STATE MATCH

Missouri Course Level Expectations

Communication Arts, Mathematics, and Science
Grades 9–12

and

EXPLORE®, PLAN®, and the ACT®

March 2009

ACT®

About This Report

EXECUTIVE SUMMARY
(pp. 1–4)

This portion summarizes the findings of the alignment between Missouri's Course Level Expectations and ACT's Educational Planning and Assessment System (EPAS™) tests—EXPLORE® (8th and 9th grades), PLAN® (10th grade), and the ACT® (11th and 12th grades). It also presents ACT's involvement in meeting NCLB requirements and describes additional information about the unique programs and services ACT can provide to Missouri.

SECTION A
(pp. 5–7)

This section provides tables by content area (Communication Arts, Mathematics, and Science), listing the precise number of Missouri Course Level Expectations measured by ACT's EPAS tests by grade level.

SECTION B
(pp. 9–55)

All Missouri Course Level Expectations are listed here; each one highlighted is measured by ACT's EPAS tests. Underlined science content indicates that the content topics are included in, but not directly measured by, ACT's EPAS Science tests. Missouri standards listed here are from the Missouri Course Level Expectations as presented on the Missouri Department of Elementary & Secondary Education website in February 2009:

Missouri Course Level Expectations	Publication Date	Academic Year of Implementation
Communication Arts	October 2008	2009–2010
Mathematics	April 2008	2009–2010
Science	June 2007 DRAFT	2009–2010

SECTION C
(pp. 57–92)

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

A supplement that identifies the specific ACT College Readiness Standard(s) corresponding to each Missouri Course Level Expectation in a side-by-side format is available at **www.act.org/education/statematch**.

ACT

Executive Summary

We at ACT believe our programs offer many advantages to Missouri 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 Missouri's Course Level Expectations?
2. Can the results from ACT's testing programs be used to meet Missouri's NCLB requirement?
3. Why should Missouri choose EPAS?

ACT'S TESTS MEASURE MANY IMPORTANT MISSOURI COURSE LEVEL EXPECTATIONS IN COMMUNICATION 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 Missouri Communication Arts, Mathematics, and Science Course Level Expectations:

- Communication Arts: 2 out of 4 Strands

  Most Missouri Communication Arts Course Level Expectations in Writing and many in Reading are covered by ACT's English, Reading, and Writing tests.

- Mathematics: 5 out of 5 Strands

  Almost all Missouri Mathematics Course Level Expectations are covered by ACT's Mathematics tests.

- Science: Process: 2 out of 2 Strands
  (Content: 6 out of 6 Strands)

  Most Missouri Science Course Level Expectations 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 Missouri Science Course Level Expectations.

  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 Missouri 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 Missouri's Course Level Expectations arise from standards not being assessable in group settings, standards that are personal in nature, and standards requiring measurement over

extended time. If additional testing is deemed necessary, ACT would be interested in working with Missouri on developing any necessary augmentation.

2. NCLB requirement? Yes; Illinois and Michigan use ACT's tests as integral components of their statewide academic assessment systems under NCLB for Grade 11 students and submit evidence of compliance with NCLB to the U.S. Department of Education (ED) for approval. Through the peer review process, the ED determines whether such evidence demonstrates that a given state's assessment system meets NCLB requirements. The more closely a state's standards align with its assessments, the more likely it is that the outcome of the NCLB peer review will be favorable. With so much at stake, states must be rigorous both in developing their academic standards and in choosing assessment instruments that will help achieve the common goal of preparing students for life after high school.

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.**

3. Why implement EXPLORE, PLAN and the ACT? ACT's EPAS tests provide a longitudinal, systematic approach to educational and career planning, assessment, instructional support, and evaluation. The system focuses on the integrated, higher-order thinking skills students develop in grades K–12 that are important for success both during and after high school.

Unlike many other large-scale assessments of academic ability, EXPLORE, PLAN, and the ACT are first and foremost achievement tests. They are measures whose tasks correspond to recognized high school learning experiences, but which at the same time do not precisely duplicate the high school curriculum. EXPLORE, PLAN, and the ACT measure not an abstract quality, such as intelligence or aptitude, but rather what students are able to do with what they have learned in school.

States and school districts choose the EPAS system 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*. ACT's College Readiness Standards are precise descriptors of the essential skills and knowledge that students need to become ready for college and career, beginning in grade 8 and continuing through grade 12. 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

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™**

each course level and for college and work readiness. The responses drive the test specifications for EXPLORE, PLAN, and the ACT.

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

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

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

  Using thousands of student records and responses, content and measurement experts at ACT have developed detailed statements that describe what students typically know and are able to do at different levels of test performance. These data-driven, empirically derived score descriptors articulate student achievement within various score ranges on the English, Reading, Writing, Mathematics, and Science tests on the EXPLORE, PLAN, and ACT. These statements provide specific details about students' college readiness and can be used to identify next steps for improvement.

ACT research has shown that, whether planning to enter college or workforce training programs after graduation, high school students need to be educated to a comparable level of readiness in reading and mathematics. Graduates need this level of readiness if they are to succeed in college-level courses without remediation and to enter workforce training programs ready to learn job-specific skills.

Early planning based on sound information is a key factor in helping students reach their academic and career goals. **EXPLORE** provides baseline information on the academic preparation of students that can be used to plan high school coursework. ACT's research has shown that eighth-grade academic achievement is the best predictor of college and career readiness by high school graduation. Further, improvement in eighth-grade academic achievement and being on target for college and career readiness in eighth grade are more beneficial than any high school-level achievement enhancement.

PLAN helps tenth-grade students build a foundation for future academic and career success and provides information needed to address school districts' high-priority issues. It is a comprehensive guidance resource that helps students measure their current academic development, explore career/training options, and make plans for the remaining years of high school land post-graduation years. PLAN provides a midpoint review of students' progress toward their education and career goals while there is still time to make necessary interventions.

The ACT test assesses high school students' general educational development and provides unparalleled information about a student's readiness for entry-level college coursework and ability to make successful transitions to college and work after high school.

Each test also includes non-cognitive measures and surveys that allow students to build relationships between their academic development, their backgrounds, and their plans.

If the goal of high school education is to prepare students for college and career readiness, then we should be educating all high school students according to a common academic expectation, one that prepares them for both postsecondary education and the workforce. Only then—whether they are among the two-thirds who enter college directly after graduation or those who enter workforce training programs—will they be ready for life after high school.

ACT's EPAS system would not only provide important information regarding students' academic achievement relative to the Missouri Course Level Expectations, but EPAS offers what no other testing program can: an empirically based, time-honored measure of college and career readiness that can help Illinois students reach their educational and career goals and help provide Missouri High Schools with the information they need to prepare their students for college and career.

Section A: Number of Missouri Course Level Expectations Measured by EXPLORE, PLAN, and the ACT

Table A-1. Number of Missouri Communication Arts CLEs Measured by EXPLORE, PLAN, and the ACT

Missouri Strands*	Number of Missouri CLEs Measured by ACT's tests	Aspects of Missouri CLEs that are Not Measured
Reading	Eng I: 22 out of 46 Eng II: 23 out of 51 Eng II: 19 out of 48 Eng IV: 17 out of 44	Apply decoding strategies Adjust reading rate to difficulty and type of text Apply pre-reading strategies Self-monitor comprehension Question to clarify Compare, contrast, analyze and evaluate connections Analyze and evaluate text features Apply multi-step directions to perform complex procedures
Writing	Eng I: 15 out of 28 Eng II: 15 out of 28 Eng II: 20 out of 28 Eng IV: 20 out of 28	Use appropriate prewriting strategies Share writing Compose literary analysis Compose reflective writing
Listening and Speaking		
Information Literacy		
TOTALS 2 out of 4 Strands	Eng I: 37 out of 74 Eng II: 38 out of 79 Eng II: 39 out of 76 Eng IV: 37 out of 72	

*Refer to Missouri's Communication Arts Course Level Expectations on pages 9–20
= EPAS tests do not assess this material.

ACT

Table A-2. Number of Missouri Mathematics CLEs Measured by EXPLORE, PLAN, and the ACT					
Missouri Strands*	**Number of Missouri CLEs Measured by ACT's tests**				**Aspects of Missouri CLEs that are Not Measured**
Number and Operations	Algebra I:	7	out of	7	
	Geometry:	5	out of	5	
	Int Math II:	6	out of	6	
	Algebra II:	5	out of	5	
	Int Math III:	6	out of	6	
Algebraic Relationships	Algebra I:	10	out of	10	
	Geometry:	3	out of	5	
	Int Math II:	10	out of	10	
	Algebra II:	10	out of	10	
	Int Math III:	10	out of	10	
Geometric and Spatial Relationships	Algebra I:	2	out of	2	
	Geometry:	6	out of	6	
	Int Math II:	6	out of	6	
	Algebra II:	3	out of	3	
	Int Math III:	5	out of	5	
Measurement	Algebra I:	2	out of	2	
	Geometry:	3	out of	3	
	Int Math II:	0	out of	1	
	Algebra II:	2	out of	2	
	Int Math III:	4	out of	4	
Data and Probability	Algebra I:	5	out of	5	
	Geometry:	2	out of	2	
	Int Math II:	4	out of	4	
	Algebra II:	5	out of	5	
	Int Math III:	4	out of	6	
TOTALS 5 out of 5 Strands	Algebra I:	26	out of	26	
	Geometry:	19	out of	21	
	Int Math II:	26	out of	27	
	Algebra II:	25	out of	25	
	Int Math III:	29	out of	31	

*Refer to Missouri's Mathematics Course Level Expectations on pages 21–30

Table A-3. Number of Missouri Science CLEs Measured by EXPLORE, PLAN, and the ACT		
Missouri Strands*	**Number of Missouri CLEs Measured by ACT's tests**	**Aspects of Missouri CLEs that are Not Measured**
7. Scientific Inquiry	15 out of 20	Explain importance of public presentation of scientific work
8. Impact of Science, Technology and Human Activity	1 or 2 out of 6–13 per course	Analyze roles of science and society as they interact Identify need for informed consent in experimentation
TOTALS 2 out of 2 Process Strands	16 or 17 out of 26–33	
1. Matter & Energy	Phy Sci: (35) out of (35) E/S Sci: (20) out of (20) Bio I: (2) out of (2) Chem I: (28) out of (28) Physics I: (14) out of (14)	
2. Properties and Principles of Force and Motion	Phy Sci: (20) out of (20) E/S Sci: (1) out of (1) Physics I: (21) out of (21)	
3. Characteristic and Interactions of Living Organisms	Bio I: (37) out of (37)	
4. Changes in Ecosystems and Interactions of Organisms with their Environments	E/S Sci: (3) out of (3) Bio I: (24) out of (24)	
5. Processes and Interactions of the Earth's Systems (Geo-sphere, Atmosphere, and Hydrosphere)	E/S Sci: (26) out of (26) Bio I: (2) out of (2) Chem I: (4) out of (4) Physics I: (2) out of (2)	
6. Composition and Structure of the Universe and the Motion of the Objects Within It	Phy Sci: (5) out of (5) E/S Sci: (11) out of (11) Bio I: (1) out of (1) Physics I: (11) out of (11)	
TOTALS 6 out of 6 Content Strands	Phy Sci: (60) out of (60) E/S Sci: (61) out of (61) Bio I: (66) out of (66) Chem I: (32) out of (32) Physics I: (48) out of (48)	

*Refer to Missouri's Science Course Level Expectations on pages 31–55

Communication Arts

Missouri English I
Course Level Expectations

Strand 1: Reading

Big Idea 1. Develop and apply skills and strategies to the reading process

A. Print Concepts

No CLE

B. Phonemic Awareness

No CLE

C. Phonics

Apply decoding strategies to "problem-solve" unknown words when reading when needed*

D. Fluency

Read grade-level instructional text*

a. with fluency: accuracy, comprehension and appropriate expression
b. adjusting reading rate to difficulty and type of text

E. Vocabulary

Develop vocabulary through text, using

a. roots and affixes
b. context clues
c. glossary, dictionary and thesaurus

F. Pre-Reading

Apply pre-reading strategies to aid comprehension*

a. access prior knowledge
b. preview
c. predict with text support or rationale
d. set a purpose and rate for reading

G. During reading

During reading, utilize strategies to*

a. determine meaning of unknown words
b. self-monitor comprehension
c. question the text
d. infer
e. visualize
f. paraphrase
g. summarize

H. Post-Reading

Apply post-reading skills to comprehend, interpret, analyze, and evaluate text:

a. identify and explain the relationship between the main idea and supporting details
b. question to clarify*
c. reflect
d. draw conclusions
e. paraphrase
f. summarize

I. Making Connections

Compare, contrast, analyze and evaluate connections:

a. text to text (information and relationships in various fiction and non-fiction works)
b. text to self (text ideas and own experiences)*
c. text to world (text ideas and the world by analyzing and evaluating the relationship between literature and its historical period and culture)*

Big Idea 2. Develop and apply skills and strategies to comprehend, analyze and evaluate fiction, poetry and drama from a variety of cultures and times

A. Text Features

Analyze and evaluate the text features in grade-level text

B. Literary Techniques

Identify and explain literary techniques, in text emphasizing

a. irony
b. imagery
c. repeated sound, line or phrase
d. analyze literary techniques previously introduced

C. Literary Elements

Use details from text(s) to

a. demonstrate comprehension skills previously introduced
b. analyze character, plot, setting, point of view
c. analyze the development of a theme across genres
d. evaluate the effect of author's style

Big Idea 3. Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction (such as biographies, newspapers, technical manuals) from a variety of cultures and times

A. Text Features

Explain, analyze and evaluate the author's use of text features to clarify meaning

B. Literary Techniques

Identify, explain, and analyze literary techniques in non-fiction, emphasizing

a. irony

*Locally assessed.

b. imagery
c. repeated sound, line or phrase
d. figurative language and sound devices previously introduced

C. Text Structures

Use details from informational text to

a. identify and explain the organizational pattern
b. analyze and evaluate effectiveness of word choice
c. analyze and evaluate the accuracy and adequacy of evidence
d. analyze and evaluate point of view
e. analyze and evaluate author's viewpoint/perspective
f. evaluate proposed solutions
g. demonstrate comprehension skills previously introduced

D. Understanding Directions

Read and apply multi-step directions to perform complex procedures and/or tasks*

Strand 2: Writing

Big Idea 1. Apply a writing process in composing text

A. Writing Process

Follow a writing process to

a. use appropriate prewriting strategies as needed
b. generate a draft
c. revise in response to feedback (peer and/or teacher)*
d. edit for conventions*
e. share writing*

Big Idea 2. Compose well-developed text

A. Audience and purpose

Compose text

a. showing awareness of audience
b. choosing a form and point of view appropriate to purpose and audience

B. Ideas and Content

Compose text with:

a. strong controlling idea
b. relevant specific details
c. complex ideas
d. freshness of thought

C. Organization and Sentence Structure

Compose text with

a. effective beginning, middle, and end
b. a logical order
c. effective paragraphing
d. cohesive devices
e. varied sentence structure
f. clarity of expression
g. active voice

D. Word Choice

Compose text using

a. precise and vivid language
b. writing techniques such as imagery, humor, voice, and figurative language

E. Conventions

In written text apply

a. conventions of capitalization
b. conventions of punctuation
c. standard usage

Big Idea 3. Write effectively in various forms and types of writing

A. Forms/Types/Modes of Writing

Compose a variety of texts,

a. using narrative, descriptive, expository, and/or persuasive features
b. in various formats, including workplace communication
c. including summary
d. including literary analysis
e. including reflective writing

Strand 3: Listening and Speaking

Big Idea 1. Develop and apply effective listening skills and strategies

A. Purpose for Listening

Listen

- for enjoyment
- for information
- for directions
- critically to summarize and evaluate communications that inform, persuade and entertain
- to evaluate own and others' effectiveness in presentations and group discussions, using provided criteria
- to evaluate the validity and reliability of speaker's message

B. Listening Behavior

Use active-listening behaviors (e.g., asks questions of speaker and uses body language and facial expressions to indicate agreement, disagreement or confusion)

Big Idea 2. Develop and apply effective speaking skills and strategies for various audiences and purposes

A. Discussion and Presentation

In discussions and presentations,

- create concise presentations on a variety of topics
- incorporate appropriate media or technology

*Locally assessed.

- respond to feedback
- defend ideas
- demonstrate poise and self-control

B. Giving Directions

Give clear and concise multi-step oral directions to perform complex procedures and/or tasks

Strand 4: Information Literacy

Big Idea 1. Develop and apply effective research process skills to gather, analyze and evaluate information

A. Research Plan

Develop an appropriate research plan to guide investigation and research of focus questions

B. Acquire information

Locate and use multiple primary and secondary sources to

- select relevant and credible information
- evaluate reliability of information
- evaluate reliability of sources

C. Record Information

Record relevant information from multiple primary and secondary sources using a self-selected note-taking or organizational strategy

D. Sources Consulted

Document sources of information using a standard citation format

Big Idea 2. Develop and apply effective skills and strategies to analyze and evaluate oral and visual media

A. Media Messages

Analyze, describe and evaluate the elements of messages projected in various media (e.g., videos, pictures, web-sites, artwork, plays and/or news programs)

*Locally assessed.

Missouri English II
Course Level Expectations

Strand 1: Reading

Big Idea 1. Develop and apply skills and strategies to the reading process

A. Print Concepts

No CLE

B. Phonemic Awareness

No CLE

C. Phonics

Apply decoding strategies to "problem-solve" unknown words when reading when needed*

D. Fluency

Read grade-level instructional text*

a. with fluency: accuracy, comprehension and appropriate expression
b. adjusting reading rate to difficulty and type of text

E. Vocabulary

Develop vocabulary through text, using

a. roots and affixes
b. context clues
c. glossary, dictionary and thesaurus

F. Pre-Reading

Apply pre-reading strategies to aid comprehension*

a. access prior knowledge
b. preview
c. predict with text support or rationale
d. set a purpose and rate for reading

G. During reading

During reading, utilize strategies to*

a. determine meaning of unknown words
b. self-monitor comprehension
c. question the text
d. infer
e. visualize
f. paraphrase
g. summarize

H. Post-Reading

Apply post-reading skills to comprehend, interpret, analyze, and evaluate text:

a. identify and explain the relationship between the main idea and supporting details
b. question to clarify*
c. reflect
d. draw conclusions
e. paraphrase
f. summarize

I. Making Connections

Compare, contrast, analyze and evaluate connections:

a. text to text (information and relationships in various fiction and non-fiction works)
b. text to self (text ideas and own experiences)*
c. text to world (text ideas and the world by analyzing and evaluating the relationship between literature and its historical period and culture)*

Big Idea 2. Develop and apply skills and strategies to comprehend, analyze and evaluate fiction, poetry and drama from a variety of cultures and times

A. Text Features

Analyze and evaluate the text features in grade-level text

B. Literary Techniques

Identify and explain literary techniques, in text emphasizing

a. understatement
b. parallelism
c. allusion
d. analogy
e. analyze and evaluate literary techniques previously introduced

C. Literary Elements

Use details from text(s) to

a. demonstrate comprehension skills previously introduced
b. analyze character, plot, setting, point of view
c. analyze the development of a theme across genres
d. identify and analyze tone

Big Idea 3. Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction (such as biographies, newspapers, technical manuals) from a variety of cultures and times

A. Text Features

Explain, analyze and evaluate the author's use of text features to clarify meaning

B. Literary Techniques

Identify, explain, and analyze literary techniques in non-fiction, emphasizing

a. understatement
b. parallelism
c. allusion
d. analogy
e. figurative language and sound devices previously introduced

*Locally assessed.

C. Text Structures

Use details from informational text to

a. analyze and evaluate the organizational patterns
b. identify and analyze faulty reasoning and unfounded inferences
c. evaluate proposed solutions
d. evaluate for accuracy and adequacy of evidence
e. evaluate effect of tone on the overall meaning of work
f. analyze and evaluate point of view
g. analyze and evaluate author's viewpoint/perspective
h. demonstrate comprehension skills previously introduced

D. Understanding Directions

Read and apply multi-step directions to perform complex procedures and/or tasks*

Strand 2: Writing

Big Idea 1. Apply a writing process in composing text

A. Writing Process

Follow a writing process to

a. use appropriate prewriting strategies as needed
b. generate a draft
c. revise in response to feedback (peer and/or teacher)*
d. edit for conventions*
e. share writing*

Big Idea 2. Compose well-developed text

A. Audience and purpose

Compose text

a. showing awareness of audience
b. choosing a form and point of view appropriate to purpose and audience

B. Ideas and Content

Compose text with:

a. strong controlling idea
b. relevant specific details
c. complex ideas
d. freshness of thought

C. Organization and Sentence Structure

Compose text with

a. effective beginning, middle, and end
b. a logical order
c. effective paragraphing
d. cohesive devices
e. varied sentence structure
f. clarity of expression
g. active voice

D. Word Choice

Compose text using

a. precise and vivid language
b. writing techniques such as imagery, humor, voice, and figurative language

E. Conventions

In written text apply

a. conventions of capitalization
b. conventions of punctuation
c. standard usage

Big Idea 3. Write effectively in various forms and types of writing

A. Forms/Types/Modes of Writing

Compose a variety of texts,

a. using narrative, descriptive, expository, and/or persuasive features
b. in various formats, including workplace communication
c. including summary
d. including literary analysis
e. including reflective writing

Strand 3: Listening and Speaking

Big Idea 1. Develop and apply effective listening skills and strategies

A. Purpose for Listening

Listen

- for enjoyment
- for information
- for directions
- critically to summarize and evaluate communications that inform, persuade and entertain
- to evaluate own and others' effectiveness in presentations and group discussions, using provided criteria
- to evaluate the validity and reliability of speaker's message

B. Listening Behavior

Use active-listening behaviors (e.g., asks questions of speaker and uses body language and facial expressions to indicate agreement, disagreement or confusion)

Big Idea 2. Develop and apply effective speaking skills and strategies for various audiences and purposes

A. Discussion and Presentation

In discussions and presentations,

- create concise presentations on a variety of topics
- incorporate appropriate media or technology
- respond to feedback
- defend ideas
- demonstrate poise and self-control

*Locally assessed.

B. Giving Directions

Give clear and concise multi-step oral directions to perform complex procedures and/or tasks

Strand 4: Information Literacy

Big Idea 1. Develop and apply effective research process skills to gather, analyze and evaluate information

A. Research Plan

Develop an appropriate research plan to guide investigation and research of focus questions

B. Acquire information

Locate and use multiple primary and secondary sources to

- select relevant and credible information
- evaluate reliability of information
- evaluate reliability of sources

C. Record Information

Record relevant information from multiple primary and secondary sources using a self-selected note-taking or organizational strategy

D. Sources Consulted

Document sources of information using a standard citation format

Big Idea 2. Develop and apply effective skills and strategies to analyze and evaluate oral and visual media

A. Media Messages

Analyze, describe and evaluate the elements of messages projected in various media (e.g., videos, pictures, web-sites, artwork, plays and/or news programs)

*Locally assessed.

Missouri English III
Course Level Expectations

Strand 1: Reading

Big Idea 1. Develop and apply skills and strategies to the reading process

A. Print Concepts

No CLE

B. Phonemic Awareness

No CLE

C. Phonics

Apply decoding strategies to "problem-solve" unknown words when reading when needed*

D. Fluency

Read grade-level instructional text*

a. with fluency: accuracy, comprehension and appropriate expression
b. adjusting reading rate to difficulty and type of text

E. Vocabulary

Develop vocabulary through text, using

a. roots and affixes
b. context clues
c. glossary, dictionary and thesaurus

F. Pre-Reading

Apply pre-reading strategies to aid comprehension*

a. access prior knowledge
b. preview
c. predict with text support or rationale
d. set a purpose and rate for reading

G. During reading

During reading, utilize strategies to*

a. determine meaning of unknown words
b. self-monitor comprehension
c. question the text
d. infer
e. visualize
f. paraphrase
g. summarize

H. Post-Reading

Apply post-reading skills to comprehend, interpret, analyze, and evaluate text:

a. identify and explain the relationship between the main idea and supporting details
b. question to clarify*
c. reflect
d. draw conclusions
e. paraphrase
f. summarize

I. Making Connections

Compare, contrast, analyze and evaluate connections:

a. text to text (information and relationships in various fiction and non-fiction works)
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c. text to world (text ideas and the world by analyzing and evaluating the relationship between literature and its historical period and culture)*

Big Idea 2. Develop and apply skills and strategies to comprehend, analyze and evaluate fiction, poetry and drama from a variety of cultures and times

A. Text Features

Analyze and evaluate the text features in grade-level text

B. Literary Techniques

Identify and explain literary techniques, in text emphasizing

a. euphemism
b. satire
c. analyze and evaluate literary techniques previously introduced

C. Literary Elements

Use details from text(s) to

a. demonstrate comprehension skills previously introduced
b. analyze character, plot, setting, point of view
c. analyze the development of a theme across genres
d. evaluate the effect of tone on the overall meaning of work

Big Idea 3. Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction (such as biographies, newspapers, technical manuals) from a variety of cultures and times

A. Text Features

Explain, analyze and evaluate the author's use of text features to clarify meaning

B. Literary Techniques

Identify, explain, and analyze literary techniques in non-fiction, emphasizing

a. euphemism
b. satire
c. figurative language and sound devices previously introduced

C. Text Structures

Use details from informational text to

a. analyze and evaluate the organizational patterns
b. identify and analyze faulty reasoning and unfounded inferences
c. evaluate proposed solutions

*Locally assessed.

d. evaluate for accuracy and adequacy of evidence
e. analyze and evaluate the type of appeal (emotional, ethical, and logical)
f. evaluate effect of tone on the overall meaning of work
g. analyze and evaluate point of view
h. analyze and evaluate author's viewpoint/perspective
i. demonstrate comprehension skills previously introduced

D. Understanding Directions

Read and apply multi-step directions to perform complex procedures and/or tasks*

Strand 2: Writing

Big Idea 1. Apply a writing process in composing text

A. Writing Process

Follow a writing process to

a. use appropriate prewriting strategies as needed
b. generate a draft
c. revise in response to feedback (peer and/or teacher)*
d. edit for conventions*
e. share writing*

Big Idea 2. Compose well-developed text

A. Audience and purpose

Compose text

a. showing awareness of audience
b. choosing a form and point of view appropriate to purpose and audience

B. Ideas and Content

Compose text with:

a. strong controlling idea
b. relevant specific details
c. complex ideas
d. freshness of thought

C. Organization and Sentence Structure

Compose text with

a. effective beginning, middle, and end
b. a logical order
c. effective paragraphing
d. cohesive devices
e. varied sentence structure
f. clarity of expression
g. active voice

D. Word Choice

Compose text using

a. precise and vivid language
b. writing techniques such as imagery, humor, voice, figurative language, and rhetorical devices

E. Conventions

In written text apply

a. conventions of capitalization
b. conventions of punctuation
c. standard usage

Big Idea 3. Write effectively in various forms and types of writing

A. Forms/Types/Modes of Writing

Compose a variety of texts,

a. using narrative, descriptive, expository, and/or persuasive features
b. in various formats, including workplace communications (resume, letter of application, follow-up letter)
c. including summary
d. including literary analysis
e. including reflective writing

Strand 3: Listening and Speaking

Big Idea 1. Develop and apply effective listening skills and strategies

A. Purpose for Listening

Listen

- for enjoyment
- for information
- for directions
- critically to summarize and evaluate communications that inform, persuade and entertain
- to evaluate own and others' effectiveness in presentations and group discussions, using provided criteria
- to evaluate the validity and reliability of speaker's message

B. Listening Behavior

Use active-listening behaviors (e.g., asks questions of speaker and uses body language and facial expressions to indicate agreement, disagreement or confusion)

Big Idea 2. Develop and apply effective speaking skills and strategies for various audiences and purposes

A. Discussion and Presentation

In discussions and presentations,

- create concise presentations on a variety of topics
- incorporate appropriate media or technology
- respond to feedback
- defend ideas
- demonstrate poise and self-control

*Locally assessed.

B. Giving Directions

Give clear and concise multi-step oral directions to perform complex procedures and/or tasks

Strand 4: Information Literacy

Big Idea 1. Develop and apply effective research process skills to gather, analyze and evaluate information

A. Research Plan

Develop an appropriate research plan to guide investigation and research of focus questions

B. Acquire information

Locate and use multiple primary and secondary sources to

- select relevant and credible information
- evaluate reliability of information
- evaluate reliability of sources

C. Record Information

Record relevant information from multiple primary and secondary sources using a self-selected note-taking or organizational strategy

D. Sources Consulted

Document sources of information using a standard citation format

Big Idea 2. Develop and apply effective skills and strategies to analyze and evaluate oral and visual media

A. Media Messages

Analyze, describe and evaluate the elements of messages projected in various media (e.g., videos, pictures, web-sites, artwork, plays and/or news programs)

*Locally assessed.

Missouri English IV
Course Level Expectations

Strand 1: Reading

Big Idea 1. Develop and apply skills and strategies to the reading process

A. Print Concepts

No CLE

B. Phonemic Awareness

No CLE

C. Phonics

Apply decoding strategies to "problem-solve" unknown words when reading when needed*

D. Fluency

Read grade-level instructional text*

a. with fluency: accuracy, comprehension and appropriate expression
b. adjusting reading rate to difficulty and type of text

E. Vocabulary

Develop vocabulary through text, using

a. roots and affixes
b. context clues
c. glossary, dictionary and thesaurus

F. Pre-Reading

Apply pre-reading strategies to aid comprehension*

a. access prior knowledge
b. preview
c. predict with text support or rationale
d. set a purpose and rate for reading

G. During reading

During reading, utilize strategies to*

a. determine meaning of unknown words
b. self-monitor comprehension
c. question the text
d. infer
e. visualize
f. paraphrase
g. summarize

H. Post-Reading

Apply post-reading skills to comprehend, interpret, analyze, and evaluate text:

a. identify and explain the relationship between the main idea and supporting details
b. question to clarify*
c. reflect
d. draw conclusions
e. paraphrase
f. summarize

I. Making Connections

Compare, contrast, analyze and evaluate connections:

a. text to text (information and relationships in various fiction and non-fiction works)
b. text to self (text ideas and own experiences)*
c. text to world (text ideas and the world by analyzing and evaluating the relationship between literature and its historical period and culture)*

Big Idea 2. Develop and apply skills and strategies to comprehend, analyze and evaluate fiction, poetry and drama from a variety of cultures and times

A. Text Features

Analyze and evaluate the text features in grade-level text

B. Literary Techniques

Analyze and evaluate literary techniques previously introduced

C. Literary Elements

Use details from text(s) to

a. demonstrate comprehension skills previously introduced
b. analyze character, plot, setting, point of view
c. analyze the development of a theme across genres
d. evaluate the effect of tone on the overall meaning of work

Big Idea 3. Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction (such as biographies, newspapers, technical manuals) from a variety of cultures and times

A. Text Features

Explain, analyze and evaluate the author's use of text features to clarify meaning

B. Literary Techniques

Analyze and evaluate literary techniques in non-fiction including figurative language and sound devices previously introduced

C. Text Structures

Use details from informational text to

a. analyze and evaluate the organizational patterns
b. identify and analyze faulty reasoning and unfounded inferences
c. evaluate proposed solutions
d. evaluate for accuracy and adequacy of evidence
e. analyze and evaluate the type of appeal (emotional, ethical, and logical)
f. evaluate effect of tone on the overall meaning of work
g. analyze and evaluate point of view

*Locally assessed.

h. analyze and evaluate author's viewpoint/perspective

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Read and apply multi-step directions to perform complex procedures and/or tasks*

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*Locally assessed.

Mathematics

Missouri Algebra I
Course Level Expectations

Strand 1: Number and Operations

Big Idea 1. Understand numbers, ways of representing numbers, relationships among numbers and number systems

A. **Read, write and compare numbers:** compare and order rational and irrational numbers, including finding their approximate locations on a number line

B. **Represent and use rational numbers:** use real numbers and various models, drawing, etc. to solve problems

C. **Compose and decompose numbers:** use a variety of representations to demonstrate an understanding of very large and very small numbers*

D. **Classify and describe numeric relationships:** No CLE

Big Idea 2. Understand meanings of operations and how they relate to one another

A. **Represent operations:** No CLE

B. **Describe effects of operations:** describe the effects of operations, such as multiplication, division, and computing powers and roots on the magnitude of quantities*

C. **Apply properties of operations:** No CLE

D. **Apply operations on real and complex numbers:** apply operations to real numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases*

Big Idea 3. Compute fluently and make reasonable estimates

A. **Describe or represent mental strategies:** No CLE

B. **Develop and demonstrate fluency:** No CLE

C. **Compute problems:** No CLE

D. **Estimate and justify solutions:** judge the reasonableness of numerical computations and their results*

E. **Use proportional reasoning:** solve problems involving proportions*

Strand 2: Algebraic Relationships

Big Idea 1. Understand patterns, relations and functions

A. **Recognize and extend patterns:** No CLE

B. **Create and analyze patterns:** generalize patterns using explicitly or recursively defined functions

C. **Classify objects and representations:** compare and contrast various forms of representations of patterns

D. **Identify and compare functions:** understand and compare the properties of linear and nonlinear functions

E. **Describe the effects of parameter changes:** describe the effects of parameter changes on linear, exponential growth/decay and quadratic functions including intercepts

Big Idea 2. Represent and analyze mathematical situations and structures using algebraic symbols

A. **Represent mathematical situations:** use symbolic algebra to represent and solve problems that involve linear and quadratic relationships including equations and inequalities

B. **Describe and use mathematical manipulation:** describe and use algebraic manipulations, including factoring and rules of integer exponents and apply properties of exponents (including order of operations) to simplify expressions

C. **Utilize equivalent forms:** use and solve equivalent forms of equations (linear, absolute value, and quadratic)

D. **Utilize systems:** use and solve systems of linear equations or inequalities with 2 variables

Big Idea 3. Use mathematical models to represent and understand quantitative relationships

A. **Use mathematical models:** identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem

Big Idea 4. Analyze change in various contexts

A. **Analyze change:** analyze linear and quadratic functions by investigating rates of change, intercepts and zeros

Strand 3: Geometric and Spatial Relationships

Big Idea 1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

A. **Describe and use geometric relationships:** No CLE

B. **Apply geometric relationships:** apply geometric properties such as similarity and angle relationship to solve multi-step problems in 2 dimensions*

C. **Compose and decompose shapes:** No CLE

Big Idea 2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems

A. **Use coordinate systems:** No CLE

*Locally assessed.

Big Idea 3. Apply transformations and use symmetry to analyze mathematical situations

A. Use transformations on objects: No CLE

B. Use transformations on functions: No CLE

C. Use symmetry: No CLE

Big Idea 4. Use visualization, spatial reasoning and geometric modeling to solve problems

A. Recognize and draw three-dimensional representations: No CLE

B. Draw and use visual models: draw or use visual models to represent and solve problems*

Strand 4: Measurement

Big Idea 1. Understand measurable attributes of objects and the units, systems and processes of measurement

A. Determine unit of measurement: No CLE

B. Identify equivalent measures: No CLE

C. Tell and use units of time: No CLE

D. Count and compute money: No CLE

Big Idea 2. Apply appropriate techniques, tools and formulas to determine measurements

A. Use standard or non-standard measurement: No CLE

B. Use angle measurement: No CLE

C. Apply geometric measurements: No CLE

D. Analyze precision: describe the effects of operations, such as multiplication, division and computing powers and roots on magnitudes of quantities and effects of computation on precision which include the judging of reasonableness of numerical computations and their results*

E. Use relationships within a measurement system: use unit analysis to solve problems*

Strand 5: Data and Probability

Big Idea 1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them

A. Formulate questions: formulate questions and collect data about a characteristic which include sample spaces and distributions

B. Classify and organize data: No CLE

C. Represent and interpret data: select and use appropriate graphical representation of data and given one-variable quantitative data, display the distribution and describe its shape

Big Idea 2. Select and use appropriate statistical methods to analyze data

A. Describe and analyze data: apply statistical measures of center to solve problems

B. Compare data representations: No CLE

C. Represent data algebraically: given a scatterplot, determine an equation for a line of best fit

Big Idea 3. Develop and evaluate inferences and predictions that are based on data

A. Develop and evaluate inferences: make conjectures about possible relationships between 2 characteristics of a sample on the basis of scatter plots of the data

B. Analyze basic statistical techniques: No CLE

Big Idea 4. Understand and apply basic concepts of probability

A. Apply basic concepts of probability: No CLE

B. Use and describe compound events: No CLE

*Locally assessed.

Missouri Geometry
Course Level Expectations

Strand 1: Number and Operations

Big Idea 1. Understand numbers, ways of representing numbers, relationships among numbers and number systems

A. Read, write and compare numbers: compare and order rational and irrational numbers, including finding their approximate locations on a number line

B. Represent and use rational numbers: use real numbers and various models, drawing, etc. to solve problems

C. Compose and decompose numbers: No CLE

D. Classify and describe numeric relationships: No CLE

Big Idea 2. Understand meanings of operations and how they relate to one another

A. Represent operations: No CLE

B. Describe effects of operations: No CLE

C. Apply properties of operations: No CLE

D. Apply operations on real and complex numbers: apply operations to real numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases*

Big Idea 3. Compute fluently and make reasonable estimates

A. Describe or represent mental strategies: No CLE

B. Develop and demonstrate fluency: No CLE

C. Compute problems: No CLE

D. Estimate and justify solutions: judge the reasonableness of numerical computations and their results*

E. Use proportional reasoning: solve problems involving proportions*

Strand 2: Algebraic Relationships

Big Idea 1. Understand patterns, relations and functions

A. Recognize and extend patterns: No CLE

B. Create and analyze patterns: generalize patterns using explicitly or recursively defined functions

C. Classify objects and representations: compare and contrast various forms of representations of patterns

D. Identify and compare functions: No CLE

E. Describe the effects of parameter changes: No CLE

Big Idea 2. Represent and analyze mathematical situations and structures using algebraic symbols

A. Represent mathematical situations: No CLE

B. Describe and use mathematical manipulation: apply appropriate properties of exponents to simplify expressions and solve equations

C. Utilize equivalent forms: No CLE

D. Utilize systems: No CLE

Big Idea 3. Use mathematical models to represent and understand quantitative relationships

A. Use mathematical models: identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem

Big Idea 4. Analyze change in various contexts

A. Analyze change: analyze linear functions by investigating rates of change and intercepts

Strand 3: Geometric and Spatial Relationships

Big Idea 1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

A. Describe and use geometric relationships: use inductive and deductive reasoning to establish the validity of geometric conjectures, prove theorems and critique arguments made by others

B. Apply geometric relationships: No CLE

C. Compose and decompose shapes: No CLE

Big Idea 2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems

A. Use coordinate systems: make conjectures and solve problems involving 2-dimensional objects represented with Cartesian coordinates

Big Idea 3. Apply transformations and use symmetry to analyze mathematical situations

A. Use transformations on objects: use and apply constructions and the coordinate plane to represent translations, reflections, rotations and dilations of objects

B. Use transformations on functions: No CLE

C. Use symmetry: identify types of symmetries of 2- and 3-dimensional figures

Big Idea 4. Use visualization, spatial reasoning and geometric modeling to solve problems

A. Recognize and draw three-dimensional representations: draw and use vertex-edge graphs or networks to find optimal solutions and draw representations of 3-dimensional geometric objects from different perspectives

B. Draw and use visual models: draw or use visual models to represent and solve problems*

Strand 4: Measurement

Big Idea 1. Understand measurable attributes of objects and the units, systems and processes of measurement

A. Determine unit of measurement: No CLE

B. Identify equivalent measures: No CLE

C. Tell and use units of time: No CLE

D. Count and compute money: No CLE

*Locally assessed.

Big Idea 2. Apply appropriate techniques, tools and formulas to determine measurements

A. **Use standard or non-standard measurement:** No CLE
B. **Use angle measurement:** solve problems of angle measure, including those involving triangles or other polygons and of parallel lines cut by a transversal
C. **Apply geometric measurements:** determine the surface area, and volume of geometric figures, including cones, spheres, and cylinders
D. **Analyze precision:** No CLE
E. **Use relationships within a measurement system:** use unit analysis to solve problems*

Strand 5: Data and Probability

Big Idea 1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them

A. **Formulate questions:** formulate and collect data about a characteristic
B. **Classify and organize data:** No CLE
C. **Represent and interpret data:** select and use appropriate graphical representation of data and given one-variable quantitative data, display the distribution and describe its shape

Big Idea 2. Select and use appropriate statistical methods to analyze data

A. **Describe and analyze data:** No CLE
B. **Compare data representations:** No CLE
C. **Represent data algebraically:** No CLE

Big Idea 3. Develop and evaluate inferences and predictions that are based on data

A. **Develop and evaluate inferences:** No CLE
B. **Analyze basic statistical techniques:** No CLE

Big Idea 4. Understand and apply basic concepts of probability

A. **Apply basic concepts of probability:** No CLE
B. **Use and describe compound events:** No CLE

*Locally assessed.

Missouri Integrated Math II
Course Level Expectations

Strand 1: Number and Operations

Big Idea 1. Understand numbers, ways of representing numbers, relationships among numbers and number systems

- **A. Read, write and compare numbers:** compare and order rational and irrational numbers, including finding their approximate locations on a number line
- **B. Represent and use rational numbers:** use real numbers and various models, drawings, etc. to solve problems
- **C. Compose and decompose numbers:** No CLE
- **D. Classify and describe numeric relationships:** No CLE

Big Idea 2. Understand meanings of operations and how they relate to one another

- **A. Represent operations:** No CLE
- **B. Describe effects of operations:** No CLE
- **C. Apply properties of operations:** apply properties of exponents to simplify expressions or solve equations
- **D. Apply operations on real and complex numbers:** apply operations to real numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases*

Big Idea 3. Compute fluently and make reasonable estimates

- **A. Describe or represent mental strategies:** No CLE
- **B. Develop and demonstrate fluency:** No CLE
- **C. Compute problems:** No CLE
- **D. Estimate and justify solutions:** judge the reasonableness of numerical computations and their results*
- **E. Use proportional reasoning:** solve problems involving proportions*

Strand 2: Algebraic Relationships

Big Idea 1. Understand patterns, relations and functions

- **A. Recognize and extend patterns:** No CLE
- **B. Create and analyze patterns:** generalize patterns using explicitly or recursively defined functions
- **C. Classify objects and representations:** compare and contrast various forms of representations of patterns
- **D. Identify and compare functions:** understand and compare the properties of linear, exponential and quadratic functions (include domain and range)
- **E. Describe the effects of parameter changes:** describe the effects of parameter changes on quadratic and exponential functions

Big Idea 2. Represent and analyze mathematical situations and structures using algebraic symbols

- **A. Represent mathematical situations:** use symbolic algebra to represent and solve problems that involve quadratic relationships, including recursive relationships
- **B. Describe and use mathematical manipulation:** describe and use algebraic manipulations, including factoring and rules of integer exponents
- **C. Utilize equivalent forms:** use and solve equivalent forms of equations and inequalities (piece-wise and quadratic)
- **D. Utilize systems:** use and solve systems of linear equations or inequalities with 2 variables

Big Idea 3. Use mathematical models to represent and understand quantitative relationships

- **A. Use mathematical models:** identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem

Big Idea 4. Analyze change in various contexts

- **A. Analyze change:** analyze quadratic functions by investigating rates of change, intercepts and zeros

Strand 3: Geometric and Spatial Relationships

Big Idea 1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

- **A. Describe and use geometric relationships:** use trigonometric relationships with right triangles to determine lengths and angle measures
- **B. Apply geometric relationships:** apply relationships among surface areas and among volumes of similar objects*
- **C. Compose and decompose shapes:** No CLE

Big Idea 2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems

- **A. Use coordinate systems:** make conjectures and solve problems involving 2-dimensional objects represented with Cartesian coordinates

Big Idea 3. Apply transformations and use symmetry to analyze mathematical situations

- **A. Use transformations on objects:** use and apply constructions and matrices to represent translations, reflections, rotations, and dilations
- **B. Use transformations on functions:** translate, dilate and reflect quadratic and exponential functions
- **C. Use symmetry:** No CLE

*Locally assessed.

Big Idea 4. Use visualization, spatial reasoning and geometric modeling to solve problems

A. Recognize and draw three-dimensional representations: No CLE

B. Draw and use visual models: draw or use visual models to represent and solve problems*

Strand 4: Measurement

Big Idea 1. Understand measurable attributes of objects and the units, systems and processes of measurement

A. Determine unit of measurement: No CLE

B. Identify equivalent measures: No CLE

C. Tell and use units of time: No CLE

D. Count and compute money: No CLE

Big Idea 2. Apply appropriate techniques, tools and formulas to determine measurements

A. Use standard or non-standard measurement: No CLE

B. Use angle measurement: No CLE

C. Apply geometric measurements: No CLE

D. Analyze precision: analyze effects of computation on accuracy and precision in measurement*

E. Use relationships within a measurement system: No CLE

Strand 5: Data and Probability

Big Idea 1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them

A. Formulate questions: No CLE

B. Classify and organize data: No CLE

C. Represent and interpret data: No CLE

Big Idea 2. Select and use appropriate statistical methods to analyze data

A. Describe and analyze data: apply statistical concepts to solve problems and distinguish between a statistic and a parameter

B. Compare data representations: No CLE

C. Represent data algebraically: given a scatterplot, determine the type of function which models the data

Big Idea 3. Develop and evaluate inferences and predictions that are based on data

A. Develop and evaluate inferences: No CLE

B. Analyze basic statistical techniques: No CLE

Big Idea 4. Understand and apply basic concepts of probability

A. Apply basic concepts of probability: describe the concepts of sample space and probability distribution

B. Use and describe compound events: use and describe the concepts of conditional probability and independent events

*Locally assessed.

Missouri Algebra II
Course Level Expectations

Strand 1: Number and Operations

Big Idea 1. Understand numbers, ways of representing numbers, relationships among numbers and number systems

- **A. Read, write and compare numbers:** compare and order rational and irrational numbers, including finding their approximate locations on a number line
- **B. Represent and use rational numbers:** use real numbers and various models, drawing, etc. to solve problems
- **C. Compose and decompose numbers:** use a variety of representations to demonstrate an understanding of very large and very small numbers*
- **D. Classify and describe numeric relationships:** No CLE

Big Idea 2. Understand meanings of operations and how they relate to one another

- **A. Represent operations:** No CLE
- **B. Describe effects of operations:** No CLE
- **C. Apply properties of operations:** No CLE
- **D. Apply operations on real and complex numbers:** apply operations to matrices and complex numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases*

Big Idea 3. Compute fluently and make reasonable estimates

- **A. Describe or represent mental strategies:** No CLE
- **B. Develop and demonstrate fluency:** No CLE
- **C. Compute problems:** No CLE
- **D. Estimate and justify solutions:** judge the reasonableness of numerical computations and their results, including complex numbers*
- **E. Use proportional reasoning:** solve problems involving proportions*

Strand 2: Algebraic Relationships

Big Idea 1. Understand patterns, relations and functions

- **A. Recognize and extend patterns:** No CLE
- **B. Create and analyze patterns:** generalize patterns using explicitly or recursively defined functions
- **C. Classify objects and representations:** compare and contrast various forms of representations of patterns
- **D. Identify and compare functions:** compare properties of linear, exponential, logarithmic and rational functions
- **E. Describe the effects of parameter changes:** describe the effects of parameter changes on functions

Big Idea 2. Represent and analyze mathematical situations and structures using algebraic symbols

- **A. Represent mathematical situations:** use symbolic algebra to represent and solve problems that involve exponential, quadratic and logarithmic relationships
- **B. Describe and use mathematical manipulation:** describe and use algebraic manipulations, inverse or composition of functions
- **C. Utilize equivalent forms:** use and solve equivalent forms of equations and inequalities
- **D. Utilize systems:** use and solve systems of linear and quadratic equations or inequalities with 2 variables

Big Idea 3. Use mathematical models to represent and understand quantitative relationships

- **A. Use mathematical models:** identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem

Big Idea 4. Analyze change in various contexts

- **A. Analyze change:** analyze exponential and logarithmic functions by investigating rates of change, intercepts and asymptotes

Strand 3: Geometric and Spatial Relationships

Big Idea 1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

- **A. Describe and use geometric relationships:** use trigonometric relationships with right triangles to determine lengths and angle measures
- **B. Apply geometric relationships:** No CLE
- **C. Compose and decompose shapes:** No CLE

Big Idea 2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems

- **A. Use coordinate systems:** No CLE

Big Idea 3. Apply transformations and use symmetry to analyze mathematical situations

- **A. Use transformations on objects:** No CLE
- **B. Use transformations on functions:** translate, dilate and reflect functions
- **C. Use symmetry:** No CLE

Big Idea 4. Use visualization, spatial reasoning and geometric modeling to solve problems

- **A. Recognize and draw three-dimensional representations:** No CLE
- **B. Draw and use visual models:** draw or use visual models to represent and solve problems*

*Locally assessed.

Strand 4: Measurement

Big Idea 1. Understand measurable attributes of objects and the units, systems and processes of measurement

A. Determine unit of measurement: No CLE

B. Identify equivalent measures: No CLE

C. Tell and use units of time: No CLE

D. Count and compute money: No CLE

Big Idea 2. Apply appropriate techniques, tools and formulas to determine measurements

A. Use standard or non-standard measurement: No CLE

B. Use angle measurement: No CLE

C. Apply geometric measurements: No CLE

D. Analyze precision: apply concepts of successive approximation

E. Use relationships within a measurement system: use unit analysis to solve problems involving rates, such as speed, density or population density*

Strand 5: Data and Probability

Big Idea 1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them

A. Formulate questions: No CLE

B. Classify and organize data: No CLE

C. Represent and interpret data: select and use appropriate graphical representation of data and given one-variable quantitative data, describe its shape and calculate summary statistics

Big Idea 2. Select and use appropriate statistical methods to analyze data

A. Describe and analyze data: apply statistical measures of center to solve problems

B. Compare data representations: No CLE

C. Represent data algebraically: given a scatterplot, determine a type of function which models the data

Big Idea 3. Develop and evaluate inferences and predictions that are based on data

A. Develop and evaluate inferences: No CLE

B. Analyze basic statistical techniques: No CLE

Big Idea 4. Understand and apply basic concepts of probability

A. Apply basic concepts of probability: describe the concepts of sample space and probability distribution

B. Use and describe compound events: use and describe the concepts of conditional probability and independent events and how to compute the probability of a compound event

*Locally assessed.

Missouri Integrated Math III
Course Level Expectations

Strand 1: Number and Operations

Big Idea 1. Understand numbers, ways of representing numbers, relationships among numbers and number systems

- **A. Read, write and compare numbers:** compare and order rational and irrational numbers, including finding their approximate locations on a number line
- **B. Represent and use rational numbers:** use real numbers and various models, drawings, etc. to solve problems
- **C. Compose and decompose numbers:** No CLE
- **D. Classify and describe numeric relationships:** No CLE

Big Idea 2. Understand meanings of operations and how they relate to one another

- **A. Represent operations:** No CLE
- **B. Describe effects of operations:** No CLE
- **C. Apply properties of operations:** apply properties of logarithms to simplify expressions or solve equations
- **D. Apply operations on real and complex numbers:** apply operations to matrices and complex numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases*

Big Idea 3. Compute fluently and make reasonable estimates

- **A. Describe or represent mental strategies:** No CLE
- **B. Develop and demonstrate fluency:** No CLE
- **C. Compute problems:** No CLE
- **D. Estimate and justify solutions:** judge the reasonableness of numerical computations and their results*
- **E. Use proportional reasoning:** solve problems involving proportions*

Strand 2: Algebraic Relationships

Big Idea 1. Understand patterns, relations and functions

- **A. Recognize and extend patterns:** No CLE
- **B. Create and analyze patterns:** generalize patterns using explicitly or recursively defined functions
- **C. Classify objects and representations:** compare and contrast various forms of representations of patterns
- **D. Identify and compare functions:** understand and compare the properties of linear, quadratic, exponential, logarithmic, rational and periodic functions (include asymptotes)
- **E. Describe the effects of parameter changes:** describe the effects of parameter changes on logarithmic and exponential functions

Big Idea 2. Represent and analyze mathematical situations and structures using algebraic symbols

- **A. Represent mathematical situations:** use symbolic algebra to represent and solve problems that involve exponential and logarithmic relationships, including recursive and parametric relationships
- **B. Describe and use mathematical manipulation:** describe and use algebraic manipulations, including inverse of functions, composition of functions and rules of exponents
- **C. Utilize equivalent forms:** use and solve equivalent forms of equations and inequalities (exponential, logarithmic and rational)
- **D. Utilize systems:** use and solve systems of linear and quadratic equations or inequalities with 2 variables

Big Idea 3. Use mathematical models to represent and understand quantitative relationships

- **A. Use mathematical models:** identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem (including recursive forms)

Big Idea 4. Analyze change in various contexts

- **A. Analyze change:** analyze exponential and logarithmic functions by investigating rates of change, intercepts and asymptotes

Strand 3: Geometric and Spatial Relationships

Big Idea 1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

- **A. Describe and use geometric relationships:** use inductive and deductive reasoning to determine lengths and angle measures in all types of triangles and to establish the validity of geometric conjectures, proved theorems and critique arguments made by others
- **B. Apply geometric relationships:** determine the effect on surface area or volume of changing one measurement*
- **C. Compose and decompose shapes:** No CLE

Big Idea 2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems

- **A. Use coordinate systems:** No CLE

Big Idea 3. Apply transformations and use symmetry to analyze mathematical situations

- **A. Use transformations on objects:** No CLE
- **B. Use transformations on functions:** perform simple transformations and their compositions on linear, quadratic, logarithmic and exponential functions
- **C. Use symmetry:** No CLE

*Locally assessed.

Big Idea 4. Use visualization, spatial reasoning and geometric modeling to solve problems

A. Recognize and draw three-dimensional representations: draw representations of 3-dimensional geometric objects from different perspectives using a variety of tools

B. Draw and use visual models: draw or use visual models to represent and solve problems*

Strand 4: Measurement

Big Idea 1. Understand measurable attributes of objects and the units, systems and processes of measurement

A. Determine unit of measurement: No CLE

B. Identify equivalent measures: compare and contrast between angle and radian measure*

C. Tell and use units of time: No CLE

D. Count and compute money: No CLE

Big Idea 2. Apply appropriate techniques, tools and formulas to determine measurements

A. Use standard or non-standard measurement: No CLE

B. Use angle measurement: solve problems of angle measure of parallel lines cut by a transversal

C. Apply geometric measurements: No CLE

D. Analyze precision: analyze concepts of successive approximation*

E. Use relationships within a measurement system: use unit analysis to solve problems involving rates, such as speed, density or population density*

Strand 5: Data and Probability

Big Idea 1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them

A. Formulate questions: describe the characteristics of well designed studies, including the role of randomization in survey and experimental research

B. Classify and organize data: No CLE

C. Represent and interpret data: display and analyze bivariate data where one variable is categorical and the other is numerical

Big Idea 2. Select and use appropriate statistical methods to analyze data

A. Describe and analyze data: No CLE

B. Compare data representations: recognize how linear transformations of single-variable data affect shape, center, and spread

C. Represent data algebraically: create a scatter plot, describe its shape, determine and analyze regression equations

Big Idea 3. Develop and evaluate inferences and predictions that are based on data

A. Develop and evaluate inferences: describe how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal reference

B. Analyze basic statistical techniques: No CLE

Big Idea 4. Understand and apply basic concepts of probability

A. Apply basic concepts of probability: No CLE

B. Use and describe compound events: use and describe how to compute the probability of a compound event

*Locally assessed.

Science

Missouri Physical Science
Course Level Expectations

Strand 1: Properties and Principles of Matter and Energy

Big Idea 1. Changes in properties and states of matter provide evidence of the atomic theory of matter

A. Objects, and the materials they are made of, have properties that can be used to describe and classify them

a. Compare the densities of regular and irregular objects using their respective measures of volume and mass♦

b. Identify pure substances by their physical and chemical properties (i.e., color, luster/reflectivity, hardness, conductivity, density, pH, melting point, boiling point, specific heat, solubility, phase at room temperature, chemical reactivity)♦

c. Classify a substance as being made up of one kind of atom (element) or a compound when given the molecular formula or structural formula (introduce electron dot diagram) for the substance

d. Compare and contrast the common properties of metals, nonmetals, metalloids (semi-conductors) and noble gases

B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles

a. Compare and contrast the properties of acidic, basic, and neutral solutions

C. [No CLEs in this course]

D. Physical changes in states of matter due to thermal changes in materials can be explained by the Kinetic Theory of Matter

a. Using the Kinetic Theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released during a phase change♦

b. Predict the effect of a temperature change on the properties (i.e., pressure, density, volume) of a material (solids, liquids, gases)

c. Predict the effect of pressure changes on the properties (i.e., temperature, volume, density) of a material (solids, liquids, gases)

E. The atomic model describes the electrically neutral atom

a. Describe the atom as having a dense, positive nucleus surrounded by a cloud of negative electrons♦

b. Calculate the number of protons, neutrons, and electrons of an element/isotopes given its mass number and atomic number♦

c. Describe the information provided by the atomic number and the mass number (i.e., electrical charge, chemical stability)♦

F. The periodic table organizes the elements according to their atomic structure and chemical reactivity

a. Explain the structure of the periodic table in terms of the elements with common properties (groups/ families) and repeating properties (periods)♦

b. Classify elements as metals, nonmetals, metalloids (semi-conductors), and noble gases according to their location on the Periodic Table♦

c. Predict the chemical reactivity of elements, and the type of bonds that may result between them, using the Periodic Table

G. Properties of objects and states of matter can change chemically and/or physically

a. Distinguish between physical and chemical changes in matter♦

H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties

[NOTE: No a. or b. in source document]

c. Describe how the valence electron configuration determines how atoms interact and may bond

d. Compare and contrast the types of chemical bonds (i.e., ionic, covalent)

I. Mass is conserved during any physical or chemical change

a. Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass♦

Big Idea 2. Energy has a source, can be stored, and can be transferred but is conserved within a system

A. Forms of energy have a source, a means of transfer (work and heat), and a receiver

a. Differentiate between thermal energy (the total internal energy of a substance which is dependent upon mass), heat (thermal energy that transfers from one object or system to another due to a difference in temperature), and temperature (the measure of average kinetic energy of molecules or atoms in a substance)

b. Differentiate between the properties and examples of conductors and insulators

c. Describe sources and common uses of different forms of energy: chemical, nuclear, thermal, mechanical, electromagnetic♦

d. Identify and evaluate advantages/disadvantages of using various sources of energy (e.g., wind, solar, geothermal, hydroelectric, biomass, fossil fuel) for human activity

e. Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms (e.g., radio, infrared, visible, ultraviolet, gamma, cosmic rays)

f. Interpret examples of heat transfer (e.g., home heating, solar panels) as convection, conduction, or radiation

B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object

a. Relate kinetic energy to an object's mass and its velocity♦

b. Relate an object's gravitational potential energy to its weight and height relative to the surface of the Earth♦

c. Distinguish between examples of kinetic and potential energy (i.e., gravitational) within a system♦

d. Describe the effect of work on an object's kinetic and potential energy

C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth

- Identify stars as producers of electromagnetic energy
- Describe how electromagnetic energy is transferred through space as electromagnetic waves of varying wavelength and frequency♦

D. [No CLEs in this course]

E. Nuclear energy is a major source of energy throughout the universe

- Describe how changes in the nucleus of an atom during a nuclear reaction (i.e., nuclear decay, fusion, fission) result in emission of radiation
- Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity (e.g., source of electromagnetic radiation, nuclear power plants, fuel for stars)

F. Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)

- Describe the transfer of energy that occurs as energy changes from kinetic to potential within a system (e.g., car moving on rollercoaster track, child swinging, diver jumping off a board)(Do NOT assess calculations)♦
- Compare the efficiency of systems (recognizing that, as work is done, the amount of usable energy decreases)♦
- Classify the different ways to store energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system (e.g., using gasoline to move a car, photocell generating electricity, electromagnetic motor doing work, energy generated by nuclear reactor)♦

Strand 2: Properties and Principles of Force and Motion

Big Idea 1. The motion of an object is described by its change in position relative to another object or point

A. The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)

- Represent and analyze the motion of an object graphically♦
- Analyze the velocity of two objects in terms of distance and time (i.e., verbally, diagrammatically, graphically, mathematically)♦

B. An object that is accelerating is speeding up, slowing down, or changing direction

- Measure and analyze an object's motion in terms of speed, velocity, and acceleration (i.e., verbally, diagrammatically, graphically)♦

C. Momentum depends on the mass of the object and the velocity with which it is traveling

- Compare the momentum of two objects in terms of mass and velocity (Do NOT assess calculations)
- Explain that the total momentum remains constant within a system

Big Idea 2. Forces affect motion

A. Forces are classified as either contact forces (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism), that can be described in terms of direction and magnitude

- Identify and describe the forces acting on an object (i.e., type of force, direction, magnitude in Newtons) using a force diagram (do not assess calculations)♦

B. Every object exerts a gravitational force on every other object

- Describe gravity as an attractive force among all objects
- Compare and describe the gravitational forces between two objects in terms of their masses and the distances between them
- Describe weight in terms of the force of a planet's or moon's gravity acting on a given mass♦
- Recognize all free falling bodies accelerate at the same rate due to gravity regardless of their mass

C. [No CLEs in this course]

D. Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion

- Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion, and is dependent upon the object's mass (Newton's First Law of Motion)♦
- Determine the effect (i.e., direction and magnitude) of the sum of the forces acting on an object (i.e., net force)♦
- Using information about net force and mass determine the effect on acceleration (Newton's Second Law of Motion)♦
- Identify forces acting on a falling object (i.e., weight, air resistance) and how those forces affect the rate of acceleration
- Analyze force pairs (i.e., action/reaction forces) when given a scenario (e.g., handball hits concrete wall, shotgun firing) and describe their magnitudes and directions. (Newton's Third Law of Motion)♦

E. Perpendicular forces act independently of each other

- Predict the path of an object when the net force changes♦

F. Work transfers energy into and out of a mechanical system

- Describe the relationships among work, applied net force, and the distance an object moves♦
- Explain how the efficiency of a mechanical system can be expressed as a ratio of work output to work input
- Describe power in terms of work and time
- Describe and analyze the relationships among force, distance, work, efficiency, and power

Strand 3: Characteristic and Interactions of Living Organisms

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

Big Idea 1. The universe has observable properties and structure

A. [No CLEs in this course]

B. The Earth has a composition and location suitable to sustain life

- Explain how Earth's environmental characteristics and location in the universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment

C. Most of the information we know about the universe comes from the electromagnetic spectrum

- Identify information that the electromagnetic spectrum provides about the stars and the universe (e.g., chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies)♦

Big Idea 2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces

A.–B. [No CLEs in this course]

C. The regular and predictable motions of a planet and moon relative to the Sun explain natural phenomena, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons

- Predict the moon rise/set times, phases of the moon, and/or eclipses when given the relative positions of the moon, planet, and Sun
- Explain how the gravitational forces, due to the relative positions of a planet, moon, and Sun, determine the height and frequency of tides

D. Gravity is a force of attraction between objects in the solar system that governs their motion

- Explain orbital motions of moons around planets, and planets around the Sun, as the result of gravitational forces between those objects

Strand 7: Scientific Inquiry

Big Idea 1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking

A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation

- Formulate testable questions and hypotheses
- Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment♦
- Design and conduct a valid experiment
- Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature)

- Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using a controlled laboratory experiment, but instead by using a model, due to the limits of the laboratory environment, resources, and/or technologies
- Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations
- Evaluate the design of an experiment and make suggestions for reasonable improvements♦

B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations

- Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders)
- Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second
- Determine the appropriate tools and techniques to collect, analyze, and interpret data
- Judge whether measurements and computation of quantities are reasonable
- Calculate the range, average/mean, percent, and ratios for sets of data
- Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)

C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)

- Use quantitative and qualitative data as support for reasonable explanations (conclusions)♦
- Analyze experimental data to determine patterns, relationships, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable)♦
- Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions)
- Analyze whether evidence (data) and scientific principles support proposed explanations (laws/principles, theories/models)♦

D. The nature of science relies upon communication of results and justification of explanations

- Communicate the procedures and results of investigations and explanations through:
  - oral presentations
  - drawings and maps
  - data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
  - graphs (bar, single, and multiple line)
  - equations and writings
- Communicate and defend a scientific argument
- Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work)

Strand 8: Impact of Science, Technology and Human Activity

Big Idea 1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs

A. [No CLEs in this course]

B. Advances in technology often result in improved data collection and an increase in scientific information

- Recognize the relationships linking technology and science (e.g., how technological problems may create a demand for new science knowledge, how new technologies make it possible for scientists to extend research and advance science)

Big Idea 2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time

A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations

- Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups
- Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology

B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity

- Identify and describe how explanations (laws/ principles, theories/models) of scientific phenomena have changed over time as a result of new evidence (e.g., model of the solar system, basic structure of matter, structure of an atom, Big Bang and nebular theory of the Universe)
- Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones (e.g., theories of evolution, extinction, global warming)

Big Idea 3. Science and technology affect, and are affected by, society

A. [No CLEs in this course]

B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology

- Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research)
- Identify and evaluate the drawbacks (e.g., design constraints, unintended consequences, risks) and benefits of technological solutions to a given problem (e.g., use of alternative energies to reduce the use of carbon fuels, use of satellite communications to gather information)

C. [No CLEs in this course]

D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible

- Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness," a scientist speaking within or outside his/her area of expertise)
- Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society

Strand 1: Properties and Principles of Matter and Energy

Big Idea 1. Changes in properties and states of matter provide evidence of the atomic theory of matter

A. Objects, and the materials they are made of, have properties that can be used to describe and classify them

a. Compare the densities of regular and irregular objects using their respective measures of volume and mass

b. Identify pure substances(e.g., minerals, water, atmospheric gases) by their physical and chemical properties (i.e., color, luster/reflectivity, hardness, cleavage, fracture, conductivity, density, pH, melting point, boiling point, specific heat, solubility, phase at room temperature, chemical reactivity)

B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles

a. Compare and contrast the properties of acidic, basic, and neutral solutions

b. Predict the effects of solvent and solute polarity on solubility ("like dissolves like"); and predict the effects of temperature, surface area, particle size, and agitation on rates of solubility

C. [No CLEs in this course]

D. Physical changes in states of matter due to thermal changes in materials can be explained by the Kinetic Theory of Matter

a. Using the Kinetic Theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released during a phase change

b. Predict the effect of a temperature change on the properties (e.g., pressure, density) of earth materials (i.e., rock, water, air)

c. Predict the effect of pressure changes on the properties (e.g., temperature, density) of earth materials (i.e., rock, water, air)

E.–G. [No CLEs in this course]

H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties

a. Compare and contrast the types of chemical bonds (i.e., ionic, covalent) as they relate to mineralization, changes in rock type within the rock cycle, formation of pollutant molecules (e.g., acid rain, ozone)

b. Predict the products of an acid/base (neutralization), oxidation (rusting), and combustion (burning) reaction as it may occur in the geosphere, hydrosphere, or atmosphere

I. Mass is conserved during any physical or chemical change

a. Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change (e.g., cycling of minerals within rock cycle, process of erosion/weathering, carbon dioxide-oxygen cycle, nitrogen cycle, water cycle, nuclear reaction) as support for the Law of Conservation of Mass♦

Big Idea 2. Energy has a source, can be stored, and can be transferred but is conserved within a system

A. Forms of energy have a source, a means of transfer (work and heat), and a receiver

a. Describe the relationship among wavelength, energy, and frequency as illustrated by the electromagnetic spectrum

b. Describe sources and common uses of different forms of energy: chemical, nuclear, thermal, electromagnetic , mechanical (as transferred by moving objects, including rock, water, wind, waves)

c. Identify and evaluate advantages/disadvantages of using various sources of energy (e.g., wind, solar, geothermal, hydroelectric, biomass, fossil fuel, electromagnetic radiation) for human activity♦

d. Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms (e.g., radio, infrared, visible, ultraviolet, gamma, cosmic rays)

e. Interpret examples (e.g., land and sea breezes, plate tectonics) of heat transfer as convection, conduction, or radiation

B. [No CLEs in this course]

C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth

- Identify stars as producers of electromagnetic energy
- Describe how electromagnetic energy is transferred through space as electromagnetic waves of varying wavelength and frequency

D. [No CLEs in this course]

E. Nuclear energy is a major source of energy throughout the universe

- Describe how changes in the nucleus of an atom during a nuclear reaction (i.e., nuclear decay, fusion, fission) result in emission of radiation
- Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity (e.g., source of electromagnetic radiation, thermal energy within mantle, nuclear power plants, fuel for stars)

F. Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)

- Classify the different ways to store energy (i.e., chemical, nuclear, thermal, mechanical, electro-agetic) and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system (e.g., process of erosion/weathering, cycling of minerals within rock cycle, carbon dioxide-oxygen cycle, nitrogen cycle, water cycle, nuclear reaction)♦

Strand 2: Properties and Principles of Force and Motion

Big Idea 1.

Big Idea 2. Forces affect motion

A. [No CLEs in this course]

B. Every object exerts a gravitational force on every other object

- Compare and describe the gravitational forces between two objects in terms of their masses and the distances between them

C.–F. [No CLEs in this course]

Strand 3: Characteristic and Interactions of Living Organisms

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

Big Idea 1. Organisms are interdependent with one another and with their environment

A.–B. [No CLEs in this course]

C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem

- Predict and explain how natural or human caused changes (biological, chemical and/or physical) in one ecosystem may affect other ecosystems due to natural mechanisms (e.g., global wind patterns, water cycle, ocean currents)

D. [No CLEs in this course]

Big Idea 2. Matter and energy flow through the ecosystem

A. [No CLEs in this course]

B. Matter is recycled through an ecosystem

- Explain the processes involved in the recycling of nitrogen, oxygen, and carbon through an ecosystem
- Explain the importance of the recycling of nitrogen, oxygen, and carbon within an ecosystem

Big Idea 3. [No CLEs in this course]

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

Big Idea 1. Earth's Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures

A. The Earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties

- Classify minerals (rock-forming and ore) based on physical and chemical properties (e.g., color, streak, luster/reflectivity, hardness, cleavage, fracture, conductivity, density, melting point, boiling point, solubility, pH, chemical reactivity)
- Classify common igneous, metamorphic, and/or sedimentary rocks based on physical and chemical properties (e.g., mineral composition, texture, density, and other unique properties)
- Classify earth materials as minerals, rocks, and soils by comparing and contrasting their components, unique properties, and the processes which formed them♦

B. The hydrosphere is composed of water (a material with unique properties) and other materials

- Recognize the importance of water as a solvent in the environment as it relates to karst geology (dissolution and mineralization), acid rain, water pollution, erosion and deposition of rock and soil materials♦

C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles

- Relate the composition of gases and temperature of the layers of the atmosphere (i.e., troposphere, stratosphere, ionosphere) to cloud formation and transmission of radiation (e.g., ultraviolet, infrared)♦
- Describe the causes and consequences of observed and predicted changes in the ozone layer♦

Big Idea 2. Earth's Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes

A. The Earth's materials and surface features are changed through a variety of external processes

- Explain the external processes (i.e., weathering, erosion, deposition of sediment) that result in the formation and modification of landforms♦
- Describe the factors that affect rates of weathering and erosion of landforms (e.g., soil/rock type, amount and force of run-off, slope)♦

B. There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates

- Describe the internal source of energy on Earth that results in uneven heating of the mantle (i.e., decay of radioactive isotopes)

- Illustrate and explain the convection currents that result from the uneven heating inside the mantle and cause movement of crustal plates
- Describe how the energy of an earthquake travels as seismic waves and provides evidence for the layers of the geosphere
- Relate the densities of the materials found in continental and oceanic plates to the processes that result in each type of plate boundary (i.e., diverging, converging, transform)
- Describe the effects of the movement of crustal plates (i.e., earthquakes, sea floor spreading, mountain building, volcanic eruptions) at a given location on the planet♦
- Articulate the processes involved in the Theory of Plate Tectonics (i.e., uneven heating of the mantle due to the decay of radioactive isotopes, movement of materials via convection currents, movement of continental and oceanic plates along diverging, converging, or transform plate boundaries) and describe evidence that supports that theory (e.g., correlation of rock sequences, landforms, and fossils; presence of intrusions and faults; evidence of sea-floor spreading)♦

C. Continual changes in Earth's materials and surface that result from internal and external processes is described by the rock cycle

- Describe the rock cycle as it relates to the origin and transformation of rock types (i.e., igneous, metamorphic, and sedimentary)♦

D. Changes in the Earth over time can be inferred through rock and fossil evidence

- Use evidence from relative and real dating techniques (e.g., correlation of trace fossils, landforms, and rock sequences; evidence of climate changes; presence of intrusions and faults; magnetic orientation; relative age of drill samples) to infer geologic history♦

E. [No CLEs in this course]

F. Climate is a description of average weather conditions in a given area due to the transfer of energy and matter through Earth's systems

- Predict the weather (patterns of change in the atmosphere) at a designated location using weather maps (including map legends) and/or weather data (e.g., temperature, barometric pressure, cloud cover and type, wind speed and direction, precipitation)♦
- Explain how global wind and ocean currents are produced on the Earth's surface (e.g., effects of unequal heating of the Earth's land masses, oceans, and air by the Sun due to latitude and surface material type; effects of gravitational forces acting on layers of air of different densities due to temperature differences; effects of the rotation of the Earth; effects of surface topography)♦
- Describe the effects of natural phenomena (e.g., burning organic material, volcanic eruptions, lightning, changes in global wind and ocean currents) on the properties of the atmosphere
- Explain how climate and weather patterns in a particular region are affected by factors such as proximity to large bodies of water or ice/ocean currents, latitude, altitude, wind and ocean currents, amount of solar radiation, changes in the atmosphere due to natural phenomena (e.g., burning organic material, volcanic eruptions)♦
- Provide evidence (e.g., fossils, desertification, variation in sea level, glaciations, and permafrost layers) that supports theories of climate change due to natural phenomena and/or human interactions with the environment♦

Big Idea 3. Human activity is dependent upon and affects Earth's resources and systems

A. Earth's materials are limited natural resources affected by human activity

- Recognize the limited availability of some energy resources (i.e., solar radiation, wind, fossil fuels) and major mineral deposits in the United States (e.g., lead, petroleum, coal, copper, zinc, iron, gravel, aluminum) and the factors that affect their availability♦
- Identify human activities that may adversely affect the composition of the atmosphere, hydrosphere, or geosphere
- Predict local and/or global effects of environmental changes when given a scenario describing how the composition of the geosphere, hydrosphere, or atmosphere is altered by natural phenomena or human activities♦
- Recognize how the geomorphology of Missouri (i.e., different types of Missouri soil and rock materials such as limestone, granite, clay, loam; land formations such as karst (cave) formations, glaciated plains, river channels) affects the survival of organisms and the development of land use by humans (e.g., agriculture, recreation, planning and zoning, waste management)♦
- Recognize the economic, political, social, and ethical constraints associated with obtaining and using natural resources (e.g., mining and use of different types of Missouri mineral resources such as lead mining, gravel dredging, strip mining, coal burning, production of fertilizers and explosives; use of fossil fuels versus renewable resources)

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

Big Idea 1. The universe has observable properties and structure

A. The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies

- Describe and relate the positions and motions of the Sun-Earth solar system, the Milky-Way galaxy, and other galaxies within the universe (i.e., it is just one of several solar systems orbiting the center of a rotating spiral galaxy; that spiral galaxy is just one of many galaxies which orbit a common center of gravity; the expanding universe causes the distance between galaxies to increase)♦

B. The Earth has a composition and location suitable to sustain life

- Explain how Earth's environmental characteristics and location in the universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment
- Compare the environmental characteristics and location in the universe of Earth and other celestial bodies (e.g., planets, moons) to determine ability to support life♦

C. Most of the information we know about the universe comes from the electromagnetic spectrum

- Identify information that the electromagnetic spectrum provides about the stars and the universe (e.g., chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies)
- Evaluate the advantages/ disadvantages of using different tools (e.g., spectroscope, different types of telescopes, probes) to gather information about the universe (e.g., background radiation, magnetic fields, discovery of previously unknown celestial bodies)

Big Idea 2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces

A.–B. [No CLEs in this course]

C. The regular and predictable motions of a planet and moon relative to the Sun explain natural phenomena, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons

- Relate units of time (i.e., day, month, year) to the regular and predictable motion of the planets and moons and their positions in the Solar system
- Explain seasonal phenomena (i.e., weather, length of day, temperature, intensity of sunlight) as a consequence of a planet's axial tilt as it rotates and a planet's orbital position as it revolves around the Sun♦
- Provide evidence that can be observed from Earth that supports the fact Earth rotates on its axis and revolves around the Sun♦
- Predict the moon rise/set times, phases of the moon, and/or eclipses when given the relative positions of the moon, planet, and Sun
- Explain how the gravitational forces, due to the relative positions of a planet, moon, and Sun, determine the height and frequency of tides

D. Gravity is a force of attraction between objects in the solar system that governs their motion

- Explain orbital motions of moons around planets, and planets around the Sun, as the result of gravitational forces between those objects

Strand 7: Scientific Inquiry

Big Idea 1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking

A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation

- Formulate testable questions and hypotheses
- Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment♦
- Design and conduct a valid experiment
- Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature)
- Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using a controlled laboratory experiment, but instead by using a model, due to the limits of the laboratory environment, resources, and/or technologies
- Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations
- Evaluate the design of an experiment and make suggestions for reasonable improvements♦

B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations

- Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders)

- Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second
- Determine the appropriate tools and techniques to collect, analyze, and interpret data
- Judge whether measurements and computation of quantities are reasonable
- Calculate the range, average/mean, percent, and ratios for sets of data
- Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)

C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)

- Use quantitative and qualitative data as support for reasonable explanations (conclusions)♦
- Analyze experimental data to determine patterns, relationships, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable)♦
- Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions)
- Analyze whether evidence (data) and scientific principles support proposed explanations (laws/principles, theories/models)♦

D. The nature of science relies upon communication of results and justification of explanations

- Communicate the procedures and results of investigations and explanations through:
  - oral presentations
  - drawings and maps
  - data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
  - graphs (bar, single, and multiple line)
  - equations and writings
- Communicate and defend a scientific argument
- Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work)

Strand 8: Impact of Science, Technology and Human Activity

Big Idea 1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs

A. [No CLEs in this course]

B. Advances in technology often result in improved data collection and an increase in scientific information

- Recognize the relationships linking technology and science (e.g., how technological problems may create a demand for new science knowledge, how new technologies make it possible for scientists to extend research and advance science)

Big Idea 2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time

A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations

- Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups
- Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology

B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity

- Identify and describe how explanations (laws/principles, theories/models) of scientific phenomena have changed over time as a result of new evidence (e.g., model of the solar system, basic structure of matter, structure of an atom, Big Bang and nebular theory of the Universe)♦
- Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones (e.g., theories of evolution, extinction, global warming)

Big Idea 3. Science and technology affect, and are affected by, society

A. [No CLEs in this course]

B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology

- Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges)

- Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research)
- Analyze and evaluate the drawbacks (e.g., design constraints, unintended consequences, risks), benefits, and factors (i.e., social, political, economic, ethical, and environmental) affecting progress toward meeting major scientific and technological challenges (e.g., use of alternative energies to reduce the use of carbon fuels, damming a river for flood control, use of satellite communications to gather information, deforestation, nuclear energy, space technology)

C. Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent

- Identify and evaluate the need for informed consent in experimentation
- Identify the ethical issues involved in experimentation (i.e., risks to organisms or environment)
- Identify and evaluate the role of models as an ethical alternative to direct experimentation (e.g., using a model for a stream rather than pouring oil in an existing stream when studying the effects of oil pollution)

D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible

- Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness," a scientist speaking within or outside his/her area of expertise)♦
- Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society

Strand 1: Properties and Principles of Matter and Energy

Big Idea 1. Changes in properties and states of matter provide evidence of the atomic theory of matter

A.–H. [No CLEs in this course]

I. Mass is conserved during any physical or chemical change

a. Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change (e.g., biochemical processes, carbon dioxide-oxygen cycle, nitrogen cycle, decomposition and synthesis reactions involved in a food web) as support for the Law of Conservation of Mass♦

Big Idea 2. Energy has a source, can be stored, and can be transferred but is conserved within a system

A.–E. [No CLEs in this course]

F. Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)

- Classify the different ways to store energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system (e.g., biochemical processes, carbon dioxide-oxygen cycle, nitrogen cycle, food web)♦

Strand 2: Properties and Principles of Force and Motion

Strand 3: Characteristic and Interactions of Living Organisms

Big Idea 1. There is a fundamental unity underlying the diversity of all living organisms

A. [No CLEs in this course]

B. Organisms progress through life cycles unique to different types of organisms

- Recognize cells both increase in number and differentiate, becoming specialized in structure and function, during and after embryonic development♦
- Identify factors (e.g., biochemical, temperature) that may affect the differentiation of cells and the development of an organism

C. Cells are the fundamental units of structure and function of all living things

- Recognize all organisms are composed of cells, the fundamental units of structure and function
- Describe the structure of cell parts (e.g., cell wall, cell membrane, cytoplasm, nucleus, chloroplast, mitochondrion, ribosome, vacuole) found in different types of cells (e.g., bacterial, plant, skin, nerve, blood, muscle) and the functions they perform (e.g., structural support, transport of materials, storage of genetic information, photosynthesis and respiration, synthesis of new molecules, waste disposal) that are necessary to the survival of the cell and organism♦

D. [No CLEs in this course]

E. Biological classifications are based on how organisms are related

- Explain how similarities used to group taxa might reflect evolutionary relationships (e.g., similarities in DNA and protein structures, internal anatomical features, patterns of development)
- Explain how and why the classification of any taxon might change as more is learned about the organisms assigned to that taxon

Big Idea 2. Living organisms carry out life processes in order to survive

A. The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means

- Compare and contrast the structure and function of mitochondria and chloroplasts
- Compare and contrast the structure and function of cell wall and cell membranes
- Explain physical and chemicalinteractions that occur between organelles (e.g. nucleus, cell membrane, chloroplast, mitochondrian, ribosome) as they carry out life processes♦

B. Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth

- Explain the interrelationship between the processes of photosynthesis and cellular respiration (e.g., recycling of oxygen and carbon dioxide), comparing and contrasting photosynthesis and cellular respiration reactions (Do NOT assess intermediate reactions)♦
- Determine what factors affect the processes of photosynthesis and cellular respiration (i.e., light intensity, availability of reactants, temperature)♦

C. [No CLEs in this course]

D. Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds

- Summarize how energy transfer occurs during photosynthesis and cellular respiration as energy is stored in and released from the bonds of chemical compounds (i.e., ATP)♦

- Relate the structure of organic compounds (e.g., proteins, nucleic acids, lipids, carbohydrates) to their role in living systems♦
- Recognize energy is absorbed or released in the breakdown and/or synthesis of organic compounds
- Explain how protein enzymes affect chemical reactions (e.g., the breakdown of food molecules, growth and repair, regulation)♦
- Interpret a data table showing the effects of an enzyme on a biochemical reaction

E. Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule

- Explain how the DNA code determines the sequence of amino acids necessary for protein synthesis
- Recognize the function of protein in cell structure and function (i.e., enzyme action, growth and repair of body parts, regulation of cell division and differentiation)

F. Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)

- Explain the significance of the selectively permeable membrane to the transport of molecules♦
- Predict the movement of moleculesacross a selectively permeable membrane (i.e., diffusion, osmosis, active transport) needed for a cell to maintain homeostasis given concentration gradients and different sizes of molecules♦
- Explain how water is important to cells (e.g., is a buffer for body temperature, provides soluble environment for chemical reactions, serves as a reactant in chemical reactions, provides hydration that maintains cell turgidity, maintains protein shape)♦

G. [No CLEs in this course]

Big Idea 3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes

A. Reproduction can occur asexually or sexually

- Distinguish between asexual (i.e., binary fission, budding, cloning) and sexual reproduction

B. All living organisms have genetic material (DNA) that carries hereditary information

- Describe the chemical and structural properties of DNA (e.g., DNA is a large polymer formed from linked subunits of four kinds of nitrogen bases; genetic information is encoded in genes based on the sequence of subunits; each DNA molecule in a cell forms a single chromosome) (Assess the concepts – NOT memorization of nitrogen base pairs)♦
- Recognize that DNA codes for proteins, which are expressed as the heritable characteristics of an organism♦
- Recognize that degree of relatedness can be determined by comparing DNA sequences
- Explain how an error in the DNA molecule (mutation) can be transferred during replication
- Identify possible external causes (e.g., heat, radiation, certain chemicals) and effects of DNA mutations (e.g., altered proteins which may affect chemical reactions and structural development)♦

C. Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction

- Recognize the chromosomes of daughter cells, formed through the processes of asexual reproduction and mitosis, the formation of somatic (body) cells in multicellular organisms, are identical to the chromosomes of the parent cell♦
- Recognize that during meiosis, the formation of sex cells, chromosomes are reduced to half the number present in the parent cell♦
- Explain how fertilization restores the diploid number of chromosomes♦
- Identify the implications of human sex chromosomes for sex determination

D. There is heritable variation within every species of organism

- Describe the advantages and disadvantages of asexual and sexual reproduction with regard to variation within a population♦
- Describe how genes can be altered and combined to create genetic variation within a species (e.g., mutation, recombination of genes)
- Recognize that new heritable characteristics can only result from new combinations of existing genes or from mutations of genes in an organism's sex cells♦

E. The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics

- Explain how genotypes (heterozygous and homozygous) contribute to phenotypic variation within a species♦
- Predict the probability of the occurrence of specific traits, including sex-linked traits, in an offspring by using a monohybrid cross
- Explain how sex-linked traits may or may not result in the expression of a genetic disorder (e.g., hemophilia, muscular dystrophy, color blindness) depending on gender

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environment

Big Idea 1. Organisms are interdependent with one another and with their environment

A. All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem

- Explain the nature of interactions between organisms in predator/prey relationships and different symbiotic relationships (i.e., mutualism, commensalism, parasitism)♦
- Explain howcooperative (e.g., symbiotic) and competitive (e.g., predator/prey) relationships help maintain balance within an ecosystem♦
- Explain why no two species can occupy the same niche in a community
- Through the years, two concepts of niche have evolved in ecology. The first is the place niche, the physical space in which an organism lives. The second is the ecological niche, and it encompasses the particular location occupied by an organism and its functional role in the community. The functional role of a species is not limited to its placement along a food pyramid; it also includes the interactions of a species with other organisms while obtaining food. For example, the methods used to tolerate the physical factors of its environment, such as climate, water, nutrients, soils, and parasites, are all part of its functional role. In other words, the ecological niche of an organism is its natural history: all the interactions and interrelationships of the species with other organisms and the environment.

B. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite

- Identify and explain the limiting factors (biotic and abiotic) that may affect the carrying capacity of a population within an ecosystem♦
- Predict how populations within an ecosystem may change in number and/or structure in response to hypothesized changes in biotic and/or abiotic factors

C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem

- Devise a multi-step plan to restore the stability and/or biodiversity of an ecosystem when given a scenario describing the possible adverse effects of human interactions with that ecosystem (e.g., destruction caused by direct harvesting, pollution, atmospheric changes)
- Predict and explain how natural or human caused changes (biological, chemical and/or physical) in one ecosystem may affect other ecosystems due to natural mechanisms (e.g., global wind patterns, water cycle, ocean currents)

D. The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes

- Predict the impact (beneficial or harmful) a natural environmental event (e.g., forest fire, flood, volcanic eruption, avalanche) or human caused change (e.g., acid rain, global warming, pollution, deforestation, introduction of an exotic species) may have on the diversity of different species in an ecosystem♦
- Predict the impact (beneficial or harmful) a natural or human caused environmental event (e.g., forest fire, flood, volcanic eruption, avalanche, acid rain, global warming, pollution, deforestation, introduction of an exotic species) may have on the biodiversity of a community♦
- Describe possible causes of extinction of a population

Big Idea 2. Matter and energy flow through the ecosystem

A. As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use

- Illustrate and describe the flow of energy within a food web
- Explain why there are generally more producers than consumers in an energy pyramid
- Predict how the use and flow of energy will be altered due to changes in a food web♦

B. Matter is recycled through an ecosystem

- Explain the processes involved in the recycling of nitrogen, oxygen, and carbon through an ecosystem
- Explain the importance of the recycling of nitrogen, oxygen, and carbon within an ecosystem

Big Idea 3. Genetic variation sorted by the natural selection process explains evidence of biological evolution

A. Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record

- Interpret fossil evidence to explain the relatedness of organisms using the principles of superposition and fossil correlation
- Evaluate the evidence that supports the theory of biological evolution (e.g., fossil records, similarities between DNA and protein structures, similarities between developmental stages of organisms, homologous and vestigial structures)♦

B. Reproduction is essential to the continuation of every species

- Define a species in terms of the ability to mate and produce fertile offspring♦
- Explain the importance of reproduction to the survival of a species (i.e., the failure of a species to reproduce will lead to extinction of that species)♦

C. Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem

- Identify examples of adaptations that may have resulted from variations favored by natural selection (e.g., long-necked giraffes, long-eared jack rabbits) and describe how that variation may have provided populations an advantage for survival♦
- Explain how genetic homogeneity may cause a population to be more susceptible to extinction (e.g., succumbing to a disease for which there is no natural resistance)
- Explain how environmental factors (e.g., habitat loss, climate change, pollution, introduction of non-native species) can be agents of natural selection♦
- Given a scenario describing an environmental change, hypothesize why a given species was unable to survive

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

Big Idea 1. [No CLEs in this course]

Big Idea 2. [No CLEs in this course]

Big Idea 3. Human activity is dependent upon and affects Earth's resources and systems

A. Earth's materials are limited natural resources affected by human activity

- Predict local and/or global effects of environmental changes when given a scenario describing how the composition of the geosphere, hydrosphere, or atmosphere is altered by natural phenomena or human activities
- Recognize how the geomorphology of Missouri (i.e., different types of Missouri soil and rock materials such as limestone, granite, clay, loam; land formations such as karst (cave) formations, glaciated plains, river channels) affects the survival of organisms

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

Big Idea 1. The universe has observable properties and structure

A. [No CLEs in this course]

B. The Earth has a composition and location suitable to sustain life

- Explain how Earth's environmental characteristics and location in the universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment

C. [No CLEs in this course]

Big Idea 2. [No CLEs in this course]

Strand 7: Scientific Inquiry

Big Idea 1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking

A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation

- Formulate testable questions and hypotheses♦
- Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment♦
- Design and conduct a valid experiment♦
- Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature)♦
- Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using a controlled laboratory experiment, but instead by using a model, due to the limits of the laboratory environment, resources, and/or technologies
- Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations
- Evaluate the design of an experiment and make suggestions for reasonable improvements♦

B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations

- Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders)
- Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second♦
- Determine the appropriate tools and techniques to collect, analyze, and interpret data♦
- Judge whether measurements and computation of quantities are reasonable♦
- Calculate the range, average/mean, percent, and ratios for sets of data♦
- Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)

C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)

- Use quantitative and qualitative data as support for reasonable explanations (conclusions)♦
- Analyze experimental data to determine patterns, relationships, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable)♦
- Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions)♦
- Analyze whether evidence (data) and scientific principles support proposed explanations (laws/principles, theories/models)♦

D. The nature of science relies upon communication of results and justification of explanations

- Communicate the procedures and results of investigations and explanations through:♦
  - oral presentations
  - drawings and maps
  - data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
  - graphs (bar, single, and multiple line)
  - equations and writings
- Communicate and defend a scientific argument
- Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work)♦

Strand 8: Impact of Science, Technology and Human Activity

Big Idea 1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs

A. [No CLEs in this course]

B. Advances in technology often result in improved data collection and an increase in scientific information

- Recognize the relationships linking technology and science (e.g., how technological problems may create a demand for new science knowledge, how new technologies make it possible for scientists to extend research and advance science)

Big Idea 2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time

A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations

- Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups
- Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology

B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity

- Identify and describe how explanations (laws/principles, theories/models) of scientific phenomena have changed over time as a result of new evidence (e.g., cell theory, theories of spontaneous generation and biogenesis, theories of extinction, evolution theory, structure of the cell membrane, genetic theory of inheritance)♦
- Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones (e.g., theories of evolution, extinction, global warming)

Big Idea 3. Science and technology affect, and are affected by, society

A. [No CLEs in this course]

B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology

- Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges)
- Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research)

- Analyze and evaluate the drawbacks (e.g., design constraints, unintended consequences, risks), benefits, and factors (i.e., social, political, economic, ethical, and environmental) affecting progress toward meeting major scientific and technological challenges (e.g., limitations placed on stem-cell research or genetic engineering, introduction of alien species, deforestation, bioterrorism, nuclear energy, genetic counseling, use of alternative energies for carbon fuels, use of pesticides)♦

C. Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent

- Identify and evaluate the need for informed consent in experimentation
- Identify the ethical issues involved in experimentation (i.e., risks to organisms or environment)
- Identify and evaluate the role of models as an ethical alternative to direct experimentation (e.g., using a model for a stream rather than pouring oil in an existing stream when studying the effects of oil pollution on aquatic plants)

D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible

- Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness," a scientist speaking within or outside his/her area of expertise)
- Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society♦

Strand 1: Properties and Principles of Matter and Energy

Big Idea 1. Changes in properties and states of matter provide evidence of the atomic theory of matter

A. Objects, and the materials they are made of, have properties that can be used to describe and classify them

a. Compare the densities of regular and irregular objects using their respective measures of volume and mass♦

b. Identify pure substances by their physical and chemical properties (i.e., color, luster/reflectivity, hardness, conductivity, density, pH, melting point, boiling point, specific heat, solubility, phase at room temperature, chemical reactivity)♦

c. Classify a substance as being made up of one kind of atom (element) or a compound when given the molecular formula or structural formula (or electron dot diagram) for the substance♦

d. Compare and contrast the common properties of metals, nonmetals, metalloids (semi-conductors), and noble gases♦

B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles

a. Classify solutions as either dilute or concentrated; as either saturated, unsaturated, or supersaturated♦

b. Compare and contrast the properties of acidic, basic, and neutral solutions♦

c. Predict the effects of solvent and solute polarity on solubility ("like dissolves like"); and predict the effects of temperature, surface area, particle size, and agitation on rates of solubility♦

C. [No CLEs in this course]

D. Physical changes in states of matter due to thermal changes in materials can be explained by the Kinetic Theory of Matter

a. Using the Kinetic Theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released during a phase change♦

b. Predict the effect of a temperature change on the properties (e.g., pressure, density) of a material (solids, liquids, gases)♦

c. Predict the effect of pressure changes on the properties (e.g., temperature, density) of a material (solids, liquids, gases)♦

E. The atomic model describes the electrically neutral atom

a. Describe the atom as having a dense, positive nucleus surrounded by a cloud of negative electrons♦

b. Calculate the number of protons, neutrons, and electrons of an isotope, given its mass number and atomic number♦

c. Describe the information provided by the atomic number and the mass number (i.e., electrical charge, chemical stability)♦

F. The periodic table organizes the elements according to their atomic structure and chemical reactivity

a. Explain the structure of the periodic table in terms of the elements with common properties (groups/ families) and repeating properties (periods)♦

b. Classify elements as metals, nonmetals, metalloids (semi-conductors), and noble gases according to their location on the Periodic Table♦

c. Predict the chemical reactivity of elements, and the type of bonds that may result between them, using the Periodic Table♦

G. Properties of objects and states of matter can change chemically and/or physically

a. Distinguish between physical and chemical changes in matter♦

H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties

a. Describe how the valence electron configuration determines how atoms interact and may bond♦

b. [No CLE in this course]

c. Compare and contrast the types of chemical bonds (i.e., ionic, covalent)♦

d. Predict the products of an acid/base (neutralization), oxidation (rusting), and combustion (burning) reaction♦

I. Mass is conserved during any physical or chemical change

a. Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass♦

b. Recognize whether the number of atoms of the reactants and products in a chemical equation are balanced♦

Big Idea 2. Energy has a source, can be stored, and can be transferred but is conserved within a system

A. Forms of energy have a source, a means of transfer (work and heat), and a receiver

a. Differentiate between thermal energy (the total internal energy of a substance which is dependent upon mass), heat (thermal energy that transfers from one object or system to another due to a difference in temperature), and temperature (the measure of average kinetic energy of molecules or atoms in a substance)

b. Describe the relationship among wavelength, energy, and frequency as illustrated by the electromagnetic spectrum

c. [No CLE in this course]

d. Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms (e.g., radio, infrared, visible, ultraviolet, gamma, cosmic rays)

B.–C. [No CLEs in this course]

D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy

- Describe evidence of energy transfer and transformations that occur during exothermic and endothermic chemical reactions♦

E. Nuclear energy is a major source of energy throughout the universe

- Describe how changes in the nucleus of an atom during a nuclear reaction (i.e., nuclear decay, fusion, fission) result in emission of radiation♦

F. Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)

- Classify the different ways to store energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system (e.g., using gasoline to move a car, photocell generating electricity, biochemical reaction, energy generated by nuclear reactor)♦

Strand 2: Properties and Principles of Force and Motion

Strand 3: Characteristic and Interactions of Living Organisms

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

Big Idea 1. Earth's Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures

A. [No CLEs in this course]

B. The hydrosphere is composed of water (a material with unique properties) and other materials

- Recognize the importance of water as a solvent in the environment as it relates to acid rain and water pollution

C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles

- Relate the composition of gases and temperature of the layers of the atmosphere (i.e., troposphere, stratosphere, ionosphere) to cloud formation and transmission of radiation (e.g., ultraviolet, infrared)
- Describe the causes and consequences of observed and predicted changes in the ozone layer

Big Idea 2. Earth's Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes

A.–E. [No CLEs in this course]

F. Climate is a description of average weather conditions in a given area due to the transfer of energy and matter through Earth's systems

- Provide evidence (e.g., variations in sea level, glaciation, and permafrost layers, fossils, desertification) that supports theories of climate change due to natural phenomena and/or human interactions

Big Idea 3. [No CLEs in this course]

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

Strand 7: Scientific Inquiry

Big Idea 1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking

A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation

- Formulate testable questions and hypotheses
- Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment♦
- Design and conduct a valid experiment
- Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature)
- Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using a controlled laboratory experiment, but instead by using a model, due to the limits of the laboratory environment, resources, and/or technologies
- Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations

- Evaluate the design of an experiment and make suggestions for reasonable improvements♦

B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations

- Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders)
- Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second
- Determine the appropriate tools and techniques to collect, analyze, and interpret data
- Judge whether measurements and computation of quantities are reasonable
- Calculate the range, average/mean, percent, and ratios for sets of data
- Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)

C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)

- Use quantitative and qualitative data as support for reasonable explanations (conclusions)♦
- Analyze experimental data to determine patterns, relationships, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable)♦
- Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions)
- Analyze whether evidence (data) and scientific principles support proposed explanations (laws/principles, theories/models)♦

D. The nature of science relies upon communication of results and justification of explanations

- Communicate the procedures and results of investigations and explanations through:
  - oral presentations
  - drawings and maps
  - data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
  - graphs (bar, single, and multiple line)
  - equations and writings
- Communicate and defend a scientific argument
- Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work)

Strand 8: Impact of Science, Technology and Human Activity

Big Idea 1. [No CLEs in this course]

Big Idea 2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time

A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations

- Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups

B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity

- Identify and describe how explanations (laws/principles, theories/models) of scientific phenomena have changed over time as a result of new evidence (e.g., basic structure of matter, structure of an atom)♦

Big Idea 3. Science and technology affect, and are affected by, society

A. [No CLEs in this course]

B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology

- Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges)
- Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research)

C. [No CLEs in this course]

D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible

- Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness," a scientist speaking within or outside his/her area of expertise)
- Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society♦

MISSOURI Physics I
Course Level Expectations

Strand 1: Properties and Principles of Matter and Energy

Big Idea 1. Changes in properties and states of matter provide evidence of the atomic theory of matter

A. Objects, and the materials they are made of, have properties that can be used to describe and classify them

a. Compare the densities of regular and irregular objects using their respective measures of volume and mass

b.–d. [No CLEs in this course]

B.–I. [No CLEs in this course]

Big Idea 2. Energy has a source, can be stored, and can be transferred but is conserved within a system

A. Forms of energy have a source, a means of transfer (work and heat), and a receiver

a–c. [No CLEs in this course]

d. Describe sources and common uses of different forms of energy: chemical, nuclear, thermal, mechanical, electromagnetic♦

e. Identify and evaluate advantages/disadvantages of using various sources of energy (e.g., wind, solar, geothermal, hydroelectric, biomass, fossil fuel) for human activity

f. Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms (e.g., radio, infrared, visible, ultraviolet, gamma, cosmic rays)

B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object

a. Relate kinetic energy to an object's mass and its velocity♦

b. Relate an object's gravitational potential energy to its weight and height relative to the surface of the Earth♦

c. Distinguish between examples of kinetic and potential energy (i.e., gravitational, elastic) within a system♦

d. Describe the effect of work on an object's kinetic and potential energy♦

C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth

- Identify stars as producers of electromagnetic energy
- Describe how electromagnetic energy is transferred through space as electromagnetic waves of varying wavelength and frequency♦

D. [No CLEs in this course]

E. Nuclear energy is a major source of energy throughout the universe

- Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity (e.g., source of electromagnetic radiation, thermal energy within mantle, nuclear power plants, fuel for stars)

F. Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)

- Describe the transfer of energy that occurs as energy changes from kinetic to potential within a system (e.g., car moving on rollercoaster track, child swinging, diver jumping off a board)♦
- Compare the efficiency of systems (recognizing that, as work is done, the amount of usable energy decreases)♦
- Classify the different ways to store energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system (e.g., using gasoline to move a car, photocell generating electricity, electromagnetic motor doing work, energy generated by nuclear reactor)♦

Strand 2: Properties and Principles of Force and Motion

Big Idea 1. The motion of an object is described by its change in position relative to another object or point

A. The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)

- Represent and analyze the motion of an object graphically♦
- Analyze the velocity of two objects in terms of distance and time (i.e., verbally, diagrammatically, graphically, mathematically)♦

B. An object that is accelerating is speeding up, slowing down, or changing direction

- Measure and analyze an object's motion in terms of speed, velocity, and acceleration (i.e., verbally, diagrammatically, graphically, mathematically)♦

C. Momentum depends on the mass of the object and the velocity with which it is traveling

- Compare the momentum of two objects in terms of mass and velocity (Do NOT assess calculations)
- Explain that the total momentum remains constant within a system

Big Idea 2. Forces affect motion

A. Forces are classified as either contact forces (pushes, pulls, friction, buoyancy) or non-contact forces (gravity,

magnetism), that can be described in terms of direction and magnitude

- Identify and describe the forces acting on an object (i.e., type of force, direction, magnitude in Newtons) using a force diagram and calculating net force♦

B. Every object exerts a gravitational force on every other object

- Describe gravity as an attractive force among all objects
- Describe weight in terms of the force of a planet's or moon's gravity acting on a given mass♦
- Recognize all free falling bodies accelerate at the same rate due to gravity regardless of their mass♦

C. [No CLEs in this course]

D. Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion

- Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion, and is dependent upon the object's mass (Newton's First Law of Motion)♦
- Determine the effect (i.e., direction and magnitude) of the sum of the forces acting on an object (i.e., net force)♦
- Using information about net force and mass determine the effect on acceleration (Newton's Second Law of Motion)♦
- Identify forces acting on a falling object (i.e., weight, air resistance) and how those forces affect the rate of acceleration♦
- Analyze force pairs (i.e., action/reaction forces) when given a scenario (e.g., handball hits concrete wall, shotgun firing) and describe their magnitudes and directions. (Newton's Third Law of Motion)♦

E. Perpendicular forces act independently of each other

- Describe the force(s) that keep an object traveling in a circular path♦
- Describe the force(s) acting on a projectile on the Earth♦
- Predict the path of an object when the net force changes♦

F. Work transfers energy into and out of a mechanical system

- Describe the relationships among work, applied net force, and the distance an object moves
- Explain how the efficiency of a mechanical system can be expressed as a ratio of work output to work input♦
- Describe power in terms of work and time♦
- Describe and analyze the relationships among force, distance, work, efficiency, and power♦

Strand 3: Characteristic and Interactions of Living Organisms

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

Big Idea 1. [No CLEs in this course]

Big Idea 2. [No CLEs in this course]

Big Idea 3. Human activity is dependent upon and affects Earth's resources and systems

A. Earth's materials are limited natural resources affected by human activity

- Distinguish between renewable and nonrenewable energy resources♦
- Identify human activities that may adversely affect the composition of the atmosphere, hydrosphere, or geosphere

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

Big Idea 1. The universe has observable properties and structure

A. The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies

- Describe and relate the positions and motions of the Sun-Earth solar system, the Milky-Way galaxy, and other galaxies within the universe (i.e., it is just one of several solar systems orbiting the center of a rotating spiral galaxy; that spiral galaxy is just one of many galaxies which orbit a common center of gravity; the expanding universe causes the distance between galaxies to increase)♦

B. The Earth has a composition and location suitable to sustain life

- Explain how Earth's environmental characteristics and location in the universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment
- Compare the environmental characteristics and location in the universe of Earth and other celestial bodies (e.g., planets, moons) to determine ability to support life

C. Most of the information we know about the universe comes from the electromagnetic spectrum

- Identify information that the electromagnetic spectrum provides about the stars and the universe (e.g., chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies)♦

- Evaluate the advantages/ disadvantages of using different tools (e.g., spectroscope, different types of telescopes, probes) to gather information about the universe (e.g., background radiation, magnetic fields, discovery of previously unknown celestial bodies)

Big Idea 2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces

A.–B. [No CLEs in this course]

C. The regular and predictable motions of a planet and moon relative to the Sun explain natural phenomena, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons

- Relate units of time (i.e., day, month, year) to the regular and predictable motion of the planets and moons and their positions in the Solar system
- Explain seasonal phenomena (i.e., weather, length of day, temperature, intensity of sunlight) as a consequence of a planet's axial tilt as it rotates and a planet's orbital position as it revolves around the Sun
- Provide evidence that can be observed from Earth that supports the fact Earth rotates on its axis and revolves around the Sun♦
- Predict the moon rise/set times, phases of the moon, and/or eclipses when given the relative positions of the moon, planet, and Sun
- Explain how the gravitational forces, due to the relative positions of a planet, moon, and Sun, determine the height and frequency of tides

D. Gravity is a force of attraction between objects in the solar system that governs their motion

- Explain orbital motions of moons around planets, and planets around the Sun, as the result of gravitational forces between those objects♦

Strand 7: Scientific Inquiry

Big Idea 1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking

A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation

- Formulate testable questions and hypotheses
- Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment♦
- Design and conduct a valid experiment
- Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature)
- Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using a controlled laboratory experiment, but instead by using a model, due to the limits of the laboratory environment, resources, and/or technologies
- Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations
- Evaluate the design of an experiment and make suggestions for reasonable improvements♦

B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations

- Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders)
- Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second
- Determine the appropriate tools and techniques to collect, analyze, and interpret data
- Judge whether measurements and computation of quantities are reasonable
- Calculate the range, average/mean, percent, and ratios for sets of data
- Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)

C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)

- Use quantitative and qualitative data as support for reasonable explanations (conclusions)♦
- Analyze experimental data to determine patterns, relationships, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable)♦
- Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions)
- Analyze whether evidence (data) and scientific principles support proposed explanations (laws/principles, theories/models)♦

D. The nature of science relies upon communication of results and justification of explanations

- Communicate the procedures and results of investigations and explanations through:
  - oral presentations
  - drawings and maps
  - data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
  - graphs (bar, single, and multiple line)
  - equations and writings
- Communicate and defend a scientific argument
- Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work)

Strand 8: Impact of Science, Technology and Human Activity

Big Idea 1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs

A. [No CLEs in this course]

B. Advances in technology often result in improved data collection and an increase in scientific information

- Recognize the relationships linking technology and science (e.g., how technological problems may create a demand for new science knowledge, how new technologies make it possible for scientists to extend research and advance science)

Big Idea 2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time

A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations

- Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups
- Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology

B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity

- Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones (e.g., theories of evolution, extinction, global warming)

Big Idea 3. Science and technology affect, and are affected by, society

A. [No CLEs in this course]

B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology

- Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges)
- Analyze and evaluate the drawbacks (e.g., design constraints, unintended consequences, risks), benefits, and factors (i.e., social, political, economic, ethical, and environmental) affecting progress toward meeting major scientific and technological challenges (e.g., use of alternative energies to reduce the use of carbon fuels, use of satellite communications to gather information, nuclear energy, computer technology)

C. Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent

- Identify and evaluate the need for informed consent in experimentation
- Identify the ethical issues involved in experimentation (i.e., risks to organisms or environment)
- Identify and evaluate the role of models as an ethical alternative to direct experimentation (e.g., using a model for human subjects when safety features of crashed vehicles)

D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible

- Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness," a scientist speaking within or outside his/her area of expertise)♦
- Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society

Section C: ACT's College Readiness Standards Included in Missouri's Grade 9–12 Course Level Expectations

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

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

Table C-1a. ACT's College Readiness Standards — English *to MISSOURI English I*

	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-1a. ACT's College Readiness Standards — English *to MISSOURI English I* (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-1b. ACT's College Readiness Standards — English *to MISSOURI English II*

	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-1b. ACT's College Readiness Standards — English *to MISSOURI English II* (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-1c. ACT's College Readiness Standards — English *to MISSOURI English III*

	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-1c. ACT's College Readiness Standards — English *to MISSOURI English III* (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-1d. ACT's College Readiness Standards — English *to MISSOURI English IV*

	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-1d. ACT's College Readiness Standards — English *to MISSOURI English IV* (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-2a. ACT's College Readiness Standards — Reading *to MISSOURI English I*	
	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-2a. ACT's College Readiness Standards — Reading *to MISSOURI English I* (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-2b. ACT's College Readiness Standards — Reading *to MISSOURI English II*		
	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-2b. ACT's College Readiness Standards — Reading *to MISSOURI English II* (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-2c. ACT's College Readiness Standards — Reading *to MISSOURI English III*	
	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-2c. ACT's College Readiness Standards — Reading *to MISSOURI English III* (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.

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Table C-2d. ACT's College Readiness Standards — Reading *to MISSOURI English IV*		
	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-2d. ACT's College Readiness Standards — Reading *to MISSOURI English IV* (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

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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-3a. ACT's College Readiness Standards — Writing *to MISSOURI English III*

	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-3a. ACT's College Readiness Standards — Writing *to MISSOURI English III* (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-3b. ACT's College Readiness Standards — Writing *to MISSOURI English IV*

	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-3b. ACT's College Readiness Standards — Writing *to MISSOURI English IV* (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-4a. ACT's College Readiness Standards — Mathematics *to MISSOURI Algebra I*

	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-4a. ACT's College Readiness Standards — Mathematics *to MISSOURI Algebra I* (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-4b. ACT's College Readiness Standards — Mathematics *to MISSOURI Geometry*

	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-4b. ACT's College Readiness Standards — Mathematics *to MISSOURI Geometry* (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-4c. ACT's College Readiness Standards — Mathematics *to MISSOURI Integrated Math II*

	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-4c. ACT's College Readiness Standards — Mathematics *to MISSOURI Integrated Math II* (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-4d. ACT's College Readiness Standards — Mathematics *to MISSOURI Algebra II*

	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-4d. ACT's College Readiness Standards — Mathematics *to MISSOURI Algebra II* (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-4e. ACT's College Readiness Standards — Mathematics *to MISSOURI Integrated Math III*

	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-4e. ACT's College Readiness Standards — Mathematics *to MISSOURI Integrated Math III* (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-5a. ACT's College Readiness Standards — Science *to MISSOURI Physical 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

Table C-5b. ACT's College Readiness Standards — Science *to MISSOURI Earth & Space 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

Table C-5c. ACT's College Readiness Standards — Science *to MISSOURI Biology I*

	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

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Table C-5d. ACT's College Readiness Standards — Science *to MISSOURI Chemistry I*

	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

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Table C-5e. ACT's College Readiness Standards — Science *to MISSOURI Physics I*

	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

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