igneous rocks.
- identify common igneous rocks (e.g., granite, rhyolite, basalt, gabbro, obsidian, pumice) using physical properties and a table.
- identify plutonic bodies (e.g., sill, dike, batholith, and laccolith).
- understand sedimentary processes.
- distinguish between clastic vs. non-clastic and detrital vs. chemical.
- identify sedimentary rock features such as stratification, fossils, graded bedding, ripple marks, and mud cracks.
- identify basic sedimentary rocks (e.g., sandstone, shale, limestone, coquina, coal, conglomerate) using physical properties and a table.
- differentiate between foliated and non-foliated metamorphic rocks.
- compare and contrast regional and contact metamorphism.
- identify common metamorphic rocks (e.g., gneiss, marble, schist, slate, quartzite) using physical properties and a table.
- interpret and explain Bowen's reaction series.
- explain gradational metamorphism with index minerals and metamorphic rock types using a table.

Content Standard: 4.0. Geologic History

The student will explore the geologic history of the Earth and evidence of life through time.

Learning Expectations

The student will:

4.1. interpret and evaluate the nature of geologic time.

4.2. investigate the evolution of Earth.

4.3. investigate the history of life.

4.4. interpret and evaluate the fossil record for evidence of biological evolution.

4.5. demonstrate the effect of the environment in the formation and extinction of species through geologic time using fossils.

State Performance Indicators

The student is able to:

- recognize how scientists estimate the age of the Earth.
- explain the law of uniformitarianism.
- recognize that fossils are found in sedimentary rock.
- construct mock fossils.
- compare and contrast fossil forms of life to modern organisms.
- recognize the difference between absolute and relative time (i.e., using a family tree).
- recognize that fossils contained in sedimentary rock provide evidence for life forms, changes in those life forms, and environmental changes.
- examine the fossil record to determine the environmental adaptations of organisms.
- cite and explain the evidence for plate tectonics (e.g., fossil record, mountain ranges, rock strata, paleomagnetism, paleoclimates, and configuration of the continents.).
- compare and contrast the mechanisms for determining the advance of geologic history: relative and absolute dating.
- construct and interpret a geologic timetable for the evolution of Earth and the history of life.
- differentiate the relative age of various fossils in sedimentary rock, given a diagram of rock strata.
- interpret the sequence of rock strata using superposition, cross cutting relationships, inclusions, the fossil record, and absolute data techniques.
- create a diorama that depicts the ancient environment or habitat in which a particular fossil existed.
- predict how environmental changes will affect the development of a new species or extinction of an existing species, given a written scenario.
- describe what a geologic time traveler might see in the future of Tennessee.

Content Standard: 5.0. Plate Tectonics

The student will relate the theory of plate tectonics to the evidence for continental drift and seafloor spreading.

Learning Expectations

The student will:

5.1. recognize different types of plate boundaries (e.g., divergent, convergent, and transform including continental vs. oceanic).

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5.2. interpret evidence for plate tectonics using paleomagnetism, fossil record, continental boundaries, and hot spots.

5.3. recognize that convection currents are the driving mechanisms for plate tectonics.

5.4. describe the processes associated with volcanoes, earthquakes, and mountain building.

State Performance Indicators

The student is able to:

- identify plate boundaries on diagrams.
- match boundaries of continents by shape as evidence of plate tectonics.
- identify the layers of the earth's structure.
- identify geologic features associated with divergent, convergent, and transform (continental and oceanic) plate boundaries.
- identify the evidence for plate tectonics using paleomagnetism, fossil record, continental boundaries, and hot spots.
- describe how convection currents drive plate tectonics.
- associate volcanoes and earthquake activity with plate boundaries using a map.
- distinguish among reverse, normal, and strike-slip faults.
- distinguish between anticline and syncline.
- label illustrations of movement of convection cells within mantle and their relationship to convergent and divergent plate boundaries.
- correlate plate movement by plotting movement of hot spots through time.
- predict the location and arrangement of the continents at a specified future time.
- describe the location of the Hawaiian islands at a specified future time.

Content Standard: 6.0. Landforms

The student will investigate landforms created by many different surficial processes and their relationships to various sources of energy in the Earth System.

Learning Expectations

The student will:

6.1. investigate the hydrosphere and its effect on various relationships to landforms.

6.2. associate surface processes such as wind, glaciers, gravity, oceans, rivers, and mankind with resulting landforms.

6.3. understand the role of groundwater.

State Performance Indicators

The student is able to:

- recognize that the earth's geologic features change.
- illustrate the hydrologic cycle and distinguish among condensation, evaporation, precipitation, transpiration, groundwater, runoff, bodies of water, etc.
- recognize groundwater as a major source of fresh water.
- describe the landforms associated with deserts, glaciers, shorelines, and rivers.
- describe the nature of groundwater and define the elements of groundwater features.
- discuss stream discharge using the Tennessee River or local stream system as an example.
- describe the fluvial processes of erosion, transportation, and deposition.
- illustrate various drainage basin models and identify different types of drainage patterns.
- relate the characteristics of a river's age with respect to its velocity, channel shape, depth, and discharge.
- explain the processes by which a stream erodes and transports its load (suspension, saltation, and bedload).
- identify meanders, point bars, cut bank, and cutoffs using a map (e.g., lower Mississippi River).
- define a floodplain and describe the behavior of a stream channel and natural levee formation during a flood.
- describe the formation of river deltas.
- investigate careers associated with water systems.
- investigate the influence of landforms on man's cultural, social and economic development.

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Content Standard: 1.0. Cells

The student will investigate the structures and functions of the cell membrane, cellular organelles, and component biomolecules related to the major cell processes.

Learning Expectations

The student will:

1.1. compare and contrast the chemistry of biomolecules and investigate their roles in cell structure and metabolism.

1.2. explore and compare the organelles of different cell types.

1.3. probe the composition of the cell membrane and it significance to homeostasis.

1.4. analyze the various cell processes.

Performance Indicators

The student is able to:

- identify major cellular organelles, given a diagram.
- distinguish between plant and animal cells, given diagrams or scenarios.
- predict the movement of water molecules across the cell membrane, given solutions of different concentrations.
- compare and contrast the cell cycle in plant and animal cells, given a diagram.
- relate the structure of the cell membrane to the role of maintaining homeostasis.
- define selective permeability, homeostasis, and plasmolysis.
- distinguish between proteins, carbohydrates, and lipids.
- distinguish between active and passive transport, given different molecules and concentrations.
- distinguish among various types of nucleic acids.

Content Standard: 2.0. Ecological Interactions

The student will investigate the relationship and interaction between living organisms and their environment.

Learning Expectations

The student will:

2.1. distinguish between abiotic and biotic factors in the environment.

2.2. compare populations, communities, and ecosystems.

2.3. analyze the flow of nutrients and energy in an environment.

2.4. distinguish among producers, consumers, and decomposers in food chains, food webs, and ecological pyramids.

2.5. distinguish between autotrophs and heterotrophs by comparing plant and animal structures.

2.6. contrast different types of symbiotic relationships.

2.7. explore how human activities can affect the balance of an ecosystem.

Performance Indicators

The student is able to:

- distinguish between abiotic and biotic factors in an environment.
- distinguish among populations, communities, and ecosystems, given examples.
- examine nutrient and energy relationships in an energy pyramid.
- classify organisms as producers, consumers, and decomposers, given their behavior and environment.
- infer how human activities can affect the balance of an ecosystem.
- differentiate among symbiotic relationships, given descriptions of commensalism, parasitism, and mutualism.
- interpret population growth curves.

Content Standard: 3.0. Energy Production and Use

The student will compare and contrast the processes involved in the transfer of energy during photosynthesis and respiration.

Learning Expectations

The student will:

3.1. identify the reactants and products of photosynthesis and respiration.

3.2. compare and contrast the processes of photosynthesis and respiration.

3.3. analyze the carbon, oxygen, and water cycles.

3.4. distinguish between aerobic and anaerobic respiration.

Performance Indicators

The student is able to:

- identify the cell organelles in which photosynthesis and respiration occur, given diagrams or descriptions.
- identify the reactants and products of photosynthesis and respiration, given equations.
- interpret carbon, oxygen, and water cycles, given diagrams.
- distinguish between aerobic and anaerobic respiration, given descriptions.
- analyze the relationship between photosynthesis and respiration, given diagrams and descriptions.

Content Standard: 4.0. Reproduction and Inheritance

The student will investigate how patterns of inheritance are linked to reproduction and infer that hereditary information contained in DNA is transmitted from parent to offspring.

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Learning Expectations

The student will:

4.1. distinguish between sexual and asexual reproduction.

4.2. organize the stages of cell division sequentially for mitosis and meiosis.

4.3. distinguish between dominant and recessive traits.

4.4. distinguish between purebred and hybrid traits.

4.5. explore various modes of inheritance (i.e., co-dominance, incomplete dominance, multiple alleles, sex-linked, and polygenic traits) using the principles of Mendelian inheritance.

4.6. relate genetic mutations with changes in DNA.

4.7. distinguish between mitosis and meiosis.

Performance Indicators

The student is able to:

- distinguish between asexual and sexual reproduction, given examples.
- distinguish between mitosis and meiosis.
- recognize the inheritance of traits using a Punnett Square.
- identify the dominant trait resulting from a monohybrid cross, using the genotypes of the parents.
- determine the phenotype given a particular gene combination.
- determine the genotypic and phenotypic ratio of a monohybrid cross.
- determine the dominant and recessive trait given the phenotypic ratios from a monohybrid cross.
- determine the number of chromosomes following mitosis and meiosis, given the number of chromosomes in the original cell.
- recognize and distinguish among sex-linked, co-dominant, incomplete dominant, polygenic, and multiple allele traits.
- determine the nature of the mutation that may have occurred when comparing complementary DNA strands.

Content Standard: 5.0. Classification and Environmental Diversity

The student will investigate the diversity of organisms by analyzing taxonomic systems, exploring diverse environments, and comparing life cycles.

Learning Expectations

The student will:

5.1. establish criteria for designing a classification system.

5.2. compare systems of classification.

5.3. infer the types of organisms native to specific major biomes.

5.4. distinguish among the life cycles of plants and animals.

Performance Indicators

The student is able to:

- infer the need for a biological classification system.
- compare Aristotle's classification system to the Linnean system of classification.
- explain how binomial nomenclature is used to name living things.
- identify, in correct sequence, the seven major classification groups.
- identify the characteristics of each kingdom in the 6-kingdom classification system.
- infer the relatedness of different organisms using the Linnean system of classification, given pictures of a variety of different plants or animals and a classification key.
- distinguish between the six major land biomes and the two major water biomes, given descriptions.
- classify organisms, given a dichotomous key containing characteristics of the organisms.
- infer animals or plants indigenous to an environment, given pictures or diagrams of organisms and a description of the environment.
- determine whether an organism undergoes complete or incomplete metamorphosis, given pictures or diagrams of the organism in its stages of development.
- infer the body symmetry of an organism, given a diagram or picture of the organism.

Content Standard: 6.0. Biological Evolution

The student will investigate physical, environmental, and chemical evidence that indicates that life on earth has changed over time.

Learning Expectations

The student will:

6.1. investigate the process of fossil formation.

6.2. interpret various forms of evidence for biological evolution.

6.3. distinguish between the concepts of relative and absolute dating.

6.4. relate environmental change to natural selection, mutation, and adaptation that may lead to the emergence of a new species or the extinction of an existing species.

6.5. use current knowledge of DNA and comparative anatomy as evidence for biological change.

Performance Indicators

The student is able to:

- arrange various fossils on a diagram of sedimentary rock strata, using a collection of fossil pictures.
- determine the process of fossil formation, given a set of fossil pictures or fossil samples.
- compare and contrast relative and absolute dating techniques.

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- predict how environmental change can contribute to the emergence of a new species, change in a population size, or extinction of an existing species.
- infer how natural selection explains why species with a common ancestor have adapted differently.
- use a geologic time scale to associate the impact of global environmental changes with the dominant species of each geologic period.
- compare homologous and analogous structures to determine the relatedness of species, using pictures.
- explain the relatedness of species using DNA strands.

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Content Standard: 1.0. Force and Motion

The student will explore the concepts of force and motion.

Learning Expectations

The student will:

1.1. investigate the relationship among speed, velocity, and acceleration.

1.2. analyze and apply Newton's three laws of motion.

1.3. relate gravitational force to mass.

1.4. demonstrate the relationship among work, power, and machines.

1.5. examine the law of conservation of momentum in everyday situations.

State Performance Indicators

The student is able to:

- distinguish between speed and velocity, given a scenario.
- relate inertia, force, or action-reaction forces to Newton's three laws of motion, given an illustration, diagram, or *scenario*.
- distinguish between mass and weight using SI units, given examples.
- identify simple machines, given illustrations of *machines in action.*
- interpret a distance-time graph for velocity or a velocity-time graph for acceleration, given the appropriate graph.
- solve application problems related to velocity, acceleration, force, work, and power using appropriate units of measurement, given the *equations.*
- distinguish among the concepts inherent in Newton's three laws of motion, given a scenario.
- choose the illustration or scenario that relates the effect of gravitational force on falling bodies or satellites.
- recognize the simple machines found in a compound machine, given an illustration of a machine in action.
- solve application problems related to mechanical advantage and the efficiency of simple machines, given appropriate equations.
- choose the correct representation of the law of conservation of momentum, given an illustration.

Content Standard: 2.0 Structure and Properties of Matter

The student will examine the structure, properties, and classes of matter.

Learning Expectations

The student will:

2.1. classify a material as a pure substance or a mixture.

2.2. explore matter in terms of specific properties.

State Performance Indicators

The student is able to:

- distinguish among the phases of matter in terms of volume, shape, and particle arrangement, given illustrations.
- identify a material as a pure substance or a mixture, given a description of the material.
- distinguish among elements, compounds, solutions, colloids, and suspensions, given examples.
- identify common elements, given symbols or names.
- distinguish between metals and nonmetals, given examples.
- identify the three major subatomic particles (*protons, neutrons*, and *electrons*) based on their location, charge, and relative mass, given descriptions.
- identify chemical formulas for common compounds (i.e., H_2O, NaCl, CO_2, HCl, Fe_2O_3, $C_6H_{12}O_6$, NaOH).
- solve application problems related to density, mass, and volume, given the equation.
- predict the behavior of an object in a fluid, given their relative densities.
- identify the atomic number, atomic mass, number of protons, number of neutrons, and number of electrons in an atom of a given element, using the periodic table.
- analyze the relationships among pressure, temperature, and volume of gases, and pressure to velocity of fluids, given scenarios.

Content Standard: 3.0. Interactions of Matter

The student will investigate the interactions of matter.

Learning Expectations

The student will:

3.1. investigate chemical and physical changes.

3.2. compare and contrast ionic and covalent bonding.

3.3. analyze chemical equations.

3.4. compare and contrast acids and bases.

3.5. explore the law of conservation of mass.

State Performance Indicators

The student is able to:

- determine whether a change in matter is physical or chemical, given a scenario.
- identify the reactants and/or products in a chemical reaction, given a chemical equation.
- identify a substance as acidic, basic, or neutral, given its pH.
- identify a chemical bond as ionic or covalent, given the elements in a compound.

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- identify a chemical reaction as synthesis, decomposition, single-replacement, or double-replacement, given an equation.
- select the correct coefficient(s) to balance a chemical equation, given a list of coefficients.
- apply the law of conservation of mass in a chemical reaction by selecting the balanced equation.
- distinguish between endothermic and exothermic reactions, given a description of the temperature change in a reaction.
- identify the effect of acid rain on the environment, given a scenario.
- select the product(s) given the reactant(s) of a chemical reaction.

Content Standard: 4.0. Energy

The student will compare and contrast various forms of energy.

Learning Expectations

The student will:

4.1. investigate the properties and behaviors of waves.

4.2. explore and explain the nature of sound and light energy.

4.3. examine the applications and effects of heat energy.

4.4. probe the fundamental principles and applications of electricity.

4.5. distinguish between nuclear fission and nuclear fusion.

4.6. investigate the law of conservation of energy.

State Performance Indicators

The student is able to:

- classify a wave as transverse or longitudinal, given a description or an illustration.
- identify wavelength, frequency and amplitude, given a description or an illustration.
- identify the boiling and/or freezing point of water, given the Celsius, Fahrenheit, or Kelvin temperature scales.
- classify sound as a longitudinal, mechanical wave and light as a transverse, electromagnetic wave, given an illustration or description.
- identify a wave's behavior as reflection, refraction, diffraction, or interference, given an example.
- classify the transfer of heat energy as conduction, convection, or radiation, given an example.
- select a scenario that represents the law of conservation of energy, given an illustration.
- solve application problems related to voltage, resistance, and current in a simple circuit, given the equation.
- distinguish between nuclear fission and nuclear fusion, given a scenario.
- solve problems regarding heat, mass, specific heat capacity, and temperature change, given the equation.

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Content Standard: 1.0. Cells

The student will investigate the structures and functions of cell membranes, organelles, and component biomolecules as related to major cell processes.

Learning Expectations

The student will:

1.1. compare and contrast the chemistry of biomolecules and investigate their roles in cell structure and metabolism.

1.2. explore and compare the organelles of different cell types.

1.3. probe the composition of the cell membrane and its significance in maintaining homeostasis.

1.4. analyze cell processes.

State Performance Indicators

The student is able to:

- identify major cell organelles and their functions, given a diagram, description, and/or scenario.
- distinguish between plant and animals cells, given diagrams or scenarios.
- predict the movement of water molecules across a semi-permeable membrane, given a diagram showing solutions of different concentrations.
- sequence a series of diagrams depicting the movement of chromosomes during the cell cycle.
- compare and contrast the cell cycle in plant and animal cells, given a diagram or description.
- distinguish among proteins, carbohydrates, lipids, and nucleic acids, given structural formulas.
- identify a positive test for carbohydrates and lipids when given an experimental procedure, data, and results.
- distinguish between active and passive transport, given examples.
- evaluate the role of meiosis in maintaining genetic variability and continuity, given a scenario.
- determine the number of chromosomes following mitosis or meiosis, given the number of chromosomes in the original cell.
- recognize the importance and the mechanisms of homeostasis to the viability of organisms, given a scenario.
- identify the biomolecules responsible for communication, response, regulation, or reproduction in the cell.

Content Standard: 2.0 Interactions

The student will investigate the interactions of organisms within their environment through different nutritional relationships, population dynamics, and patterns of behavior.

Learning Expectations

The student will:

2.1. compare and contrast the different types of symbiotic relationships.

2.2. distinguish between abiotic and biotic factors in an environment.

2.3. analyze the flow of energy in an ecosystem using energy pyramids.

2.4. analyze innate and learned behaviors and relate these to the survival of organisms.

2.5. investigate the roles of producers, consumers, and decomposers in an ecosystem.

2.6. examine the impact of human activity on ecosystems.

State Performance Indicators

The student is able to:

- identify commensalism, parasitism, and mutualism, given a scenario with examples.
- classify an organism as a producer, consumer, or decomposer, given its behavior.
- identify abiotic and biotic factors, given a description or an illustration of an ecosystem.
- make inferences about how environmental factors affect population growth, given a scenario.
- examine the energy flow through the trophic levels of an ecosystem, given a diagram and/or scenario.
- determine the effects of human activities on ecosystems, given a scenario.
- analyze and interpret population growth curves, given graphs.
- distinguish between a learned and innate behavior, given a description of that behavior.

Content Standard: 3.0. Photosynthesis and Respiration

The student will compare and contrast the biochemical processes involved in the transfer of energy during photosynthesis and respiration and analyze the major biogeochemical cycles in the biosphere.

Learning Expectations

The student will:

3.1. compare and contrast the light dependent and light independent reactions of photosynthesis.

3.2. investigate the relationship between the processes of photosynthesis and respiration.

3.3. analyze the carbon, oxygen, nitrogen, and water cycles in the biosphere.

3.4. explore the efficiency of aerobic and anaerobic respiration.

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State Performance Indicators

The student is able to:

- identify the reactants and products of photosynthesis and/or respiration, given equations.
- identify the cell organelle in which photosynthesis or respiration occurs, given a diagram.
- interpret a diagram of the carbon-oxygen cycle.
- distinguish between aerobic and anaerobic respiration in terms of the presence or absence of oxygen and ATP produced.
- investigate the interdependence of photosynthesis and respiration in living organisms, given a diagram or scenario.
- relate how energy is transferred from cellular energy to cellular work.

Content Standard: 4.0. Genetics and Biotechnology

The student will investigate genetics and heredity, different methods of reproduction, patterns of inheritance, and genetic disorders; as well as explore and evaluate DNA technologies from both scientific and ethical perspectives.

Learning Expectations

The student will:

4.1. investigate the structure of DNA and RNA.

4.2. relate the structure of DNA and RNA to the processes of replication and protein synthesis.

4.3. compare and contrast asexual and sexual reproductive strategies used by organisms.

4.4. apply the principles of Mendelian inheritance to make predictions about offspring.

4.5. examine modes of inheritance involving sex linkage, co-dominance, incomplete dominance, multiple alleles, and polygenic traits.

4.6. investigate the causes and effects of mutations.

4.7. identify the causes and effects of genetic disorders in plants and animals.

4.8. investigate the scientific and ethical ramifications of genetic engineering, recombinant DNA, selective breeding, hybridization, cell and tissue culturing, transgenic animals, and DNA fingerprinting.

State Performance Indicators

The student is able to:

- distinguish between asexual and sexual methods of reproduction, using a scenario.
- identify dominant and recessive traits, given the results of a monohybrid cross in a scenario.
- determine the genotype and phenotype of a monohybrid cross, given a Punnett square.
- relate changes in the DNA instructions that cause mutations, given diagrams.
- recognize the major functions of DNA as replication or transcription, given diagrams and/or descriptions.
- identify the sex chromosomes in humans and recognize inheritance patterns that are sex-linked (X-linked), using a pedigree or scenario.
- analyze modes of inheritance including co-dominance, incomplete dominance, and multiple alleles using genetic problems or Punnett squares.
- analyze DNA fingerprinting using an illustration of DNA.
- determine the probability of having a child with an autosomal disorder, such as cystic fibrosis or Tay-Sachs , given a scenario or genetic problem.
- differentiate the process of replication, transcription, and translation, given descriptions and/or diagrams.
- analyze a dihybrid cross to determine the probability of a particular trait, given a completed Punnett square.

Content Standard: 5.0. Diversity

The student will investigate the diversity among organisms by analyzing classification systems, exploring diverse environments, and comparing life cycles.

Learning Expectations

The student will:

5.1. establish criteria for designing a classification system and compare historically relevant systems of classification.

5.2. infer the types of organisms native to specific environments included in the major biomes present on earth.

5.3. compare plant and animal structures and life cycles to recognize relationships among organisms.

State Performance Indicators

The student is able to:

- infer animals or plants indigenous to an environment, given pictures or diagrams of the organisms and a description of the environment.
- infer the biome in which an animal or plant lives, given a description of the organism and pictures of various biomes.
- infer the relatedness of different organisms using the Linnean system of classification, given pictures and/or descriptions of a variety of different plants or animals and a classification key.
- determine the genus and species of an organism, given a dichotomous key containing descriptions of the characteristics at each classification level.
- determine whether an insect undergoes complete or incomplete metamorphosis, given pictures, diagrams, or descriptions.
- infer the body symmetry of an organism, given a diagram, picture, and/or description.
- infer the function of a system or organ, given structural descriptions of an earthworm, crayfish, frog, or human.

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- compare and contrast the life cycles of various organisms to include alternation of generations, given diagrams or pictures.

Content Standard: 6.0. Biological Change

The student will investigate the process of natural selection and examine the evidence for biological evolution.

Learning Expectations

The student will:

6.1. interpret and evaluate the evidence for biological evolution in the fossil record.

6.2. investigate how mutation, natural selection, and adaptation impact the emergence of new species.

6.3. recognize the contributions of scientists, including Darwin, that led to the concept of evolution.

6.4. apply current knowledge of DNA and comparative anatomy to provide evidence for biological evolution.

State Performance Indicators

The student is able to:

- differentiate between the relative age of fossils in sedimentary rock, given a diagram, scenario, or description of rock strata.
- predict how environmental changes affect the formation of a new species or the extinction of an existing species, given a scenario.
- apply knowledge of divergent evolution, as in Darwin's finches, to determine why species with a common ancestor have adapted differently, given a diagram or description.
- compare homologous structures in species to determine the relatedness of certain species, given diagrams or pictures.
- differentiate between natural selection and selective breeding, given a scenario.
- recognize the relatedness of species using illustrations of anatomical structures, protein sequences, and/or DNA bands.

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TENNESSEE Biology II
Standards, Expectations, and State Indicators

Content Standard: 1.0. Comparative Anatomy/ Zoology

The student will observe, model, and/or manipulate a variety of organisms representing the major groups of invertebrate and vertebrate animals, to gain an understanding of increasing complexity.

Learning Expectations

The student will:

1.1. compare and contrast animals, from simplest organisms to most complex, with regard to anatomical differences, embryological development, and evolutionary history.

1.2. investigate how animals accomplish functions like ingestion and digestion, transportation of materials, respiration, excretion, movement, reproduction and development.

1.3. demonstrate an understanding of systems of increasing complexity, as well as the relationship between structure and function in all organisms.

State Performance Indicators

The student is able to:

- observe, model, manipulate, and/or dissect specimens representative of major groups of animals. (These may include, but are not limited to earthworms, clams, crayfish, grasshoppers, starfish, fish, and frogs.)
- distinguish among organisms that reproduce asexually and sexually.
- identify organisms with intracellular digestion, two-way, and one-way digestive systems, and name vertebrate organisms that are herbivores, carnivores, and omnivores.
- relate methods of respiration to the anatomy and the habitat of an animal.
- identify the bones and major muscles of the musculoskeletal system, and investigate the physiology of muscle movement.
- compare the circulatory systems of representative organisms, components of blood, and the differences among vertebrate hearts.
- investigate the increasing complexity of methods of excretion utilized by animals.
- investigate careers in wildlife and marine biology, zoo curator, and wildlife management.
- relate the growth and development of organisms to genetic, hormonal, and environmental controls.
- examine the ways that the endocrine system, nervous systems, and sense organs assist in monitoring an organism's environment.
- compare human models to similar structures in animals.

Content Standard: 2.0 : Embryology

The student will investigate the processes of gamete production, fertilization, and development.

Learning Expectations

The student will:

2.1. compare and contrast the anatomy and production of eggs and sperm.

2.2. investigate the process of zygote formation.

2.3. distinguish between internal and external fertilization.

2.4. describe and distinguish among cleavage, gastrulation, and differentiation.

2.5. compare the embryological development of organisms including, but not limited to frog, chicken, and human.

State Performance Indicators

The student is able to:

- relate the process of meiosis to the formation of haploid from diploid cells.
- label diagrams representing the formation of egg and sperm.
- examine and describe the behavior of egg and sperm during fertilization.
- research the formation of body systems from origin tissues: the endoderm, mesoderm, and ectoderm.
- research careers in animal husbandry, veterinary medicine, genetics, and zoology.
- describe blastula formation in a variety of egg types, including frogs, chickens, and humans.
- sequence a series of diagrams depicting gastrulation of a frog, chicken, and human embryo.
- contrast normal and abnormal differentiation of cells in amphibians, chickens, and mammals.
- describe the process of cloning and debate its ethical and social implications.

Content Standard: 3.0. Genetics

The student will examine the structure and function of DNA.

Learning Expectations

The student will:

3.1. examine modes of inheritance involving linked genes and epistasis.

3.2. investigate the effects of the environment on DNA.

3.3. investigate chromosome mapping, crossing over, and the formation of new gene combinations.

3.4. examine the process of regulating gene expression.

3.5. explore the genomic organization and inheritance of DNA in prokaryotes, eukaryotes, cellular organelles, and humans.

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3.6. investigate the applications of recombinant DNA technology, including cloning.

3.7. investigate population genetics and the Hardy-Weinberg Law.

3.8. explore the processes of transcription and translation.

State Performance Indicators

The student is able to:

- relate the process of speciation and the ability of a population to undergo evolutionary divergence to allele frequencies using the Hardy-Weinberg Law.
- explain how proteins are the end product of gene expression, using models.
- interpret data from a model of crossing-over and explain how crossing-over increases genetic diversity.
- analyze modes of inheritance including gene linkage and epistasis, using karyotypes, genetic problems, pedigrees, or Punnett squares.
- distinguish among nuclear DNA and the DNA of bacteria, organelles, and bacteriophages.
- research methods of genetic engineering, including recombinant DNA and cloning.
- research the relationship of genetics to cancer.
- explain the relationship between environmental conditions and changes in the DNA sequences.
- investigate careers in genetic engineering, genetic counseling, and genetic research.
- research DNA mutations related to environmental influences.
- investigate the editing of mRNA and its translation into a protein.

Content Standard: 4.0. Immunology

The student will investigate the reaction of, causes for, and results of the immune response.

Learning Expectations

The student will:

4.1. examine the stages of an immune response.

4.2. analyze an immune response at the cellular and molecular level.

4.3. explore immune disorders.

4.4. compare the different types of immune responses evoked by antigens.

4.5. explore the worldwide impact of vaccination programs.

State Performance Indicators

The student is able to:

- describe the role of lymphocytes in an immune response.
- compare autoimmune diseases to other diseases.
- investigate the sociological effects of AIDS and other autoimmune diseases.
- compare and contrast specific immunity and acquired immunity.
- investigate the effect of environmental and genetic factors on immune responses.
- debate the use of other species for studying immune responses in humans.
- research the process for the FDA approval of experimental drugs.
- research careers in immunology, epidemiology, chemistry, virology, serology, and statistics.
- investigate the major antibodies found in human serum.
- research how vaccines are produced and the considerations made when manufacturing the influenza vaccine each year.
- investigate the sharp increase in the number and kinds of allergies.

Content Standard: 5.0. Microbiology

The student will investigate diversity, impact, and uses of microorganisms as well as diseases caused by microorganisms.

Learning Expectations

The student will:

5.1. examine the diversity of microbial life forms and explore the conditions under which microbes thrive.

5.2. compare and contrast pathogenic and parasitic microbes as regards their identity, interactions, the diseases they cause, and methods used to control their growth.

5.3. investigate the role of microbes in genetic engineering and examine ways microbes are used in society.

5.4. identify the various relationships shared among humans, plants, and microbes.

State Performance Indicators

The student is able to:

- distinguish among bacterial types according to shape and by using different stains.
- distinguish among bacterial, fungal, and microscopic parasites according to their growth and nutrition.
- describe symbiosis, mutualism, parasitism, and commensalism in relation to the major classes of microbes.
- describe the beneficial uses of microbes.
- explain exponential growth of bacterial populations and evaluate long term methods used to control growth.
- demonstrate the process of using recombinant DNA production with the bacterium *E. coli.*
- describe an environment for the major classes of microbes: bacteria, viruses, fungi, parasites, and protists that will maximize growth and reproduction capabilities.

= Standards measured by ACT's Science tests

_____ = Standards content sampled by ACT's Science tests

- research careers that involve microbiology, such as mycology, the brewing industry, microbes in water purification systems, and parisitology.
- describe the procedure for a Gram stain, and use it to distinguish among bacteria.
- participate in a classroom debate on the use of biological weapons.
- research graphs, charts, and data of an epidemic and debate the position that this same scenario could or could not happen again today.
- use microscopes to analyze a soil sample for bacteria, fungi, and various roundworms found in a healthy sample.
- investigate epidemiology of emerging infectious diseases.

Content Standard: 6.0. Botany

The student will investigate simple and complex plant forms and understand the importance of plant life to survival on earth.

Learning Expectations

The student will:

6.1. examine the anatomy and physiology of non-vascular and vascular plants to demonstrate the biological evolution of plants on the earth.

6.2. investigate the anatomical and physiological differences among plants that explain how plants grow, reproduce, survive, and coexist with animals in their particular habitats.

6.3. demonstrate the wide variety of plants that are both harmful and useful to animals, especially humans.

State Performance Indicators

The student is able to:

- observe and explain the life cycles of mosses and ferns.
- identify, describe, or label the major organs of vascular plants to be the roots, stems, leaves, and seed-producing structures.
- observe, draw, and label the major structures contained within the flowers and seeds of angiosperms, and explain the processes of pollination and germination.
- observe differences in plants to identify those that are non-vascular or vascular, spore-bearing or seed producing, gymnosperms or angiosperms, and monocots or dicots.
- distinguish the types of plants adapted to life in a variety of habitats, and explain the specializations necessary for survival in those habitats.
- compare and contrast spores and seeds, and relate them to the structures of plants where they are produced.
- compare and contrast gymnosperms and angiosperms.
- research careers in agriculture, horticulture, landscaping, agronomy, food science, and nutrition.
- explain the transpiration, tension-cohesion (adhesion-cohesion), and pressure flow models to describe transport of materials in vascular plants.
- describe how hormonal and environmental factors affect the growth and development of plants, and predict what occurs when these factors are changed.
- describe and list plants, or parts of plants, that are helpful and harmful to animals, and especially humans, paying particular attention to sources of food, shelter, clothing, and medicines.
- research local plant populations, using a dichotomous key to identify the various species.

= Standards measured by ACT's Science tests

_____ = Standards content sampled by ACT's Science tests

TENNESSEE Chemistry I

Standards, Expectations, and State Indicators

Content Standard: 1.0. Atomic Structure

The student will investigate atomic structure and how this determines the physical and chemical properties of matter.

Learning Expectations

The student will:

1.1. compare and contrast various models of the atom as they emerged historically, from the Greeks to the modern electron-cloud model.

1.2. investigate the basic organization of the modern periodic table, including atomic number and atomic properties.

1.3. describe models of the atom in terms of orbital, electron configuration, orbital notation, quantum numbers, and electron-dot structures.

1.4. investigate the composition of the nucleus so as to explain isotopes and nuclear reactions.

1.5. relate the spectral lines of an atom's emission spectrum to the transition of electrons between different energy levels within an atom.

State Performance Indicators

The student is able to:

- categorize an element as a metal, metalloid, nonmetal, or noble gas based on its position in the periodic table.
- identify an element's atomic number and name or symbol, given the number of protons or electrons in a neutral atom using a periodic table.
- identify protons, neutrons and electrons with regard to their relative mass, relative charge, and location in an atom.
- identify the major characteristics of various models of the atom: Democritus, Thomson, Rutherford, Bohr, and the modern quantum mechanical model.
- determine the number of protons, neutrons, and electrons in an atom or ion, given the symbol of the atom or ion and a periodic table.
- compare *s* and *p* orbitals in an energy level in terms of general shape, energy and/or numbers of electrons possible.
- determine the Lewis electron-dot structure or number of valence electrons for an atom of any main group element (1, 2, 13–18), given its atomic number or its position in the periodic table.
- describe the trends present in the periodic table with respect to atomic size, ionization energy, electron affinity or electronegativity.

Content Standard: 2.0 Matter and Energy

The student will investigate the characteristics of matter and the interaction of matter and energy.

Learning Expectations

The student will:

2.1. investigate the characteristics of matter.

2.2. explore the interactions of matter and energy.

State Performance Indicators

The student is able to:

- identify a pure substance as element or compound, when given its chemical name or formula.
- distinguish among elements, compounds, solutions, colloids, and suspensions, given examples.
- classify changes in matter as physical or chemical, given examples or scenarios.
- classify properties of matter as physical or chemical when given examples or scenarios.
- distinguish between heat content and temperature when given a unit, a definition, or an example.
- distinguish among gases, liquids, and solids in terms of particle spacing and relative movement, given a diagram or scenario.
- predict the effect of changing one gas variable (volume, temperature, or pressure) on another variable, given a scenario.
- demonstrate an understanding of the law of conservation of matter, given experimental data.
- categorize a process as endothermic or exothermic, given an example or scenario.
- demonstrate an understanding of the law of conservation of energy by equating heat loss and heat gain in an interaction, given the formulas $-q = q$ and $q = mc\Delta t$, and the specific heat.

Content Standard: 3.0. Interactions of Matter

The student will examine the interactions of matter.

Learning Expectations

The student will:

3.1. investigate chemical bonding.

3.2. analyze chemical reactions.

3.3. apply the mathematics of chemical formulas and equations.

State Performance Indicators

The student is able to:

- distinguish between a chemical symbol and a chemical formula, given examples.
- identify the reactants and products in a chemical reaction, given a balanced chemical equation.
- explain the differences among the composition, decomposition, double replacement, and single replacement types of chemical reactions, given a balanced equation.

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- determine the number of atoms, formula units, or molecules of a particular substance, given a balanced equation.
- distinguish between ionic and covalent compounds, given binary formulas.
- identify the formula for a compound using a periodic table and a list of common ions, given the name of the compound.
- identify the name of compounds and common acids (sulfuric acid, nitric acid, hydrochloric acid, acetic acid, and phosphoric acid), using a periodic table and a list of common ions.
- select a correctly balanced chemical equation, when given examples.
- recognize a balanced chemical equation using appropriate symbols, given a word equation.
- convert between any two of the following quantities of a substance:
  mass
  number of moles
  number of particles
  molar volume (at STP)
- determine molar ratios expressed in balanced chemical equations.
- analyze percent composition of the elements in a compound, given the formula.
- solve mass to mass stoichiometry problems.
- identify and solve different types of stoichiometry problems.

Content Standard: 4.0. Solutions and Acids/Bases

The student will investigate the characteristics of solutions with particular attention to acids and bases.

Learning Expectations

The student will:

4.1. investigate the characteristics of solutions.

4.2. investigate the characteristics of acids and bases.

State Performance Indicators

The student is able to:

- classify substances as acids or bases, given the formula.
- identify the solute and solvent in a solid, liquid or gaseous solution, given its composition.
- classify a solution as saturated, unsaturated, or supersaturated, given the composition of the solution and a solubility graph.
- calculate the concentration of a solution in terms of molarity or mass percent, given mass of solute, and mass or volume of solution.
- classify a substance as an acid or a base, given its properties (e.g., color of litmus, color of phenol-phthalein, taste, pH and slippery or non-slippery).
- predict the products of a neutralization reaction involving inorganic acids and bases, given the reactants.

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TENNESSEE Chemistry II

Standards, Expectations, and State Indicators

Content Standard: 1.0. Structure of Matter

The student will extend their Chemistry I investigation of atomic theory, chemical bonding and nuclear chemistry.

Learning Expectations

The student will:

1.1. recognize how electron energy levels relate to atomic spectra, quantum numbers, and atomic orbitals.

1.2. represent electron arrangements in atoms in a variety of ways.

1.3. describe periodic relationships including atomic radii, ionization energies, electron affinities, and oxidation states.

1.4. investigate the subject of ionic, covalent, metallic bonds, and attractive forces between molecules.

1.5. investigate the relationship of chemical bonding to the state, structure and properties of matter.

1.6. explore Lewis structures, characteristics of valence bonds (including hybridized orbitals, resonance, and sigma and pi bonds), bond directionality, and ionic or molecular geometry using the VSEPR theory.

1.7. investigate the characteristics of simple organic molecules including isomerism.

1.8. explore nuclear chemistry.

State Performance Indicators

The student is able to:

- write the arrangement of electrons in an atom using orbital notation, electron configuration notation, and electron-dot notation.
- organize atoms from the main-group elements (1, 2, 13–18) based on atomic radii, ionization energies, and electron affinities.
- predict the charge for ions (groups 1, 2, 13–18) and the oxidation state of any atom in a compound or polyatomic ion.
- use the Bohr model to represent an electron moving between its ground state and its excited state.
- correlate lines of Balmer's series of an emission or absorbance spectrum of the hydrogen atom to their respective energy-level transitions.
- calculate the wavelength, frequency, and energy of a photon of electromagnetic radiation (formula and constants provided).
- compare the shape, energy, or number of electrons possible in s, p, d, and f orbitals.
- determine quantum numbers for elements given the electron configuration.
- explain in a paragraph why some elements do not have the predicted electron configuration (e.g., Cu: [Ar] $4s^1 3d^{10}$ instead of [Ar] $4s^2 3d^9$).
- illustrate various types of bonding (ionic, covalent and metallic), and draw models to illustrate dipole interactions and dispersion forces.
- draw Lewis structures for polyatomic ions and simple covalent molecules.
- explain the formation of hybridized orbitals, resonance, and sigma and pi bonds.
- predict the geometry about a central atom in a polyatomic ion or molecule using the VSEPR theory.
- demonstrate, by drawing simple organic molecules (e.g., alkanes, alkenes, alkynes, alcohols), an understanding of structural isomers.
- correlate Lyman's ultraviolet and Paschen's infrared series of hydrogen's spectrum.
- display the dipole moments of molecules using molecular geometry and electronegativity of atoms.
- compare and contrast the structure and function of proteins, carbohydrates, lipids, and nucleic acids.
- write the nuclear equation involving alpha or beta decay and gamma emission (given the mass number of the parent isotope).
- determine the half-life of an isotope by examining a graph or by using an appropriate equation.
- calculate the mass of the parent isotope remaining after a period of time.
- graph the decay series given the emissions of a radioactive isotope.
- describe societal implications of nuclear chemistry (dangers, uses, occupations, etc.).

Content Standard: 2.0 States of Matter

The student will investigate interactions of matter using the kinetic molecular theory to explain solid, liquid, gas, and solution phenomena.

Learning Expectations

The student will:

2.1. apply the kinetic molecular theory to describe solids, liquids, and gases.

2.2. investigate topics associated with the gaseous state.

2.3. discuss phase diagrams of one-component systems.

2.4. extend their understanding of solutions introduced in Chemistry I.

State Performance Indicators

The student is able to:

- identify the basic contents of the kinetic-molecular theory and relate kinetic energy to temperature.
- relate the kinetic-molecular theory to solids, liquids, gases, and phase changes.
- relate Avogadro's hypothesis to gas volumes.

= Standards measured by ACT's Science tests

= Standards content sampled by ACT's Science tests

- understand the mole concept of matter as it relates to mass, volume, or number of particles.
- solve gas law problems including the ideal gas law equation (given the formulas and constant).
- recognize critical temperature, critical pressure, and triple point using phase diagrams of one-component systems.
- interpret changes in temperature and/or pressure using phase diagrams of one-component systems.
- calculate concentration of solutions (e.g., molarity, molality, and mass percent).
- determine the concentration of a dilute solution that is prepared from a concentrated solution of known molarity.
- investigate colligative properties and calculate freezing point depression and boiling point elevation of a solvent when a solute is added to it (given formula and appropriate constants).
- differentiate among unsaturated, saturated, and supersaturated solutions using solubility graphs.
- identify factors affecting solubility (e.g., temperature, pressure, concentration and polarity).
- explain deviations that real gases have from ideal gas characteristics.
- apply Raoult's law and osmosis to the study of solutions given formulas.
- investigate Beer's law using a dilution series.

Content Standard: 3.0. Reactions

The student will investigate types of reactions, stoichiometry, equilibrium phenomena, kinetics, and thermodynamics of chemical reactions.

Learning Expectations

The student will:

3.1. investigate various chemical reactions associated with acids and bases, precipitation, and oxidation and reduction.

3.2. expand the study of stoichiometry.

3.3. explore the concept of physical and chemical equilibrium.

3.4. investigate chemical kinetics and the rate of reaction concept.

3.5. explore the concept of thermodynamics.

State Performance Indicators

The student is able to:

- write a balanced chemical equation and classify as to type, given a word description of a chemical reaction.
- predict the products, write the net ionic equation, and identify spectator ions in single and/or double replacement reactions (given the activity series table and a solubility table).
- determine percent composition, empirical, and molecular formula of a compound from data.
- predict amounts of products given either mole or mass amounts of reactants, compare actual yield to theoretical yield, and solve problems using limiting reagents.
- examine oxidation-reduction half-reactions given an equation.
- classify a solution as neutral, acidic, or basic, and calculate its pH given either the hydrogen or hydroxide ion concentration.
- graph data from a neutralization titration using strong or weak acids/bases.
- characterize acids and bases using the Arrhenius, Brönsted-Lowry and Lewis definitions, and identify conjugate acid-base pairs.
- characterize a substance as amphoteric.
- recognize dynamic processes, incorporating the concept of Le Chatelier's Principle.
- solve for equilibrium constants given appropriate concentrations, or solve for desired concentrations given necessary information, with emphasis on pK.
- determine if a precipitate will form given the concentrations of ions in solution (given a table of solubility product constants).
- explain rate of reaction, determine the order of a reaction, and calculate the rate constant from experimental data.
- describe activation energy and predict the effect of a temperature change on the rate of a reaction
- describe the role of a catalyst in a chemical reaction and its relationship to activation energy.
- define enthalpy and entropy.
- calculate calorimetry problems using laboratory data (given the equation).
- describe the common ion effect, buffers, and hydrolysis given a solution.
- differentiate electrolytic and voltaic cells by writing the appropriate standard half-cell reactions (given a diagram of each cell).
- describe both physical and chemical equilibria using the Nernst equation.
- describe and use Faraday's laws to solve problems (given an equation).
- identify the rate-determining step given a reaction mechanism.
- calculate the pH of buffer solutions.
- calculate the solubility and resulting concentration using the common-ion effect.
- calculate changes in enthalpy using Hess's law (given a table of heats of formation).
- calculate changes in entropy (given an entropy table).
- calculate Gibbs free energy and determine if a reaction is spontaneous (given the equation).

= Standards measured by ACT's Science tests
= Standards content sampled by ACT's Science tests

TENNESSEE Physics
Standards, Expectations, and State Indicators

Content Standard: 1.0. Mechanics

The student will investigate the laws and properties of mechanics.

Learning Expectations

The student will:

1.1. investigate fundamental physical quantities of mass and time.

1.2. analyze and apply Newton's three laws of motion.

1.3. understand work, energy, and power.

1.4. investigate kinematics and dynamics.

State Performance Indicators

The student is able to:

- distinguish between mass and weight using base units in the standard international (SI) system.
- relate time in the (SI) system to the independent experimental variable in most situations.
- relate inertia, force or action-reaction forces to Newton's three laws of motion and distinguish between the three laws in various scenarios.
- compare and contrast characteristic properties of scalar and vector quantities.
- investigate the definitions of force, work, power, kinetic energy, and potential energy.
- explore velocity and acceleration.
- analyze vector diagrams (addition, subtraction and scaling) and solve composition and resolution problems for force and momentum.
- explore characteristics of rectilinear motion and analyze distance-time graphs (velocity), velocity-time graphs (acceleration and distance).
- investigate the characteristics of centripetal motion and centripetal acceleration.
- evaluate the dynamics of systems in motion including friction, gravity, impulse and momentum, change in momentum, and conservation of momentum.
- analyze the characteristics of energy, and conservation of energy including friction, and gravitational potential energy.
- relate work and power to various simple machines, mechanical advantage of different machines and recognize simple machines utilized in compound machines.
- describe rotational equilibrium and relate to torque.
- investigate projectile motion.
- utilize trigonometry and vector analysis to solve force and momentum problems.
- apply elementary calculus to solve motion problems.
- experiment with elastic and inelastic collisions.

Content Standard: 2.0 Thermodynamics

The student will examine the properties and laws of thermodynamics.

Learning Expectations

The student will:

2.1. develop an understanding of heat and internal energy.

2.2. compare Celsius, Kelvin and the Absolute temperature scales.

2.3. investigate exchanges in internal energy.

State Performance Indicators

The student is able to:

- investigate temperature in relationship to kinetic energy.
- recognize that absolute zero is the absence of molecular kinetic energy.
- identify the characteristics of internal energy and temperature/heat (joules/calories).
- relate the First Law of Thermodynamics as an application of the Law of Conservation of Energy (hot to cold) and heat transfer through conduction, convection and radiation.
- relate change in heat content (quantity of thermal energy) to kinetic energy and specific heat ($Q = mc\Delta T$).
- investigate potential energy changes (phase changes) of heat of fusion, heat of vaporization, and heat of sublimation.
- explore thermal expansion and contraction.
- apply the second law of thermodynamics to the Carnot engine.

Content Standard: 3.0. Waves and Sound

The student will investigate the properties of waves and sound.

Learning Expectations

The student will:

3.1. explore conditions associated with simple harmonic motion.

3.2. investigate Hooke's law.

3.3. understand wave mechanics.

3.4. examine the Doppler Effect.

3.5. explore the characteristics and properties of sound.

State Performance Indicators

The student is able to:

- describe and investigate simple harmonic motion.
- investigate and analyze wavelength, frequency and amplitude of longitudinal and transverse waves.
- identify a wave interaction as reflection, refraction, diffraction, and interference.

= Standards measured by ACT's Science tests
_____ = Standards content sampled by ACT's Science tests

- compare mechanical and electromagnetic waves.
- explore Hooke's Law.
- investigate reflection, refraction, diffraction, and interference of waves.
- demonstrate and explain the Doppler Effect.
- experiment with reflection, refraction, diffraction, and interference of waves and sound.
- compare wave characteristics to natural auditory phenomena.
- determine the speed of sound experimentally using various materials and temperatures.
- measure spring constants.

Content Standard: 4.0. Light and Optics

The student will examine the properties of light and optics.

Learning Expectations

The student will:

4.1. describe the characteristics of the electromagnetic spectrum.

4.2. investigate the interaction of light waves.

4.3. analyze the optics of mirrors.

4.4. explore the optics of lenses.

4.5. investigate the phenomenon of color.

State Performance Indicators

The student is able to:

- explore properties of electromagnetic radiation.
- examine properties of light waves.
- differentiate among transmission, reflection, refraction, diffraction, and interference of light waves.
- investigate the optical properties of plane and curved mirrors.
- solve problems related to Snell's law.
- explore the formation of color.
- draw, explain, and solve problems for the optics of mirrors and lenses.
- investigate optical phenomena (i.e., the Puddle Effect, optical illusions, and polarization).

Content Standard: 5.0. Electricity and Magnetism

The students will investigate electricity and magnetism.

Learning Expectations

The student will:

5.1. examine properties of electric forces, electric charges, and electric fields.

5.2. explore the flow of charge and electric currents.

5.3. investigate Ohm's law.

5.4. compare and contrast series and parallel circuits.

5.5. analyze schematic diagrams.

5.6. understand magnetic poles, magnetic fields, and investigate electromagnetic induction.

State Performance Indicators

The student is able to:

- analyze a given group of charges for repulsion and attraction.
- distinguish between charged particles related to repulsion and attraction.
- create a simple electromagnet.
- describe the electric field that fills the space around a charged particle or group of charges.
- draw an electric field, given a scenario of charged particles.
- solve problems of resistance using Ohm's law.
- draw and explain series and parallel circuits.
- identify components of series and parallel circuits and solve problems related to voltage, amperage, and resistance.
- build series and parallel circuits and demonstrate how they function.
- demonstrate a generated current by electromagnetic induction.
- describe how current is generated by electromagnetic induction.
- design a lab that demonstrates the flow of charged particles and an electric current.

Content Standard: 6.0. Nuclear Physics

The student will investigate the laws and properties of nuclear physics.

Learning Expectations

The student will:

6.1. investigate the properties and structure of the atom.

6.2. compare and contrast the Bohr model and the quantum model of the atom.

6.3. explore the dynamics of the nucleus: radioactivity, nuclear decay, radiocarbon/uranium dating and half-life.

6.4. compare and contrast nuclear fission and nuclear fusion.

6.5. investigate the quantum theory.

State Performance Indicators

The student is able to:

- identify the parts of an atom.
- describe the properties and location of subatomic particles.
- describe three forms of radioactivity.
- distinguish between nuclear fission and nuclear fusion.
- distinguish between the Bohr model and the quantum model of an atom.

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_____ = Standards content sampled by ACT's Science tests

- explain the changes in atomic number or mass number for each form of radioactivity.
- write and balance equations for the three forms of radioactive decay.
- solve half-life problems.
- explain dating methods using carbon-14 or uranium
- explain how particles behave like waves.
- distinguish between coherent and incoherent light.
- describe how a laser is produced.
- recognize how the quantum theory explains the photoelectric effect.
- solve problems related to the photoelectric effect.

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_____ = Standards content sampled by ACT's Science tests

TENNESSEE Anatomy and Physiology
Standards, Expectations, and State Indicators

Content Standard: 1.0. Anatomical Orientation

The student will explore the organizational structures of the body from the molecular to the organism level.

Learning Expectations

The student will:

1.1. distinguish between anatomy and physiology.

1.2. investigate the structures of the major body systems and relate the functions.

1.3. investigate the major body cavities and the subdivisions of each cavity.

1.4. apply correct anatomical terminology when discussing the orientation of body parts and regions.

State Performance Indicators

The student is able to:

- list the hierarchy of structural organization from the molecular level through the organism level.
- label the sub-cellular components in the cell and identify the function of each component.
- list the survival needs of living organisms.
- define anatomy and physiology and describe their subdivisions, using a concept map.
- classify organ systems of the body as either (1) protection, support, and movement, (2) regulation and integration, (3) transport, or (4) absorption and excretion.
- illustrate the directional terms that refer to the body using correct anatomical terminology.
- construct a concept map to illustrate the cavities in the body and the organs contained within each area.
- relate positive and negative feedback mechanisms to the maintenance of homeostasis within the body.
- identify careers related to anatomy and physiology in medicine, allied health, and research.
- identify the major cell and tissue groups.
- construct a concept map of the major organ systems within the body and list the organs and functions of each system.
- develop scenarios of positive and negative feedback mechanisms and predict their effect upon homeostasis.

Content Standard: 2.0 Protection, Support, and Movement

The student will explore the integumentary, skeletal, and muscular systems, and relate the structures of the various parts to the functions they serve.

Learning Expectations

The student will:

2.1. identify the components of the integumentary system and explain the physiological mechanisms that make the functions of this system possible.

2.2. identify the bones and their parts that make up the skeletal system, and relate the physiological mechanisms that help the skeletal system fulfill its functions.

2.3. identify the various kinds of muscles, major muscles of the body, and explain the physiology of muscle contraction.

State Performance Indicators

The student is able to:

- relate the structure of the skin to its role in protecting the body and maintenance of homeostasis.
- distinguish the roles of bones and muscles in protection and movement.
- identify the major bones of the body, given a diagram of a skeleton.
- identify the major muscles of the body, given a diagram.
- identify characteristic cells and structures of the integumentary system and relate these structures to their functions.
- construct a model of skin layers, labeling the functions of each layer, and identify the functions of the skin.
- identify and classify the types of bones using diagrams, pictures, models, or actual bones.
- identify the axial and appendicular skeletons, as well as the bones and joints of each.
- observe, draw, and/or label the different types of muscle tissues, noting the function and anatomical differences of each type.
- depict the major steps in the sliding filament theory of muscle contraction, using diagrams.
- identify the major muscles of the body using diagrams, concept maps, pictures, and/or specimens.
- identify careers related to medicine, allied health, and/or research that relate to the integumentary and musculoskeletal systems.
- explain the biochemical and/or molecular processes involved in the growth and repair of integumentary tissues.
- write an essay describing the biochemical basis for the harmful effects of the sun.
- explain the physiological processes involved in disorders of the skin, such as burns, cuts, diseases, and skin cancer.
- relate the physiological mechanisms involved in remodeling and repair of bones at the molecular and cellular levels.

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- categorize the skeletal muscles as prime movers, antagonists, synergists, or fixators.
- identify the origin and insertion of major skeletal muscles, given a diagram.
- describe the biochemical basis of muscle contractions in oral, written, and/or diagrammatic form.

Content Standard: 3.0. Integration and Regulation

The student will investigate, compare, and contrast methods of body control by the nervous and endocrine systems.

Learning Expectations

The student will:

3.1. compare and contrast the anatomy and physiology of the central and peripheral nervous systems.

3.2. describe the structure, function, and developmental aspects of neurons and their supporting glial cells.

3.3. investigate the physiology of electrochemical impulses and neural integration.

3.4. investigate organs utilized by the body for perception of external stimuli and to the maintenance of homeostasis.

3.5. identify the major organs of the endocrine system and demonstrate the relation of each structure to hormonal regulation of homeostasis.

State Performance Indicators

The student is able to:

- label the major areas of the brain and spinal cord, using diagrams, models, or representative organs.
- identify endocrine glands, using models, diagrams, or specimens.
- relate the function of each of the major organs in the nervous system.
- identify the parts of the spinal cord, neurons, neuroglia, and the neuromuscular junction, using microscopic slides, diagrams, or models.
- describe a nerve impulse in terms of electrochemical changes.
- identify the cranial nerves and give the region of their innervations.
- identify the structures and name the functions of the parts of the sense organs.
- investigate sensory perceptions using experimentation.
- research and design a presentation related to neurological and/or endocrine abnormalities.
- interpret graphs of blood sugar levels as related to pancreatic function.
- identify careers related to medicine, health, and research.
- analyze a case study and make a speculative diagnosis and/or prognosis.
- describe the molecular neurophysiology of membrane potentials as related to electrolyte function and active transport (sodium-potassium pump).
- trace the pathway of an electrochemical impulse relating biochemical changes involved in conduction of the impulse.

Content Standard: 4.0. Transportation

The student will investigate the structure and function of the cardiovascular system with an emphasis on the blood, heart, and the lymphatic system and attention to the immune response.

Learning Expectations

The student will:

4.1. identify the molecular and cellular components of the blood.

4.2. describe the functions of the blood within the human body.

4.3. demonstrate an understanding of the anatomy of the heart and the flow of blood through the heart.

4.4. elucidate the biochemical and physiological nature of the heart's functions.

4.5. describe the structure of blood vessels and identify the major arteries and veins.

4.6. describe the physiological basis of circulation and blood pressure.

4.7. demonstrate the role of the cardiovascular system in maintaining homeostasis.

4.8. identify the major organs of the lymphatic system.

4.9. demonstrate an understanding of the immune response.

State Performance Indicators

The student is able to:

- identify the components and physical characteristics of the blood.
- identify the layers, chambers, and valves of the heart.
- trace the pathway of blood flow through the heart.
- describe the immune response in general terms.
- list the blood types and their genetic role in cross-matching.
- trace the biochemical pathway of plug formation and blood clotting.
- identify the structures of the mammalian heart.
- use a variety of methods to measure blood pressure and pulse.
- identify the major arteries and veins, and their location in the body.
- label the basic structures of a blood vessel.
- explain one biochemical mechanism for maintaining homeostasis within the circulatory or immune system, using drawings and labels.

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- identify the structure and functions of the lymph system.
- list the cells involved with immunity, and give a description of their functions.
- identify careers in medicine, allied health, and research that relate to the circulatory, lymphatic, and/or immune systems.
- identify the components of blood, using a microscope, and discuss the function of each component.
- identify the biochemical and physiological events related to contraction of the heart.
- compare the molecular affinity of hemoglobin to oxygen with that of hemoglobin to carbon monoxide.
- describe the phenomenon of carbon monoxide poisoning.
- describe the conduction system of the heart in physiological and structural terms.
- draw the mechanism for immune response at the cellular level.
- relate nonspecific cellular and chemical defenses of the body to the factors that trigger their response.
- identify several causes of homeostatic imbalances of the immune system.

Content Standard: 5.0. Absorption and Excretion

The student will investigate the structures of the body associated with the absorption and excretion of materials, from the molecular, cellular, organ, and system levels of function.

Learning Expectations

The student will:

5.1. identify the major organs of the digestive system.

5.2. observe the gross anatomy of each organ within the digestive and urinary systems.

5.3. describe mechanisms of digestion and absorption within the body.

5.4. relate how nutrition, metabolism, and body temperature are interrelated.

5.5. explain the role of the urinary system in body waste management.

5.6. examine the physiological basis for the elimination of water and salts through the skin and lungs.

State Performance Indicators

The student is able to:

- identify the organs of the digestive system, given a chart, diagram, specimen, or model.
- give one or more specific function of each region/organ of the digestive system.
- list the vitamins and minerals required for the proper functioning of the body.
- describe the role of the urinary system and the differences between the male and female urinary tracts.
- identify the types of tissue from each organ within the digestive system.
- correlate the source organ and function of the enzymes and hormones within the digestive system.
- list the substances absorbed within the stomach, small intestine, and large intestine.
- describe the function and location of sphincter muscles in the alimentary canal.
- demonstrate an understanding of the relationship between the structure and function of villi.
- differentiate among carbohydrate, lipid, and protein metabolism by the body.
- give examples of anabolic and catabolic biochemical reactions within the human body.
- identify the parts of a nephron, given a chart or a drawing.
- describe the process of glomerular filtration and its role in urine formation.
- identify careers related to medicine, allied health, and research, as they relate to the digestive and excretory systems.
- identify the molecular structure of the organic molecules needed as nutrients by the body.
- trace a particular food item through the digestive tract, listing biochemical reactions, enzymes, and resultant substances formed.
- describe the biochemical processes that allow for the movement of water through kidney filtration, reabsorption, and excretion.

Content Standard: 6.0. Reproduction, Growth, and Development

The student will investigate the reproductive system and its association with the growth and development of organisms.

Learning Expectations

The student will:

6.1. identify the structures and related functions of the male and female reproductive systems.

6.2. demonstrate an understanding of the hormonal regulation of the menstrual cycle.

6.3. indicate the duration and relate the major events at each stage of gestation.

6.4. investigate congenital disorders; their physiological, biochemical, hormonal, and chromosomal causes.

State Performance Indicators

The student is able to:

- define, compare, and contrast meiosis and mitosis.
- differentiate between genotype and phenotype.
- compare various forms of inheritance within organisms, to include dominant-recessive, incompletely dominant, and co-dominant traits.

= Standards measured by ACT's Science tests

_____ = Standards content sampled by ACT's Science tests

- describe the mechanisms and results of sex-linked inheritance.
- identify the organs of the male and female reproductive systems, given pictures, diagrams, and/or specimens.
- describe the role of hormones in producing the secondary sex characteristics of males and females.
- relate the structures of the male and female reproductive systems with their functions.
- compare and contrast the processes and products of oogenesis and spermatogenesis.
- trace the pathway that sperm travel from the site of formation to the outside of the body.
- identify and predict the major events that occur during the menstrual cycle, given diagrams and/or pictures.
- identify the stages of development from egg formation, to ovulation, fertilization, implantation, and birth.
- research and make a presentation relating to common genetic disorders.
- identify careers related to medicine, allied health, and research as they relate to the reproductive systems of the body.
- describe the homeostatic feedback controls for the hormones of the menstrual cycle.
- demonstrate an understanding of the roles of the sympathetic and parasympathetic nervous systems and the endocrine system in controlling human sexuality.
- research and debate either side of an issue related to the biotechnology involved with *in vitro* fertilization and other molecular reproductive procedures.

= Standards measured by ACT's Science tests
_____ = Standards content sampled by ACT's Science tests

TENNESSEE Scientific Research
Standards, Expectations, and State Indicators

Content Standard: 1.0. Ethical Practices

The student will demonstrate ethical practices.

Learning Expectations

The student will:

1.1. critically examine data to determine its significance.

1.2. repeat trials to enhance the reliability of data.

1.3. recognize that in science one solution often leads to new questions.

1.4. employ ethical practices with research and investigations that involve human or animal subjects and/or hazardous/bio-hazardous materials.

1.5. follow safety procedures in the classroom, laboratory, and home environments.

1.6. respect and understand copyright and patent laws.

State Performance Indicators

The student is able to:

- use printed references and correct citations.
- honor all copyright laws.
- choose appropriate sources of information.
- report accurate observations.
- follow proper safety procedures.
- date and document data, observations, and reflections in a journal.
- complete a research plan that adheres to appropriate regulatory guidelines.
- reference sources of information.
- complete necessary documents regarding the involvement of human or animal subjects and/or hazardous/bio-hazardous materials.

Content Standard: 2.0 Critical Thinking Skills

The student will identify and clarify problems using critical thinking skills.

Learning Expectations

The student will:

2.1. use scientific instruments for extending the human senses in observation.

2.2. recognize limits to scientific investigations.

2.3. use technological tools and mathematical models to analyze problems or questions.

2.4. evaluate safety implications and risks associated with a question.

2.5. analyze and study classical problems.

State Performance Indicators

The student is able to:

- balance risks and benefits to solving a problem.
- employ a search engine on the web.
- work cooperatively with an equal or a mentor.
- show correct use of scientific instruments.
- perform a literature search to define a problem.
- write narratives to describe observed scientific phenomena.
- develop and refine a problem statement.
- develop an awareness of the limitations to scientific investigations.
- analyze questions using technology and mathematics models.
- examine safety precautions during experimental design.
- reflect on classical problems by documenting in a journal.
- work collaboratively with peers.
- employ advanced mathematical and computational models.

Content Standard: 3.0. Scientific Inquiry

The student will design and implement a strategy for solving a scientific problem or a strategy for answering a scientific question.

Learning Expectations

The student will:

3.1. practice appropriate safety procedures.

3.2. formulate a working hypothesis to guide research.

3.3. develop experimental procedures to test hypothesis.

3.4. collect data using a variety of scientific tools.

3.5. verify data for accuracy.

State Performance Indicators

The student is able to:

- demonstrate appropriate measurement techniques.
- differentiate between variables and controls in an experiment.
- describe basic laboratory procedures.
- exhibit proper safety techniques.
- design and use appropriate procedures for laboratory and fieldwork.
- design experiments with the proper application of controls and variables.
- demonstrate appropriate use of scientific tools and instruments.
- record and document data and observations accurately.
- apply established procedures to novel situations.
- modify or design an alternative experimental procedure.

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_____ = Standards content sampled by ACT's Science tests

Content Standard: 4.0. Analyzing and Evaluating Data

The student will develop abilities to analyze and evaluate data.

Learning Expectations

The student will:

4.1. use statistical analysis to analyze and interpret data accurately.

4.2. evaluate data based in terms of accuracy and precision.

4.3. make conclusions based on data analysis and evaluations.

State Performance Indicators

The student is able to:

- use graphing calculators or computers to process data.
- collect data with hand-held technology.
- analyze alternate methods for representing data graphically.
- use spreadsheets, graphing, and database programs.
- examine trends in data in order to answer questions.
- distinguish between accuracy and precision.
- develop alternative hypotheses.
- develop a list of open-ended effects.

Content Standard: 5.0. Communicating Scientific Results

The student will publish, present, and communicate results of a scientific investigation.

Learning Expectations

The student will:

5.1. present scientific reports in a clear, accurate, and appropriate manner to a variety of audiences.

5.2. communicate findings in order to extend the research base.

State Performance Indicators

The student is able to:

- demonstrate basic keyboarding skills.
- apply proper grammatical conventions to written communication.
- write an expository essay.
- organize written communication with clarity and cohesiveness.
- compose and present a well-enunciated oral report.
- present information effectively using audiovisual aids.
- design and implement an appropriate presentation format based upon the audience and nature of the research.
- prepare a technical report.
- collaborate with other investigators in order to revise experimental design and/or design new experiments.

= Standards measured by ACT's Science tests

_____ = Standards content sampled by ACT's Science tests

Section C: ACT's College Readiness Standards Included in Tennessee's Grades 7–12 Curriculum Standards

Using thousands of student records and responses, content and measurement experts worked backwards to develop data-driven, empirically derived statements of what students know and are typically able to do in various score ranges on the English, Reading, Writing, Mathematics, and Science tests on the EXPLORE, PLAN, and ACT tests. These empirically derived score descriptors are called **ACT's College Readiness Standards**. Because of this unique way the ACT Standards were derived, ACT's Standards contain specific descriptions of proficiency and content, including descriptions of the complexity of the test material. The ACT standards prove to be an effective way to communicate the skills and knowledge measured by our EXPLORE, PLAN, and ACT tests.

> In this section (Section C), the ACT Standards that are highlighted are those that are included in Tennessee's Standards. ACT Standards not highlighted are those statements that include specific content, complexity and/or proficiency level descriptions that were not described in Tennessee's standards.

Because Tennessee educators are the experts on the Tennessee Curriculum Standards, we would strongly encourage them to examine this document and offer their interpretations.

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