



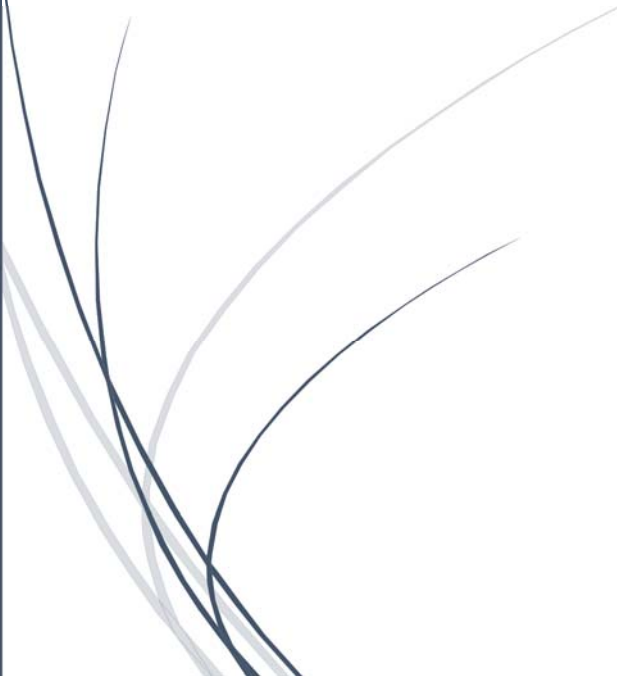
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est

Academic Reference

EST vs. Common Core Standards



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The EST is a standardized admission test, scored electronically. EST is owned by Academic Assessment Ltd. in London. EST is validated by the EST Board in the USA. It is designed specifically to measure the skills and knowledge acquired by students. The EST is scored and delivered in collaboration with Pearson, the world's largest education company.

The purpose of this admission test is to measure students' basic scientific knowledge and reasoning skills required to succeed in academic life as well as to be ready to enter university. Knowledge-based skills in math, reading, writing, language, and other specific subject-matters as well as analytical skills, critical thinking skills, and reasoning skills are measured to evaluate what students have learnt in schools and what potentials they hold to accomplish a better future.

In addition, EST results will help both students and the admissions offices in universities in choosing the right major for students in reference to their abilities and capabilities.

Two types of EST examinations are available:

- **EST I:** This type measures literacy and numeracy skills through successive tests taken on the same day: Literacy Test 1, Literacy Test 2, Math, and Essay Writing (optional).
EST I includes three mandatory sections: Reading, Language Usage, and a Math section. The Math section is divided into two subsections; calculators are not allowed in the first subsection but are allowed in the second one.
The importance of EST I relies mainly in targeting communication skills, comprehension skills, and critical and logical reasoning skills, all of which are basic requirements for a university student.
- **EST II:** The second type of EST is a subject-based test in Chemistry, Biology, Math, and Physics. These subject-based tests measure basic scientific knowledge, scientific reasoning, and higher order thinking skills. They assess the abilities and capabilities of the student to pursue education in specific majors related to engineering, science, and health care.

In the next part of the document, the comparability of the EST coverage towards the common core standards (CCS) and Next Generation Science Standards (NGSS) is elaborated.

Common Core vs EST I – Literacy

The common core standards were developed to guide educators in preparing students to be able to successfully complete their basic education and graduate from high school capable of entering college and being prepared for career and life. To achieve this goal, the common core literacy standards promote an interdisciplinary approach to literacy that develops students who are proficient in reading both literature and informational texts that cover a wide variety of content and develop within students the ability to analyze these texts using standard conventions of the English language accurately and effectively.

In line with common core standards, the EST I literacy tests assess the essential skills students should have acquired in their high school tenure to show they are ready for college, career, and life. With this in mind, the EST I literacy tests are aligned with common core standards. By continuously assessing essential cognitive skills—knowledge, application, reasoning, and synthesis—EST I serves as an accurate assessment against common core standards of a student’s level of academic preparedness.

The EST I literacy tests are comprised of three tests: Language Usage, Reading Comprehension, and (optional) Essay Writing. The following table compares the skills assessed by the three EST literacy tests to the skills developed by their corresponding common core topics.

EST		Common Core	
Test	Skills	Topic	Skills
Language Usage	<ul style="list-style-type: none"> ● Demonstrate the ability to edit and revise texts from various disciplines. ● Demonstrate the ability to revise the effectiveness and strength of ideas, the coherence and cohesion of ideas, the logical sequence of information, the uniformity of style, and the compatibility of style, word choice, and tone with the purpose of the text. ● Demonstrate command of the conventions of standard English grammar and usage. ● Demonstrate the ability to edit sentences in terms of: subject-verb-agreement, noun agreement, pronoun clarity, shifts in pronouns, misplaced modifiers, faulty parallelism, and verb tense. ● Demonstrate command of the conventions of standard rules of English punctuation, spelling, and capitalization when writing. ● Demonstrate the ability to revise sentences in terms of: sentence formation, the use of frequently confusing words, errors in punctuation at the end and in the middle of a sentence, unnecessary use of punctuation, the use of coordinating and subordinating conjunctions. 	Language	<p>To build a foundation for college and career readiness in language, students must gain control over many conventions of standard English grammar, usage, and mechanics as well as learn other ways to use language to convey meaning effectively. They must also be able to determine or clarify the meaning of grade-appropriate words encountered through listening, reading, and media use; come to appreciate that words have nonliteral meanings, shadings of meaning, and relationships to other words; and expand their vocabulary in the course of studying content. The inclusion of Language standards in their own strand should not be taken as an indication that skills related to conventions, effective language use, and vocabulary are unimportant to reading, writing, speaking, and listening; indeed, they are inseparable from such contexts.</p>

<p>Reading Comprehension</p>	<ul style="list-style-type: none"> ● Read and interpret a variety of texts from various disciplines. ● Identify the overall purpose of the text. ● Determine central ideas or themes of the text. ● Demonstrate the ability to deduce information from the texts and justify their choice. ● Determine different ways in which ideas in text can be presented. ● Identify explicit ideas mentioned in text ● Identify a summary for a certain paragraph or the whole text. ● Analyze how two or more texts address similar themes or topics. ● Determine the meaning of new vocabulary words using context clues. ● Determine the connotative and figurative meanings of words or phrases from context. ● Determine how a text is structured. ● Determine the role of certain lines or paragraphs in text. ● Interpret the meaning of certain lines or paragraphs in text ● Analyze how events and ideas develop. ● Identify the author’s purpose, point of view, tone, mood, and attitude. ● Interpret the effect of word choice on the overall purpose of a text. ● Determine the relation between the author’s perspective and the choice of words and literary elements. ● Determine and evaluate the sufficiency and validity of the evidences used to support the discussed argument. ● Interpret data in a graph and relate the information in the graph to the information given in text. 	<p>Reading Literature</p> <p>Reading Informational Texts</p>	<p>To build a foundation for college and career readiness, students must read widely and deeply from among a broad range of high-quality, increasingly challenging literary and informational texts. Through extensive reading of stories, dramas, poems, and myths from diverse cultures and different time periods, students gain literary and cultural knowledge as well as familiarity with various text structures and elements. By reading texts in history/social studies, science, and other disciplines, students build a foundation of knowledge in these fields that will also give them the background to be better readers in all content areas. Students can only gain this foundation when the curriculum is intentionally and coherently structured to develop rich content knowledge within and across grades. Students also acquire the habits of reading independently and closely, which are essential to their future success.</p> <p><i>Literature</i></p> <p>By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.</p> <p>By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 11-CCR text complexity band independently and proficiently.</p> <p><i>Informational Texts</i></p> <p>By the end of grade 11, read and comprehend literary nonfiction in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.</p> <p>By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11-CCR text complexity band independently and proficiently.</p>
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<p>Essay Writing</p>	<ul style="list-style-type: none"> ● Demonstrate a comprehensive understanding of the original text. ● Demonstrate the ability to analyze the argument presented in the source text. ● Demonstrate a clear understanding of the relation between major ideas and supporting details as presented in the source text. ● Demonstrate a clear understanding of the evidences used by the author and evaluate their validity in supporting the author’s argument. ● Produce an extended analytic response, where the writer provides an accurate, specific claim and introduces the idea(s) clearly ● Provide sufficient and relevant supporting ideas. ● Present the ideas in a logical and persuasive manner ● Maintain the cohesion of their ideas and the coherence of their writing. ● Choose the suitable tone and style. ● Develop the idea(s) or claim(s) thoroughly with well-chosen examples, facts, or details from the source text. ● Demonstrate the ability to integrate evidences from the source text in their own writings. ● Demonstrate the ability to paraphrase and quote information. ● Write clearly and demonstrate sufficient command of the conventions of standard written English. 	<p>Writing</p>	<p>To build a foundation for college and career readiness, students need to learn to use writing as a way of offering and supporting opinions, demonstrating understanding of the subjects they are studying, and conveying real and imagined experiences and events. They learn to appreciate that a key purpose of writing is to communicate clearly to an external, sometimes unfamiliar audience, and they begin to adapt the form and content of their writing to accomplish a particular task and purpose. They develop the capacity to build knowledge on a subject through research projects and to respond analytically to literary and informational sources. To meet these goals, students must devote significant time and effort to writing, producing numerous pieces over short and extended time frames throughout the year.</p>
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The EST I Language Usage test covers six main topics: conventions of usage, sentence structure, conventions of punctuation, effective use of language, expression of ideas, and understanding words in context. The following table shows how these topics coincide with the three main topics of Language from the common core standards: conventions of standard English, knowledge of language, and vocabulary acquisition and use.

Language Usage				
CC Topic	Anchor Standard	Standards for Grades 11-12	EST Topic	EST Learning Outcome
Conventions of Standard English	<p><u>CCSS.ELA-LITERACY.CCRA.L.1</u> Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</p>	<p><u>CCSS.ELA-LITERACY.L.11-12.1</u> Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.1.A</u> Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.1.B</u> Resolve issues of complex or contested usage, consulting references (e.g., <i>Merriam-Webster's Dictionary of English Usage</i>, <i>Garner's Modern American Usage</i>) as needed.</p>	<p><u>Conventions of Usage</u> These items focus on editing text to ensure conformity to the conventions of standard written English usage.</p> <p><u>Sentence Structure</u> These items focus on editing text to correct problems in sentence formation and inappropriate shifts in construction within and between sentences.</p>	<p><u>Pronoun Clarity</u> The student will recognize and correct pronouns with unclear or ambiguous antecedents.</p> <p><u>Possessive Determiners</u> The student will recognize and correct cases in which possessive determiners (<i>its, your, their</i>), contractions (<i>it's, you're, they're</i>), and adverbs (<i>there</i>) are confused with each other.</p> <p><u>Pronoun Antecedent Agreement</u> The student will recognize and correct lack of agreement between pronoun and antecedent.</p> <p><u>Possessive Nouns and Pronouns</u> The student will recognize and correct inappropriate uses of possessive nouns and pronouns as well as differentiate between possessive and plural forms.</p> <p><u>Sentence Boundaries</u> The student will recognize and correct grammatically incomplete sentences (e.g., rhetorically inappropriate fragments and run-ons).</p>

				<p><u>Subordinations and Coordination</u> The student will recognize and correct problems in coordination and subordination in sentences.</p> <p><u>Parallel Structure</u> The student will recognize and correct problems in parallel structure in sentences.</p> <p><u>Modifier Placement</u> The student will recognize and correct problems in modifier placement (e.g., misplaced or dangling modifiers).</p> <p><u>Verb tense, Mood, and Voice</u> The student will recognize and correct inappropriate shifts in verb tense, voice, and mood within and between sentences.</p> <p><u>Pronoun, Person, and Number</u> The student will recognize and correct inappropriate shifts in pronoun person and number within and between sentences.</p>
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<p>Conventions of Standard English</p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.2</u> Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.</p>	<p><u>CCSS.ELA-LITERACY.L.11-12.2</u> Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.2.A</u> Observe hyphenation conventions.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.2.B</u> Spell correctly.</p>	<p><u>Conventions of Punctuation</u> These items focus on editing text to ensure conformity to the conventions of Standard written English punctuation.</p>	<p><u>End of Sentence Punctuation</u> The student will recognize and correct inappropriate uses of ending punctuation in cases in which the context makes the intent clear.</p> <p><u>Within Sentence Punctuation</u> The student will correctly use and recognize and correct inappropriate uses of colons, semicolons, and dashes to indicate sharp breaks in thought within sentences.</p> <p><u>Items in a Series</u> The student will correctly use and recognize and correct inappropriate uses of punctuation (commas and sometimes semicolons) to separate items in a series.</p> <p><u>Nonrestrictive and Parenthetical Elements</u> The student will correctly use punctuation (commas, parentheses, dashes) to set off nonrestrictive and parenthetical sentence elements as well as recognize and correct cases in which restrictive or essential sentence elements are inappropriately set off with punctuation.</p> <p><u>Unnecessary Punctuation</u> The student will recognize and correct cases in which unnecessary punctuation appears in a sentence.</p>
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<p>Knowledge of Language</p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.3</u> Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.</p>	<p><u>CCSS.ELA-LITERACY.L.11-12.3</u> Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.3.A</u> Vary syntax for effect, consulting references (e.g., Tufte’s <i>Artful Sentences</i>) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading.</p>	<p><u>Effective Use of Language</u> These items focus on revision of text to improve the use of language to accomplish rhetorical purposes.</p>	<p><u>Precision</u> The student will revise text as needed to improve the exactness or content appropriateness of word choice.</p> <p><u>Concision</u> The student will revise text as needed to improve the economy of word choice (i.e., to eliminate wordiness and redundancy).</p> <p><u>Style and Tone</u> The student will revise text as necessary to ensure consistency of style and tone within a text or to improve the match of style and tone to purpose.</p> <p><u>Syntax</u> The student will use various sentence structures to accomplish needed rhetorical purposes.</p>
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<p>Vocabulary Acquisition and Use</p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.4</u> Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.</p>	<p><u>CCSS.ELA-LITERACY.L.11-12.4</u> Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on <i>grades 11-12 reading and content</i>, choosing flexibly from a range of strategies.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.4.A</u> Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.4.B</u> Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., <i>conceive, conception, conceivable</i>).</p> <p><u>CCSS.ELA-LITERACY.L.11-12.4.C</u> Consult general and specialized reference materials (e.g., dictionaries, glossaries,</p>	<p><u>Understand Words in Context</u></p>	<p><u>Words in Context</u> Students will determine the meaning of a word in the context of a sentence, paragraph or text.</p> <p><u>Frequently Confused Words</u> The student will recognize and correct instances in which a word or phrase is confused with another (e.g., <i>accept/except, allusion/illusion</i>).</p> <p><u>Logical Comparison</u> The student will recognize and correct cases in which unlike terms are compared.</p>
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		<p>thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.4.D</u> Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).</p>		
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<p>Vocabulary Acquisition and Use</p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.5</u> Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.</p>	<p><u>CCSS.ELA-LITERACY.L.11-12.5</u> Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.5.A</u> Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.</p> <p><u>CCSS.ELA-LITERACY.L.11-12.5.B</u> Analyze nuances in the meaning of words with similar denotations.</p>		
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<p>Vocabulary Acquisition and Use</p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.6</u> Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.</p>	<p><u>CCSS.ELA-LITERACY.L.11-12.6</u> Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.</p>	<p><u>Expression of Ideas</u></p>	<p><u>Expression of Ideas</u> The student will be able to revise a text for topic development, accuracy, logic, cohesion, and rhetorically effective use of language.</p>
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The following table shows example question items from the Language Usage test that correspond with each of the common core language anchor standards. Cognitive levels are indicated for each item.

Question	Common Core Anchor Standard	Cognitive Level
<p>Enough ought to be stated, however, to trace his development from slave to freeman, and his preparation for the platform where he secured his hearing and (14) was earning his fame.</p> <p>14. A. NO CHANGE B. earned C. has earned D. was earned</p> <p><i>Answer B</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.1</u> Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</p>	<p>Application</p>
<p>On Colonel Lloyd’s plantation Douglass spent four years of the slave life of which his graphic description on the platform stirred (21) humane, hearts to righteous judgment of an unrighteous institution.</p> <p>21. A. NO CHANGE B. humane hearts C. humane; hearts D. humane: hearts</p> <p><i>Answer B</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.2</u> Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.</p>	<p>Knowledge</p>

<p>Many rocks, such as granite, are (39) made in grains of various minerals which differ in color and in their capacity to absorb heat, and which therefore contract and expand in different ratios.</p> <p>39.</p> <p>A. NO CHANGE B. made with C. made up of D. under made</p> <p><i>Answer C</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.3</u> Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.</p>	<p>Application</p>
<p>There is a sharp and sudden fall of temperature after sunset, and the rocks, strongly heated by day, (41) are effected and now chilled perhaps even to the freezing point.</p> <p>41.</p> <p>A. NO CHANGE B. effected C. affect D. are affected</p> <p><i>Answer D</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.L.4</u> Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.</p>	<p>Reasoning</p>

<p>As a thought, it probably reflected the secret opinion of every engineer present, for, however (3) unaffected of intended wrong-doing engineers assuredly are as a group in their work of scientific investigation and development, (4) the statement that engineers were responsible for the conflict then raging in Europe was absolute truth.</p> <p>3. Which word best fits the meaning of the sentence?</p> <p>A. NO CHANGE B. innocent C. unknown D. guilty</p> <p><i>Answer B</i></p>	<p><u>CCSS.ELA-</u> <u>LITERACY.CCRA.L.6</u> Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.</p>	<p>Application</p>
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The EST I Reading Comprehension test covers three main topics: information and ideas, rhetoric, and synthesis. The following table shows how these topics coincide with the three main topics of Reading from the common core standards: key ideas and details, craft and structure, integration of knowledge and ideas, and range of reading and level of text complexity.

Reading				
CC Topic	Anchor Standard	Standards for Grades 11-12	EST Topic	EST Learning Outcome
Key Ideas and Details	<u>CCSS.ELA-LITERACY.CCRA.R.1</u> Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.	<i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.1</u> Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. <i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.1</u> Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.	<u>Information and Ideas</u> These items focus on the informational context of the text.	<u>Determine Explicit Meaning</u> The student will identify information and ideas explicitly stated in the text. <u>Determine Implicit Meaning</u> The student will draw reasonable inferences and logical conclusions from text. <u>Using Analogical Reasoning</u> The students will extrapolate in a reasonable way from the information and ideas in a text or apply information and ideas in a new, analogous situation. <u>Citing Textual Evidence</u> The student will cite the textual evidence that best supports a given claim or point.

<p>Key Ideas and Details</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.2</u> Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.2</u> Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.2</u> Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.</p>	<p><u>Information and Ideas</u> These items focus on the informational context of the text.</p>	<p><u>Determining Central Ideas and Themes</u> The student will identify explicitly stated central themes in text and determine implicit central ideas or themes from text.</p>
<p>Key Ideas and Details</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.3</u> Analyze how and why individuals, events, or ideas develop and interact over the course of a text.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.3</u> Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.3</u> Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.</p>	<p><u>Information and Ideas</u> These items focus on the informational context of the text.</p>	<p><u>Understanding Relationships</u> The student will identify explicitly stated relationships between and among individuals, events, or ideas (e.g., cause-effect, comparison-contrast, sequence).</p>

<p>Craft and Structure</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.4</u> Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.4</u> Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.4</u> Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).</p>	<p><u>Rhetoric</u> These items focus on the rhetorical analysis of text.</p>	<p><u>Interpreting Words or Phrases in Context</u> The student will determine the meaning of words and phrases in context.</p> <p><u>Analyzing Word Choice</u> The student will determine how the selection of specific words and phrases or the use of patterns of words and phrases shapes meaning and tone in text.</p>
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<p>Craft and Structure</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.5</u> Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.5</u> Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.5</u> Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.</p>	<p><u>Rhetoric</u> These items focus on the rhetorical analysis of text.</p>	<p><u>Analyzing overall text structure</u> The student will describe the overall structure of a text.</p> <p><u>Analyzing part-whole relationships</u> The student will analyze the relationship between a particular part of a text (e.g., a sentence) and the whole text.</p>
<p>Craft and Structure</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.6</u> Assess how point of view or purpose shapes the content and style of a text.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.6</u> Analyze a case in which grasping a point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.6</u> Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness or beauty of the text.</p>	<p><u>Rhetoric</u> These items focus on the rhetorical analysis of text.</p>	<p><u>Analyzing Point of View</u> The student will determine the point of view or perspective from which a text is related or the influence this point of view or perspective has on content and style.</p> <p><u>Analyzing Purpose</u> The student will determine the main or most likely purpose of a text or of a particular part of a text (typically, one or more paragraphs).</p>

<p>Integration of Knowledge and Ideas</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.7</u> Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.7</u> Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.7</u> Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.</p>	<p><u>Synthesis</u> Items that assess synthesis focus on synthesizing multiple sources of information.</p>	<p><u>Analyzing multiple texts</u> The student will synthesize information and ideas from paired texts.</p> <p><u>Analyzing quantitative reasoning</u> The student will analyze information presented quantitatively in such forms as graphs, tables, and charts and/or relate that information to information presented in text.</p>
<p>Integration of Knowledge and Ideas</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.8</u> Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.</p>	<p><i>Literature</i> NA</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.8</u> Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., <i>The Federalist</i>, presidential addresses).</p>	<p><u>Synthesis</u> Items that assess synthesis focus on synthesizing multiple sources of information.</p>	<p><u>Analyzing claims and counter claims</u> The student will identify claims and counterclaims explicitly stated in text or determine implicit claims and counterclaims from text.</p> <p><u>Assessing Reasoning</u> The student will assess an author’s reasoning for soundness.</p> <p><u>Analyzing Evidence</u> The student will assess how an author uses or fails to use evidence to support a claim or counterclaim.</p>

<p>Integration of Knowledge and Ideas</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.9</u> Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.9</u> Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.9</u> Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.</p>	<p><u>Synthesis</u> Items that assess synthesis focus on synthesizing multiple sources of information.</p>	<p><u>Analyzing multiple texts</u> The student will synthesize information and ideas from paired texts.</p>
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<p>Range of Reading and Level of Text Complexity</p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.10</u> Read and comprehend complex literary and informational texts independently and proficiently.</p>	<p><i>Literature</i> <u>CCSS.ELA-LITERACY.RL.11-12.10</u> By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 11-CCR text complexity band independently and proficiently.</p> <p><i>Informational Texts</i> <u>CCSS.ELA-LITERACY.RI.11-12.10</u> By the end of grade 11, read and comprehend literary nonfiction in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.</p> <p>By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11-CCR text complexity band independently and proficiently.</p>	<p><i>There is a total of 5 reading passages that vary in text type, range in complexity from grade 9 to post-secondary, and cover the topics of:</i></p> <ul style="list-style-type: none"> • <i>US and World Literature</i> • <i>History/Social Studies</i> • <i>Science</i>
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The following table shows example question items from the Reading Comprehension test that correspond with each of the common core reading anchor standards. Cognitive levels are indicated for each item.

Question	Common Core Anchor Standard	Cognitive Level
<p>Lines 9-14 imply which of the following about Lincoln’s character?</p> <p>A. He was impatient with tedious components of grammar. B. He was ignorant to the ethics of making a request. C. He was eager to learn and make an effort. D. He was demanding when it came to material he did not comprehend.</p> <p><i>Answer C</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.1</u> Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.</p>	<p>Knowledge</p>
<p>Passage 1 is best described as</p> <p>A. a conceptual definition. B. a methodological example. C. a procedural description. D. a theoretical discussion.</p> <p><i>Answer D</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.2</u> Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.</p>	<p>Application</p>
<p>The attitude that the author takes throughout the passage is best described as that of</p> <p>A. awe and admiration. B. indifference and nonchalance. C. professionalism and objectivity. D. reverence and subjectivity.</p> <p><i>Answer A</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.4</u> Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.</p>	<p>Reasoning</p>

<p>The relationship between the first and second paragraph and the rest of the passage can best be described as</p> <p>A. premise followed by opposition. B. analogy followed by narrative structure. C. assertion followed by supporting evidence. D. analysis followed by generalization.</p> <p><i>Answer B</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.5</u> Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.</p>	<p>Reasoning</p>
<p>The author of Passage 2 most likely mentions “Teleology” to</p> <p>A. express an opposing premise to the theory of animal adaptation. B. bolster the theory of Teleology. C. reject a premise on the grounds of evidence. D. solidify the importance of Teleology in relation to the theory of animal adaptation.</p> <p><i>Answer A</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.6</u> Assess how point of view or purpose shapes the content and style of a text.</p>	<p>Application</p>
<p>Based on the ideas presented in the passage, the graph</p> <p>A. accentuates the validity of the experiment. B. presents the long process of multiplication. C. supports the information in the passage. D. provides new information unrelated to the passage.</p> <p><i>Answer C</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.7</u> Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.</p>	<p>Reasoning</p>
<p>The author most likely mentions numbers in lines 30-38 to</p> <p>A. support his premise that bacterial cells need favorable conditions. B. provide an estimate of the multiplied bacterial cells. C. illustrate the bacterial cells’ rapid growth accurately. D. add details to the passage.</p> <p><i>Answer A</i></p>	<p><u>CCSS.ELA-LITERACY.CCRA.R.8</u> Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.</p>	<p>Reasoning</p>

The EST I optional Essay Writing test covers three main topics: composition, interpretation, and comprehension. The following table shows how these three topics coincide with three corresponding topics of Writing from the common core standards: text types and purposes, production and distribution of writing, and research to build and present knowledge.

Writing				
Topic	Anchor Standard	Standards for Grades 11-12	EST Topic	EST Learning Outcome
Text Types and Purposes	<u>CCSS.ELA-LITERACY.CCRA.W.1</u> Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.	<u>CCSS.ELA-LITERACY.W.11-12.1</u> Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. <u>CCSS.ELA-LITERACY.W.11-12.1.A</u> Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence. <u>CCSS.ELA-LITERACY.W.11-12.1.B</u> Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.	<u>Composition</u> The Composition category assesses a student's ability to write a well-developed response with clear paragraphing and a central claim. It assesses the students' progression of ideas, use of grammatical conventions, and appropriate word choice. Through writing, the student is expected to show how well the source text is understood and how it is used as the foundation for a legible discussion.	The student will: <ul style="list-style-type: none"> • Make a clear central claim with a definite thesis statement in the introductory paragraph. • Establish coherence through effective organization including appropriate paragraphing and cohesive progression. • Use effective and appropriate diction that relates to the central claim and the source text. • Apply a consistent and proper style and tone throughout the response. • Exhibit proper use of tenses and punctuation and an overall excellent command of conventions with little to no mistakes.

		<p><u>CCSS.ELA-LITERACY.W.11-12.1.C</u> Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.1.D</u> Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.1.E</u> Provide a concluding statement or section that follows from and supports the argument presented.</p>		
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<p>Text Types and Purposes</p>	<p><u>CCSS.ELA-LITERACY.CCRA.W.2</u> Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.</p>	<p><u>CCSS.ELA-LITERACY.W.11-12.2</u> Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.2.A</u> Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.2.B</u> Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.2.C</u> Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</p>	<p><u>Interpretation</u> The interpretation category assesses a student's ability to choose proper analytical evidence from the source text to support his/her argument. The student is assessed on the scope of interpretation and the explanation of the evidence to support his/her analytical response. A precise interpretation shows that the student has understood the author's argument, is able to evaluate the methods used by the author to tackle the argument and is able to use these methods to support his/her own writing.</p>	<p>The student will:</p> <ul style="list-style-type: none"> • Provide an above standard or insightful reading of the analytical task. • Show an in-depth perceptive evaluation of the author's style/tone, reasoning, use of evidence, and compelling components while carefully stressing their importance within the source text and connections made to the overall analysis of the main idea(s) and/or details. • Choose evidence that specifically relates to the analytical response and places analytical evidence appropriately within the analysis of the text.
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		<p><u>CCSS.ELA-LITERACY.W.11-12.2.D</u> Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.2.E</u> Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.2.F</u> Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</p>		
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Production and Distribution of Writing	<p><u>CCSS.ELA-LITERACY.CCRA.W.4</u> Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>	<p><u>CCSS.ELA-LITERACY.W.11-12.4</u> Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1-3 above.)</p>	<p><u>Composition</u> The Composition category assesses a student’s ability to write a well-developed response with clear paragraphing and a central claim. It assesses the students’ progression of ideas, use of grammatical conventions, and appropriate word choice. Through writing, the student is expected to show how well the source text is understood and how it is used as the foundation for a legible discussion.</p>	<ul style="list-style-type: none"> • Makes a clear central claim with a definite thesis statement in the introductory paragraph. • Establishes coherence through effective organization including appropriate paragraphing and cohesive progression. • Uses effective and appropriate diction that relates to the central claim and the source text. • Applies a consistent and proper style and tone throughout the response. • Exhibits proper use of tenses and punctuation and an overall excellent command of conventions with little to no mistakes.
	<p><u>CCSS.ELA-LITERACY.CCRA.W.5</u> Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.</p>	<p><u>CCSS.ELA-LITERACY.W.11-12.5</u> Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1-3 up to and including grades 11-12 here.)</p>	<p><i>(Students are given space for planning their essay before writing but this portion is not assessed. Similarly, editing, and revising are not a part of the scope of the essay writing exam as only one draft is assessed.)</i></p>	

<p>Research to Build and Present Knowledge</p>	<p><u>CCSS.ELA-LITERACY.CCRA.W.9</u> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>	<p><u>CCSS.ELA-LITERACY.W.11-12.9</u> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p> <p><u>CCSS.ELA-LITERACY.W.11-12.9.A</u> Apply <i>grades 11-12 Reading standards</i> to literature (e.g., "Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics").</p> <p><u>CCSS.ELA-LITERACY.W.11-12.9.B</u> Apply <i>grades 11-12 Reading standards</i> to literary nonfiction (e.g., "Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., <i>The Federalist</i>, presidential addresses]").</p>	<p><u>Comprehension</u> The Comprehension category assesses a student's ability to read a text and understand its main idea(s) and details. Students are expected to read the source text objectively and focus on how the author's argument is presented instead of concentrating on whether or not they agree with the author. The student is assessed on his/her ability to relate different ideas and details from the source text and use them effectively in their written analytical response as evidence.</p>	<ul style="list-style-type: none"> • Demonstrates thorough understanding of the source text, free from misunderstandings. • Interprets the source texts and demonstrates understanding of main idea(s) in relation to the details and their interrelation. • Exhibits competence in using contextual evidence from the source text in both forms (quotations and paraphrases).
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The following table shows example instructions from the optional Essay Writing test that correspond with each of the common core writing anchor standards. Cognitive levels are indicated for each item.

Question	Common Core Anchor Standard	Cognitive Level
<p>Directions: This assignment will allow you to demonstrate your ability to skillfully read and understand a source text and write a response analyzing the source. In your response, you should show that you have understood the source, give proficient analysis, and use the English language effectively. If your essay is off-topic, it will not be scored.</p> <p>Read the following passage, and think about how the author uses:</p> <ul style="list-style-type: none"> • Evidence, such as applicable examples, to justify the argument. • Reasoning to show logical connections among thoughts and facts. • Rhetoric, like sensory language and emotional appeals, to give weight to the argument. <p>Write a response that demonstrates how the author makes an argument to persuade her audience to agree with her theory. In your response, analyze how the author uses at least one of the features (evidence, reasoning, or rhetoric) from the essay directions (or features of your own choosing) to develop a logical and persuasive argument. Be certain that your response cites relevant aspects of the source text.</p> <p>Your response should not give your personal opinion on the merit of the source text, but instead show how the author crafts an argument to persuade readers.</p>	<p><u>CCSS.ELA-LITERACY.CCRA.W.1</u> Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.</p> <p><u>CCSS.ELA-LITERACY.CCRA.W.2</u> Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <p><u>CCSS.ELA-LITERACY.CCRA.W.4</u> Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p><u>CCSS.ELA-LITERACY.CCRA.W.9</u> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>	<p>Synthesis</p>

Common Core vs EST I – Math

In line with common core standards, the EST I Math test assesses the essential skills students should have acquired in their high school tenure to show they are ready for college, career, and life. With this in mind, the EST I Math tests are aligned with common core standards and covers content from middle school and high school, which allow to get a clear idea on the students' level in numeracy skills. By continuously assessing essential cognitive skills—knowledge, application, reasoning—EST I serves as an accurate assessment. Moreover, EST I test includes two sections: with and without calculator. The reasons why the EST I Math tests contain a section where the students are not allowed to use calculators are listed below.

- Students should be able to know when to use calculator. Usually, if calculators are allowed, students will use them in all the exercises, while if calculators are not allowed, they will show their basic skills (basic calculations, operations, etc.) and will show how smart they are.
- The section without calculator will allow to assess the fluency of the students in math, and their understanding of some concepts (except probabilities, ratios, and data).
- It will assess the students' pace and their time management (since their calculations will be done by hand).
- Questions in the no-calculator section are intended to reward students' abilities to solve problems efficiently and accurately.
- Students must have the ability of estimating the correct answer because many questions do not require to use a calculator and can actually be solved quicker without it.
- Even though using calculator is a skill but there are many instances where students can make mistakes, such as punching the wrong buttons, forgetting to change the mode, incorrect rounding up of values and wrong methods of evaluating brackets.
- Calculators result in dependence. Students may find themselves in situations where they won't be able to perform even the easiest calculations of all without the aid of a calculator.

By continuously assessing essential cognitive skills—knowledge, application, reasoning—EST I serves as an accurate assessment against common core standards of a student's level of academic preparedness.

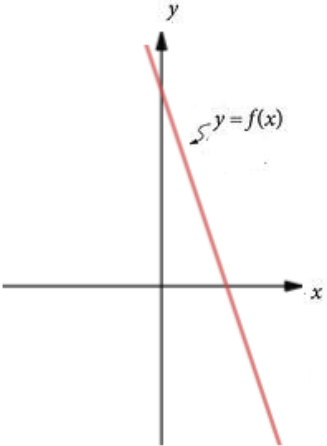
The EST I Math tests cover four main topics: Basic Algebra, Information Analysis and Data Interpretation, Higher Math and Supplementary Content in Math.

The following table compares the content assessed by the EST I Math tests to the Common Core Standards.

The following table shows how the topic Basic Algebra coincides with the common core standards.

Basic Algebra	
EST Standards Content	Common Core Standards
<ul style="list-style-type: none"> • Analyze and solve linear equations and system of linear equations • Create linear equations and inequalities to represent relationships between quantities and solve problems • Use the relationship between linear equations and inequalities and their graphs to solve problems 	<p>Middle School - Algebra</p> <ul style="list-style-type: none"> • Reason about and solve one-variable equations and inequalities. • Represent and analyze quantitative relationships between dependent and independent variables. • Solve real-life and mathematical problems using numerical and algebraic expressions and equations. • Understand the connections between proportional relationships, lines, and linear equations. • Analyze and solve linear equations and pairs of simultaneous linear equations. • Define, evaluate, and compare functions (those related to linear function) <p>High School - Algebra:</p> <ul style="list-style-type: none"> • Create equations that describe numbers or relationships • Understand solving equations as a process of reasoning and explain the reasoning • Solve equations and inequalities in one variable • Solve systems of equations • Represent and solve equations and inequalities graphically

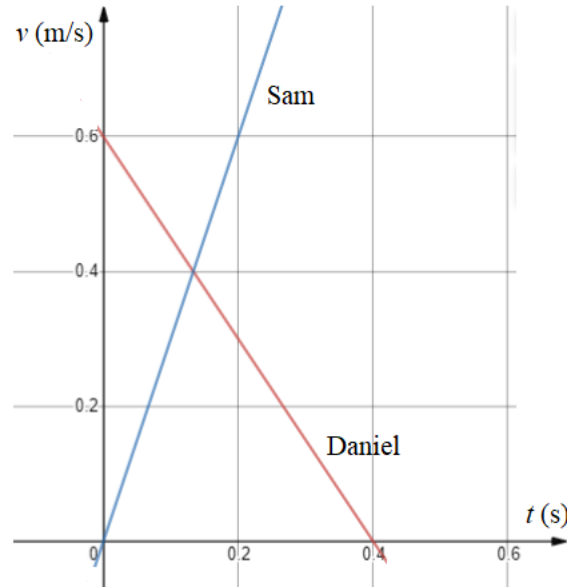
The following table shows example question items from the EST I Math test that correspond to the topic Basic Algebra. Cognitive levels are indicated for each item.

Question	Cognitive level
<p style="text-align: center;"> $3y = 12 - 3y$ $y + a = x - 1$ </p> <p>In the system of equations above, a is a constant and (x, y) is a solution, where $x = 3$. What is the value of a ?</p> <p>A. -4 B. 0 C. 2 D. 4</p> <p><i>Answer B</i></p>	<p>Knowledge</p>
<p>The graph shown above is that of a linear function f whose expression is given by $f(x) = cx + d$, where c and d are constants. Which of the following must be true about c and d?</p> <p>A. $c = d$ B. $c > d$ C. $c < d$ D. $c = 0$</p> <p><i>Answer C</i></p>	<p>Application</p> <div style="text-align: center;">  </div>

The given graph show the speeds v in meters per second (m/s) of Sam and Daniel, as they do their morning jogs, as a function of time t in seconds (s). The difference in the speeds of the two boys is how much less at $t = 0.2$ s than it was initially?

- A. 0 seconds
- B. 0.3 seconds
- C. 0.4 seconds
- D. 0.6 seconds

Answer B



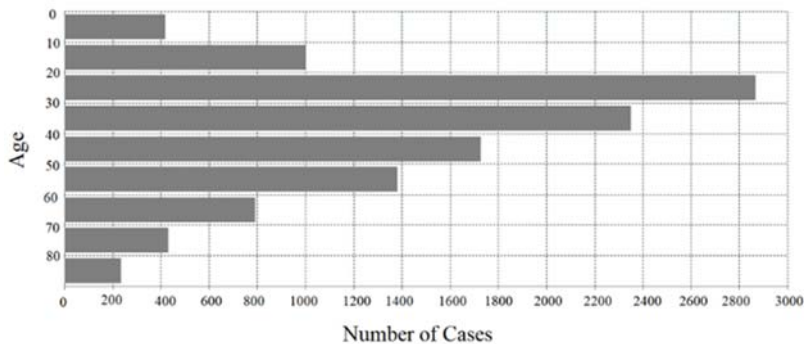
Reasoning

The following table shows how the topic Information Analysis and Data Interpretation coincides with the common core standards.

Information Analysis and Data Interpretation	
EST Standards Content	Common Core Standards
<ul style="list-style-type: none"> • Create and analyze relationship using ratios, proportional relationships, percentages and units • Represent and analyze quantitative data • Find and apply probabilities in context 	<p>Middle School – Statistics and Probability</p> <ul style="list-style-type: none"> • Understand ratio concepts and use ratio reasoning to solve problems. • Represent and analyze quantitative relationships between dependent and independent variables. • Develop understanding of statistical variability • Summarize and describe distributions • Analyze proportional relationships and use them to solve real-world and mathematical problems. • Use random sampling to draw inferences about a population. • Draw informal comparative inferences about two populations. • Investigate chance processes and develop, use, and evaluate probability models. • Investigate patterns of association in bivariate data. <p>High School – Statistics and Probability:</p> <ul style="list-style-type: none"> • Understand independence and conditional probability and use them to interpret data • Use the rules of probability to compute probabilities of compound events in a uniform probability model • Calculate expected values and use them to solve problems • Use probability to evaluate outcomes of decisions • Summarize, represent, and interpret data on a single count or measurement variable • Summarize, represent, and interpret data on two categorical and quantitative variables • Interpret linear models

The following table shows example question items from the EST I Math test that correspond to the topic Information Analysis and Data Interpretation. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>The histogram shown summarizes the number of people who got infected by the Covid-19 virus according to their age in Lebanon. The survey was done over 11,200 people.</p> <p>Which of the following is closest to the ratio of the number of infected people below the age of 10 to those above the age of 80?</p> <p>A. $\frac{10}{80}$</p> <p>B. $\frac{215}{410}$</p> <p>C. $\frac{410}{215}$</p> <p>D. $\frac{80}{10}$</p> <p><i>Answer C</i></p>	<p>Knowledge</p>

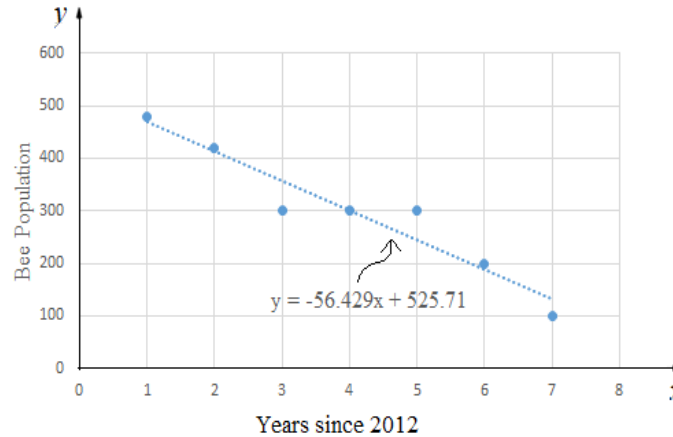


The adjacent scatterplot shows the Bee population in a certain farm for every year since 2012. A line of best fit and its equation are also shown.

Application

Which of the following is the best interpretation of the value -56.429 in the equation of the line of best fit?

- A. The average increase in the number of bees each year.
- B. The average decrease in the number of bees every 525.71 years.
- C. The average decrease in the number of bees each year.
- D. The number of bees present in the beginning.



Answer C

If the average (arithmetic mean) of three numbers a , b , and c is 10, what is the average of a and b in terms of c ?

Reasoning

- A. $5 - 0.5c$
- B. $15 - c$
- C. $30 - 0.5c$
- D. $15 - 0.5c$

Answer D

The following table shows how the topic Higher Math coincides with the common core standards.

Higher Math	
EST Standards Content	Common Core Standards
<ul style="list-style-type: none"> • Identify and create equivalent algebraic expressions • Create, Analyze and solve quadratic and other nonlinear equations • Create, use and draw exponential, quadratic and other nonlinear equations 	<p>Middle School – Number and Quantity</p> <ul style="list-style-type: none"> • Apply and extend previous understandings of arithmetic to algebraic expressions. • Use properties of operations to generate equivalent expressions. • Work with radicals and integer exponents • Define, evaluate, and compare functions.(those related to nonlinear) • Use functions to model relationships between quantities. <p>High School – Number and Quantity:</p> <ul style="list-style-type: none"> • Extend the properties of exponents to rational exponents • Perform arithmetic operations with complex numbers • Represent complex numbers and their operations on the complex plane • Use complex numbers in polynomial identities and equations <p>High School – Algebra:</p> <ul style="list-style-type: none"> • Interpret the structure of expressions • Write expressions in equivalent forms to solve problems • Perform arithmetic operations on polynomials • Understand the relationship between zeros and factors of polynomials • Use polynomial identities to solve problems • Rewrite rational expressions <p>High School – Functions:</p> <ul style="list-style-type: none"> • Understand the concept of a function and use function notation • Interpret functions that arise in applications in terms of the context • Analyze functions using different representations • Build a function that models a relationship between two quantities • Build new functions from existing functions • Construct and compare linear, quadratic, and exponential models and solve problems • Prove and apply trigonometric identities

The following table shows example question items from the EST I Math test that correspond to the topic Higher Math. Cognitive levels are indicated for each item.

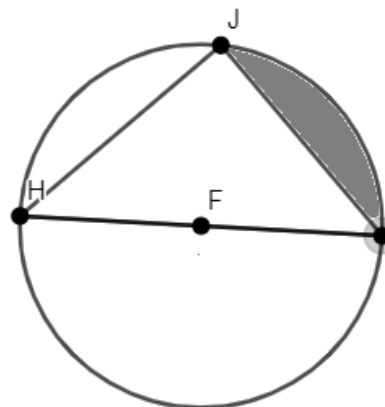
Question	Cognitive level
<p>If $p(x) = x^2 - 7x + 5$ and $q(x) = -3x^3 - 7x^2 + 2x - 5$, which of the following expressions is equal to the difference $p(x) - q(x)$?</p> <p>A. $4x^3 - 9x + 10$ B. $-3x^3 - 6x^2 - 5x$ C. $-3x^3 - 8x^2 + 9x - 10$ D. $3x^3 + 8x^2 - 9x + 10$</p> <p><i>Answer D</i></p>	Knowledge
<p>The graph (C) of the function $f(x) = 2(x + 2)(x - 6)$ is a parabola. If the line $x = k$ is the axis of symmetry of the parabola, what is the value of k?</p> <p>A. 1 B. 2 C. 3 D. 4</p> <p><i>Answer B</i></p>	Application
<p>John owns a drone that has a radio range of 55 meters, that is the owner can control it only if the drone is within 55 meters from him. As John launches the drone, the drone flies off a distance D, measured in meters, given by the expression $D = 4t^2 + 20t$, where t is the time in seconds after the drone is launched. Assuming John stays where he is, at least how many seconds after being launched, does the drone get out of range?</p> <p>A. 0 seconds B. 1 second C. 2 seconds D. 3 seconds</p> <p><i>Answer C</i></p>	Reasoning

The following table shows how the topic Supplementary Contents in Math coincides with the common core standards.

Supplementary Contents in Math	
EST Standards Content	Common Core Standards
<ul style="list-style-type: none"> • Solve problems related to area and volume • Apply definitions and theorems related to lines, angles, circles and triangles • Work with right triangles, the unit circle, and trigonometric functions 	<p>Middle School – Geometry</p> <ul style="list-style-type: none"> • Solve real-world and mathematical problems involving area, surface area, and volume. • Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. • Understand congruence and similarity using physical models, transparencies, or geometry software. • Understand and apply the Pythagorean Theorem. • Solve real-world and mathematical problems involving volume of cylinders, cones and spheres. <p>High School – Functions:</p> <ul style="list-style-type: none"> • Extend the domain of trigonometric functions using the unit circle • Model periodic phenomena with trigonometric functions • Prove and apply trigonometric identities <p>High School – Geometry:</p> <ul style="list-style-type: none"> • Experiment with transformations in the plane. • Understand congruence in terms of rigid motions. • Understand similarity in terms of similarity transformations. • Define trigonometric ratios and solve problems involving right triangles. • Apply trigonometry to general triangles. • Understand and apply theorems about circles. • Find arc lengths and areas of sectors of circles.

The following table shows example question items from the EST I Math test that correspond to the Supplementary Contents in Math. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>A right triangle has an area of 96 cm^2. If the shorter leg is 4cm less than the longer leg, what is the length of the hypotenuse? (Disregard the unit when placing in your answer).</p> <p><i>Answer: 20</i></p>	Knowledge
<p>If x and y are positive measures of acute angles, and $\sin(x - 20^\circ) = \cos(y + 12^\circ)$, what is a possible value of $x + y$? (Disregard the degree sign when placing in your answer).</p> <p><i>Answer: 98</i></p>	Application
<p>In the given figure, F is the center of the circle, and J,H, and I are points on the circle, and $FI = 4$ If $\angle JHI = \angle JIH = 45^\circ$, what is the area of the shaded region?</p> <p>A. $16\pi - 32$ B. $8\pi - 16$ C. $4\pi - 8$ D. $2\pi - 4$</p> <p><i>Answer C</i></p>	Reasoning



Common Core vs EST II – Biology

The EST II Biology test covers the main topics of the subject: cell structure and molecular biology, interdependence of living things and their relationships with the environment, biological identity and genetic information, organism systems and classification and evolution. EST II Biology test assesses the depth of knowledge in this particular subject by continuously assessing essential cognitive skills—knowledge, application, reasoning.

The following table shows the matching between the EST II Biology test and the concepts covered in the common core standards.

EST		Common core	
Topics	Content	Topics	Concepts
Cell Structure and Molecular Biology	Cell components and function, mitosis, enzymatic activity, cellular respiration and fermentation, energy expenditure, basal metabolism, biosynthesis, photosynthesis	Structures and Processes	Structure and function, growth and development of organisms, organization for matter and energy flow in organisms, cell function and reproduction, role of proteins as essential to the work of the cell and living systems, photosynthesis, respiration, the cycling of matter and flow of energy in living organisms, hierarchical organization of organism
Interdependence of Living Things and their Relationships with the Environment	Levels of organization, biotic and abiotic factors, relationship between organisms, flow of energy in ecosystem, cycling of matter, community ecology, biomes, ecosystems, populations ecology, biodiversity and conservation	Ecosystems: Interactions, Energy, and Dynamics	Interdependent relationships in Ecosystems, cycles of matter and energy transfer in ecosystems, ecosystem dynamics, functioning, and resilience, social interactions and group behavior, concepts of carrying capacity, factors affecting biodiversity and populations, the cycling of matter and flow of energy among organisms in an ecosystem, conceptual understanding of systems, impact of human activities on the environment and maintaining biodiversity.

Biological Identity and Genetic Information	Inherited genetic diseases, genes transmission, genetic recombination, chromosomal abnormalities, meiosis and sex cells production	Heredity: Inheritance and Variation of Traits	Inheritance of traits, variation of traits, genetic variation in a population, the mechanisms of genetic inheritance, environmental and genetic causes of gene mutation and the alteration of gene expression.
Organism Systems	Systems of the body, plant structure and function, hormonal communication in animals and plants, regulation, reproduction, animal behavior	Structures and Processes	Structure and function, growth and development of organisms, cell function and reproduction, hierarchical organization of organisms, role of cells in body systems and how those systems work to support the life functions of the organism, how environmental and genetic factors affect growth of organisms, the role of animal behaviors in reproduction of animals, dependence of some plants on animal behaviors for their reproduction.
Classification and Evolution	Binomial nomenclature, taxonomic categories, allele frequency in a population, evolution theories, mechanism of evolution, evolution of genes, parental relationships, human evolution	Biological Evolution: Unity and Diversity	Evidence of common ancestry and diversity, natural selection, adaptation, biodiversity and Humans, processes of natural selection and evolution

The following table shows how the topic “Cell Structure and Molecular Biology” coincides with the next generation science standards.

EST		Next Generation Science Standards (Life Science)	
Topics	Content	Topics	Standard
Cell Structure and Molecular Biology	Cell components and function, mitosis, enzymatic activity, cellular respiration and fermentation, energy expenditure, basal metabolism, biosynthesis, photosynthesis	Structures and Processes	<ul style="list-style-type: none"> - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells. - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. - Plan and conduct an investigation to provide evidence those feedback mechanisms maintain homeostasis. - Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms - Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. - Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. - Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy

The following table shows example question items from the EST II Biology test that correspond to “Cell Structure and Molecular Biology”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>ATP is produced during which of the following processes?</p> <p style="padding-left: 40px;">I. Photosynthesis II. Aerobic respiration III. Fermentation</p> <p>(A) I only (B) II only (C) I and III only (D) II and III only (E) I, II, and III</p> <p><i>Answer E</i></p>	Knowledge
<p>The cells of the yellow dung fly contain 5 pairs of autosomal chromosomes and one pair of sex chromosomes. Upon completion of Meiosis II, how many chromosomes will each yellow dung fly gamete contain?</p> <p>(A) 5 (B) 6 (C) 10 (D) 12 (E) 24</p> <p><i>Answer B</i></p>	Application

A scientist performed an experiment to determine the effect of temperature on the length of the cell cycle in one of the species. The duration of the cell cycle at room temperature is 15 hours. He cultured identical stem cells in four culture media with the same content of nutrient and oxygen gas but at different temperature. The duration of the cell cycles at different temperatures are recorded in the following table:

Temperature (°C)	Length of the cell cycle (hours)
10	54.6
15	29.8
20	18.8
25	13.3

The data in the table shows that:

- (A) Cells divide faster as the temperature decreases
- (B) The length of the cell cycle is not affected by temperature
- (C) The length of the cell cycle is inherited and not affected by temperature
- (D) Cells divide faster as the temperature increases
- (E) A and C

Answer D

Reasoning

The following table shows how the topic “Interdependence of Living Things and their Relationships with the Environment” coincides with the next generation science standards.

EST		Next Generation Science Standards (Life Science)	
Topics	Content	Topics	Standard
Interdependence of Living Things and their Relationships with the Environment	Levels of organization, biotic and abiotic factors, relationship between organisms, flow of energy in ecosystem, cycling of matter, community ecology, biomes, ecosystems, populations ecology, biodiversity and conservation	Ecosystems: Interactions, Energy, and Dynamics	<ul style="list-style-type: none"> - Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. - Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. - Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. - Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere - Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. - Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity - Evaluate evidence for the role of group behavior on individual and species’ chances to survive and reproduce

The following table shows example question items from the EST II Biology test that correspond to “Interdependence of Living Things and their Relationships with the Environment”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>Eutrophication refers to:</p> <ul style="list-style-type: none"> (A) The process that causes the depletion of the ozone layer (B) Global warming (C) The process that happens to a lake that absorbs too many nutrients (D) The invasion of new species that causes damage to an ecosystem (E) The process whereby one species outcompetes another species <p><i>Answer C</i></p>	Knowledge
<p>In spring and winter, the food of the fox is mostly small rodents due to the lack of fruits. By contrast, in summer and autumn, its food consists of 50% fruit. So the diet of fox, as function of seasons, is:</p> <ul style="list-style-type: none"> (A) Herbivorous (B) Zoophagous (C) Insectivorous (D) Carnivorous (E) Omnivorous <p><i>Answer E</i></p>	Application
<p>A farmer retired and moved away. He left his land to grow wild. What will he find when he comes back after a while?</p> <ul style="list-style-type: none"> (A) The plants will change, but the animals will stay the same (B) The animals will change, but the plants will stay the same (C) Neither the plants nor the animals will change because the climate will not change (D) Both the animals and plants will change (E) All the animals will slowly die out because they will not be adapted to the new environment <p><i>Answer D</i></p>	Reasoning

The following table shows how the topic “Biological Identity and Genetic Information” coincides with the next generation science standards.

EST		Next Generation Science Standards (Life Science)	
Topics	Content	Topics	Standard
Biological Identity and Genetic Information	Inherited genetic diseases, genes transmission, genetic recombination, chromosomal abnormalities, meiosis and sex cells production	Heredity: Inheritance and Variation of Traits	<ul style="list-style-type: none"> - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. - Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. - Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

The following table shows example question items from the EST II Biology test that correspond to “Biological Identity and Genetic Information”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>In the inheritance of blood group ABO system, the alleles behave as follows:</p> <ul style="list-style-type: none"> (A) A//A is the genotype of group A which is homozygous (B) A//B is the genotype of group A which is heterozygous (C) A//O is the genotype of group A which is homozygous (D) The two alleles A and O are codominant (E) Allele A is dominant over allele B <p><i>Answer A</i></p>	Knowledge

Which of the following statements best explains the fact that a mutation in a cell's DNA does not always result in an error in the polypeptide produced from that DNA sequence?

- (A) Some polypeptides are produced by a code other than a nucleic acid code
- (B) The nucleolus can repair damaged DNA
- (C) The Golgi body can repair damaged DNA
- (D) Different codons code for the same amino acid
- (E) Scientists have no idea why this phenomenon occurs

Answer D

Application

Tay-Sachs disease is known as an infantile disease which is characterized by relentless deterioration of mental and physical abilities. It begins at 6 months of age and usually results in death by the age of five. A couple has two girls out of which one is 2 years old and has the disease. The mother got pregnant and she is afraid of having another affected child. She visited a genetic counselor who demanded DNA analysis test for the whole family. The results of the DNA analysis of the whole members are shown in the following table.

Bands	Mother	Father	Normal girl	Affected girl	Fetus
A	_____	_____	=====		_____
B	_____	_____	=====		_____
C	_____	_____		=====	_____

Based on the above given, the band(s) which correspond(s) to the:

- (A) Disease are bands A and C
- (B) Disease are bands B and C
- (C) Normal phenotype is band A
- (D) Normal phenotype are bands A and B
- (E) Normal phenotype are bands A and C

Answer D

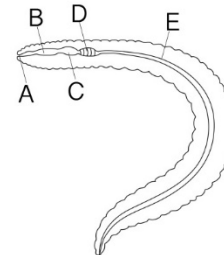
Reasoning


The following table shows how the topic “Organism Systems” coincides with the next generation science standards.

EST		Next Generation Science Standards (Life Science)	
Topics	Content	Topics	Standard
Organism Systems	Systems of the body, plant structure and function, hormonal communication in animals and plants, regulation, reproduction, animal behavior	Structures and Processes	<ul style="list-style-type: none"> - Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.* - Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.* - Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.* - Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.* - Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. * - <i>*These standards are taught in the middle school.</i>

The following table shows example question items from the EST II Biology test that correspond to “Organism Systems”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>The figure below shows the anatomy of an earthworm. The structure responsible for grinding food is represented by the letter:</p> <p>(A) A. (B) B. (C) C. (D) D. (E) E.</p> <p><i>Answer D</i></p>	Knowledge



<p>The following figure shows the training of a dog in order to sit.</p> <p>This training refers to</p> <ul style="list-style-type: none"> (A) operant conditioning. (B) classical conditioning. (C) imprinting. (D) fixed action pattern. (E) habituation. <p><i>Answer A</i></p>		<p>Application</p>
<p>A gynecologist prescribes a treatment to a newly pregnant woman who suffered from a miscarriage a year ago. This treatment is composed of one main hormone that maintains a supportive environment for the developing fetus. Which hormone is this medication composed of?</p> <ul style="list-style-type: none"> (A) Estrogen (B) FSH (C) GnRH (D) Progesterone (E) LH <p><i>Answer D</i></p>		<p>Reasoning</p>

The following table shows how the topic “Classification and Evolution” coincides with the next generation science standards.

EST		Next Generation Science Standards (Life Science)	
Topics	Content	Topics	Standard
Classification and Evolution	Binomial nomenclature, taxonomic categories, allele frequency in a population, evolution theories, mechanism of evolution, evolution of genes, parental relationships, human evolution	Biological Evolution: Unity and Diversity	<ul style="list-style-type: none"> - Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. - Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. - Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. - Construct an explanation based on evidence for how natural selection leads to adaptation of populations. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species - Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

The following table shows example question items from the EST II Biology test that correspond to “Classification and Evolution. Cognitive” levels are indicated for each item.

Question	Cognitive level
<p>Which of the following is LEAST likely to result in speciation?</p> <ul style="list-style-type: none"> (A) Random mating among members of a large population of a species (B) Occurrence of hybridization between individuals from two different species (C) Development of different mating behavior by some members of a species (D) Emigration to a specialized microenvironment by some members of a species (E) Formation of a physical barrier that blocks gene flow between members of a species <p><i>Answer A</i></p>	Knowledge
<p>Wildebeests separated from each other by a newly formed river are now separate species. This fact corresponds to:</p> <ul style="list-style-type: none"> (A) Divergent evolution (B) Convergent evolution (C) Coevolution (D) Parallel evolution (E) Genetic drift <p><i>Answer A</i></p>	Application

<p>In a certain population of goats, there are two alleles for coat color: brown and white. Brown is dominant and white is recessive. The frequency of white-colored goats is 20% during spring season. Wolves are also present in the area, and goats constitute a major portion of their diet. Wolves recognize prey when they do not blend into the environment. If the climate were to change so that snow covered the ground much of the time, what change in the population of goats would you expect?</p> <ul style="list-style-type: none">(A) The frequency of white allele would increase.(B) The frequency of white allele would decrease.(C) The frequency of brown allele would increase.(D) The population of goats would decrease and then increase.(E) The population of goats would increase and then decrease. <p><i>Answer A</i></p>	Reasoning
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Common Core vs EST II – Physics

The EST II Physics test covers the main topics of the subject: mechanics, electricity, waves and particle nature of light, thermodynamics and modern physics. EST II Physics test assesses the depth of knowledge in this particular subject by continuously assessing essential cognitive skills—knowledge, application, reasoning.

The following table shows the matching between the EST II Physics test and the concepts covered in the common core standards.

EST		Common core	
Topic	Content	Topic	Concepts
Mechanics	Principles of Kinematics (scalar and vector quantities, distance and displacement, speed, velocity (initial, final, average, instantaneous), acceleration (constant, normal, tangential), projectile motion and circular motion, Newton’s laws of motion (first, second, third), Newton’s law of universal gravitation, satellites in circular orbits, coefficient of friction and static equilibrium, energy (gravitational potential, kinetic, mechanical), efficiency, conservation and non-conservation laws, isolated system, power, work, and linear momentum impulse, oscillatory motion (simple harmonic motion of pendulums)	Energy and Motion	Motion in one dimension, motion in two dimension, mass, vectors, vector diagram, position, time, speed, velocity, acceleration, distance, displacement, rate, instantaneous velocity, average velocity, frame of reference, balanced forces gravitation force, friction, net force, normal force, weight, static equilibrium, gravitational force, center of mass, dynamics of a single particle and systems of particles, circular motion and rotation, uniform circular motion, work, work –energy theorem, power, potential energy, elastic energy, kinetic energy, internal energy, total energy, conservation of mechanical energy, law of conservation of energy, impulse and momentum, conservation of linear momentum, collisions, simple harmonic motion, pendulum motion

<p>Electricity</p>	<p>Electrostatic (electric charge, Coulomb's law, electric potential, electric fields and their effects on charged objects, electric force, and point charge), Capacitors (charging and discharging of a capacitor, capacitance of the capacitor, and amount of charge stored in a parallel plate capacitor), DC – Electric Circuit (electric current, voltage, Ohm's law, series and parallel circuits, equivalent resistance, electric power, efficiency of electric devices), Electromagnetism (magnets, magnetic field line, magnetic force, interaction of magnetic fields and moving charges, electromagnetic induction, Faraday's and Lenz's laws)</p>	<p>Electricity</p>	<p>Charge and Coulomb's Law, electric field and electric potential, electrostatics with conductors, potential difference (voltage), electric current, resistance, generators (batteries), motors, DC circuits, series circuit, parallel circuit, Ohm's law, electric power, resistors, Joules effect, capacitors, flux, induction, coil, faraday's law, Lenz's law</p>
<p>Waves and Particle Nature of Light</p>	<p>Wave Properties: characteristics of a travelling wave (amplitude, wavelength, frequency, period, speed, and phase), superposition, interference, standing waves, Doppler effect, and electromagnetic waves, Geometrical Optics (rectilinear propagation of light, laws of reflection and refraction of light, images produced by mirrors, Snell's law, and lenses (convex and concave) and aspects of light (interference, diffraction, linear polarization of light, photoelectric effect, and colors)</p>	<p>Waves, Sound and Light</p>	<p>waves, wave propagation, standing waves, superposition, sound resonance, beats and beats frequency, Doppler effect, mechanical wave, electromagnetic wave, electromagnetic spectrum, wavelength, frequency, amplitude, period, reflection, refraction, diffraction, mirrors, lenses, focal point, image distance, object distance, radio wave, microwave, infrared, visible light, ultraviolet, x-ray, gamma ray</p>
<p>Thermodynamics</p>	<p>Laws of thermodynamics, internal energy, entropy of a system and efficiency of heat engine and heat (temperature, change in state, transfer of heat, specific and latent heats and thermal energy)</p>	<p>Energy (Thermal)</p>	<p>Second law of thermodynamics, heat transfer, thermal equilibrium, volume, pressure, change in temperature, latent heat, specific heat, calorimeter, change in state, melting, solidification, condensation, evaporation, conduction, convection, radiation, ideal gas, efficiency.</p>

<p>Modern Physics</p>	<p>Quantum Phenomena (photons and photoelectric effect), atoms: Rutherford's model and Bohr's model, energy level of atoms, hydrogen spectrum, emission and absorption spectra and atomic nucleus, radioactivity and nuclear reactions (α, β and γ waves, radioactive decay, half-life, fission and fusion nuclear reactions), Special Relativity: (relativistic effects of time dilation, length contraction and mass increase, mass-energy equivalence)</p>	<p>Energy (nuclear)</p>	<p>Atom, electron levels, nucleus, isotopes, protons, neutrons, half-life, activity, radioactive decay, nuclear fission, fusion, energy quantization, absorption and emission of energy, Bohr's model of the atom, hydrogen spectrum, Albert Einstein's photoelectric effect, nuclear reactions, gamma ray, alpha and beta particles, special relativity, mass-energy equivalence equation</p>
<p>General knowledge</p>	<p>General knowledge on physics history, contemporary physics: (universe, theory of superconductivity, and Chaos theory) graph and table analysis, math skills (inverse, inverse square, linear, proportionality constant, slope, square, variable)</p>	<p><i>Scientific Progress</i></p>	

The following table shows how the topic “Mechanics” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Mechanics	Principles of Kinematics (scalar and vector quantities, distance and displacement, speed, velocity (initial, final, average, instantaneous), acceleration (constant, normal, tangential), projectile motion and circular motion, Newton’s laws of motion (first, second, third), Newton’s law of universal gravitation, satellites in circular orbits, coefficient of friction and static equilibrium, energy (gravitational potential, kinetic, mechanical), efficiency, conservation and non-conservation laws, isolated system, power, work, and linear momentum impulse, oscillatory motion (simple harmonic motion of pendulums)	Energy and Motion	<p>Newton’s laws of motion and gravitation describe and predict the motion of a vast variety of objects.</p> <p>The laws of conservation of energy and momentum provide independent approaches to predicting and describing the motion of objects</p> <ul style="list-style-type: none"> • Understand how to measure, calculate, and describe the motion of an object in terms of position, time, velocity, and acceleration. • Understand the relation between force, mass, and acceleration. • Understand the factors determining the strength of gravitational. • Understand transfer and conservation of energy.

The following table shows example question items from the EST II Physics test that correspond to “Mechanics”. Cognitive levels are indicated for each item.

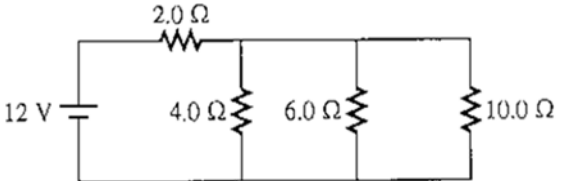
Questions	Cognitive level
<p>Which of the following cannot be negative?</p> <p>(A) elastic potential energy (B) gravitational potential energy (C) mechanical energy (D) velocity (E) work</p> <p><i>Answer: A</i></p>	Knowledge
<p>A small plane is used for training flies with constant speed $v = 60\text{m/s}$ on a circular path of radius 1,000 m. The centripetal force exerted on the plane to keep it on its path is $F = 4 \times 10^4 \text{ N}$.</p> <p>What is the mass of the plane?</p> <p>(A) $66.6 \times 10^3 \text{ kg}$ (B) $11.11 \times 10^3 \text{ kg}$ (C) $4 \times 10^3 \text{ kg}$ (D) $2 \times 10^3 \text{ kg}$ (E) 900 kg</p> <p><i>Answer: B</i></p>	Application
<p>A particle of mass $m = 0.5\text{kg}$ undergoes a simple harmonic motion on a horizontal support with period $T = \pi/5 \text{ s}$ and amplitude 5 cm.</p> <p>What is the maximum speed for this particle?</p> <p>(A) 10 cm/s (B) 50 cm/s (C) 5 cm/s (D) 25 cm/s (E) 100 cm/s</p> <p><i>Answer: B</i></p>	Reasoning

The following table shows how the topic “Electricity” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Electricity	Electrostatic (electric charge, Coulomb’s law, electric potential, electric fields and their effects on charged objects, electric force, and point charge), Capacitors (charging and discharging of a capacitor, capacitance of the capacitor, and amount of charge stored in a parallel plate capacitor), DC – Electric Circuit (electric current, voltage, Ohm’s law, series and parallel circuits, equivalent resistance, electric power, efficiency of electric devices), Electromagnetism (magnets, magnetic field line, magnetic force, interaction of magnetic fields and moving charges, electromagnetic induction, Faraday’s and Lenz’s laws)	Electricity	<p>The phenomena that fall into the categories known as electrostatics and electromagnetism are due respectively to the behavior of stationary and moving charged particles.</p> <ul style="list-style-type: none"> - Understand the factors determining the strength of electric forces. - Understand the source of electromotive force (EMF), an electric current, resistors, ... •

The following table shows example question items from the EST II Physics test that correspond to “Electricity”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>Two resistors of resistances R_1 and R_2 are connected in parallel. The equivalent resistance of the grouping is $10\ \Omega$. Which of the following statements about the resistances is correct?</p> <p>(A) Both R_1 and R_2 are greater than $10\ \Omega$. (B) Both R_1 and R_2 are equal to $10\ \Omega$. (C) Both R_1 and R_2 are less than $10\ \Omega$. (D) The sum of R_1 and R_2 is $10\ \Omega$. (E) R_1 is greater than $10\ \Omega$ and R_2 is smaller than $10\ \Omega$.</p> <p><i>Answer A</i></p>	Knowledge

<p>A long wire in a DC circuit carries 2A electric current. What is the magnitude of the magnetic field at a point in space at a distance 40 cm from the center of the wire? ($\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$)</p> <p>(A) 10^{-6} T (B) $0.5 \times 10^{-6} \text{ T}$ (C) $0.5 \pi \times 10^{-6} \text{ T}$ (D) $\pi \times 10^{-6} \text{ T}$ (E) $2\pi \times 10^{-6} \text{ T}$</p> <p><i>Answer A</i></p>	<p>Application</p>
<p>Three resistors connected in parallel have individual values of 4.0Ω, 6.0Ω, and 10.0Ω. If this combination is connected in series with a 12.0 V battery and a 2.0Ω resistor as shown to the right, what is the current in the 10.0Ω resistor?</p> <p>(A) 0.59A (B) 1A (C) 3.33A (D) 11A (E) 16A</p> <div style="text-align: center;">  </div> <p><i>Answer A</i></p>	<p>Reasoning</p>

The following table shows how the topic “Waves and Particle Nature of Light” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Waves and Particle Nature of Light	Wave Properties: characteristics of a travelling wave (amplitude, wavelength, frequency, period, speed, and phase), superposition, interference, standing waves, Doppler effect, and electromagnetic waves, Geometrical Optics (rectilinear propagation of light, laws of reflection and refraction of light, images produced by mirrors, Snell’s law, and lenses (convex and concave) and aspects of light (interference, diffraction, linear polarization of light, photoelectric effect, and colors)	Waves, Sound and Light	<p>Waves carry energy from place to place without the transfer of matter</p> <ul style="list-style-type: none"> - Students will understand the properties and applications of waves (Mechanical and electromagnetic waves).

The following table shows example question items from the EST II Physics test that correspond to “Waves and Particle Nature of Light”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>The phenomenon of the total internal reflection is the main principle for the functioning of the fiber optics. This phenomenon appears if</p> <p>(A) the index of refraction of the medium is less than 1. (B) the angle of incidence is greater than the critical angle. (C) the index of refraction of the medium is greater than 1. (D) the angle of incidence is smaller than the critical angle. (E) the angle of incidence is zero.</p> <p><i>Answer B</i></p>	Knowledge

<p>A convergent lens of focal length $f = 20$ cm gives for an object of size 2 cm placed 60 cm in front of it</p> <p>(A) a virtual image formed on a screen 30 cm behind the lens. (B) a real and inverted image of size 1 cm. (C) a real image of a size of 4 cm formed 30 cm behind the lens. (D) an erect image of a size of 4 cm formed 40 cm behind the lens. (E) a real image formed on a screen 60 cm behind the lens.</p> <p><i>Answer B</i></p>	<p>Application</p>
<p>Water drops fall at a rate of 120 drops per minute on a free surface of still water, causing ripples whose crest are 20 cm apart. The speed of propagation of the waves is</p> <p>(A) 0.3 m/s (B) 0.4 m/s (C) 0.75 m/s (D) 1.5 m/s (E) 2.4 m/s</p> <p><i>Answer B</i></p>	<p>Reasoning</p>

The following table shows how the topic “Thermodynamics” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Thermodynamics	Laws of thermodynamics, internal energy, entropy of a system and efficiency of heat engine and heat (temperature, change in state, transfer of heat, specific and latent heats and thermal energy)	Heat & Thermodynamics	<p>Energy cannot be created or destroyed; however, in many processes energy is transformed into the microscopic form called heat energy, that is, the energy of the disordered motion of atoms</p> <ul style="list-style-type: none"> Students will understand transfer and conservation of energy in systems to describe common energy transformations and the effect on availability of energy.

The following table shows example question items from the EST II Physics test that correspond to “Thermodynamics”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>The latent heat of fusion of water is 3.35×10^5 J/kg. The amount of energy required to change 500 g of ice into water is</p> <p>(A) 1.49×10^{-3} J (B) 1.49×10^{-3} J (C) 6.75×10^5 J (D) 1.675×10^5 J (E) 1.675×10^7 J</p> <p><i>Answer D</i></p>	Knowledge

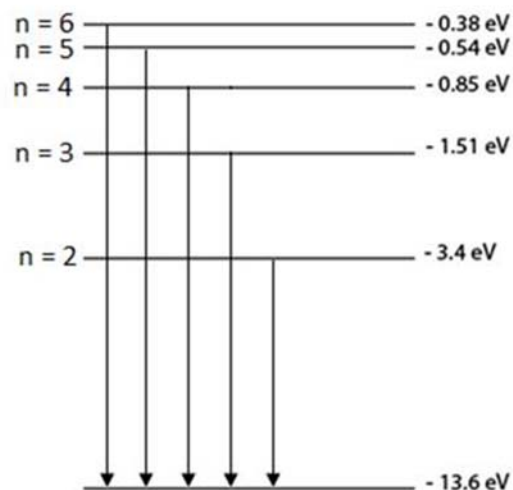
<p>The pressure of a gas inside a cylinder is 300 kPa. If the gas is compressed to half its original volume and the temperature rises from 23 °C to 323 °C, the new pressure will be</p> <ul style="list-style-type: none">(A) 1200 Pa(B) 1200 kPa(C) 2400 Pa(D) 600 kPa(E) 2400 kPa <p><i>Answer B</i></p>	Application
<p>A gasoline engine does 50 J of work in one cycle and releases 35 J as heat loss. What is the engine's efficiency?</p> <ul style="list-style-type: none">(A) 0.15(B) 0.30(C) 0.65(D) 0.45(E) 0.59 <p><i>Answer E</i></p>	Reasoning

The following table shows how the topic “Modern Physics” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Modern Physics	Quantum Phenomena (photons and photoelectric effect), atoms: Rutherford’s model and Bohr’s model, energy level of atoms, hydrogen spectrum, emission and absorption spectra and atomic nucleus, radioactivity and nuclear reactions (α , β and γ waves, radioactive decay, half-life, fission and fusion nuclear reactions), Special Relativity: (relativistic effects of time dilation, length contraction and mass increase, mass-energy equivalence)	Energy	<p>Nuclear processes are those in which an atomic nucleus changes; they include radioactive decay of naturally occurring and manmade isotopes and nuclear fission and fusion processes</p> <ul style="list-style-type: none"> - Understand the relationship between energy changes in the atom specific to the movement of electrons between energy levels in an atom resulting in the emission or absorption of quantum energy. - Understand that the emission of high-energy particles results from nuclear changes and that matter can be converted to energy during nuclear reactions. <ul style="list-style-type: none"> ✓ Nuclear processes are those in which an atomic nucleus changes; they include radioactive decay of naturally occurring and manmade isotopes and nuclear fission and fusion processes. A

The following table shows example question items from the EST II Physics test that correspond to “Modern Physics”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>Which of the following is the correct order from least to most massive fundamental particles?</p> <p>(A) electron = beta particle < proton < neutron < alpha particle (B) neutron < proton < alpha particle < electron < alpha particle (C) alpha particle < neutron < proton < electron < beta particle (D) alpha particle < neutron < proton < electron = beta particle (E) neutron < proton < electron < alpha particle < alpha particle</p> <p><i>Answer A</i></p>	<p>Knowledge</p>
<p>The energy level in the diagram below shows the first six energy levels for an electron in a hydrogen atom that drops from energy level E₃ to energy level E₂. What is the frequency of the emitted photon? ($h = 6 \times 10^{-34}$ J.s)</p> <p>(A) 2.52×10^{14} Hz (B) 5.04×10^{14} Hz (C) 7.85×10^{14} Hz (D) 4×10^{13} Hz (E) 1×10^{15} Hz</p> <p><i>Answer B</i></p>	<p>Application</p>



The following table shows how the topic “General Knowledge” in Physics coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
General knowledge	General knowledge on physics history, contemporary physics: (universe, theory of superconductivity, and Chaos theory) graph and table analysis, math skills (inverse, inverse square, linear, proportionality constant, slope, square, variable)	Scientific Progress	<p>Scientific progress is made by asking relevant questions and conducting careful investigations.</p> <ul style="list-style-type: none"> - Use Science Process and Thinking Skills - Manifest Scientific Attitudes and Interests - Demonstrate Understanding of Science Concepts, Principles and Systems - Communicate Effectively Using Science Language and Reasoning - Demonstrate Awareness of Social and Historical Aspects of Science <ul style="list-style-type: none"> • Demonstrate Understanding of the Nature of Science

The following table shows example question items from the EST II Physics test that correspond to “General knowledge” in Physics. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>A custodian tries to turn on the light upon entering the room. The bulb does not light up. His hypothesis is that a circuit breaker is open. However, the custodian finds that the room's breaker is not open. What is the next best step to solve the problem?</p> <p style="margin-left: 40px;"> I. Check whether other bulbs are plugged in. II. Check whether other breakers are open. III. Develop a new hypothesis for why the lights do not turn on. </p> <p>(A) I only (B) II only (C) III only (D) I and II only (E) I, II, and III</p> <p><i>Answer C</i></p>	Knowledge
<p>Which among the following is the fundamental equation of the simple harmonic motion (S.H.M) along the horizontal axis $x'ox$ for a mass m connected to the second extremity of horizontal spring of stiffness constant k?</p> <p>(A) $x'' + (k / m) x' = 0$ (B) $x + \omega^2 x'' = 0$ (C) $x'' + (k/ m) x = 0$ (D) $x^2 + \omega x'^2 = 0$ (E) $x'' + (m/ k)^2 x = 0$</p> <p><i>Answer C</i></p>	Application

Common Core vs EST II – Chemistry

The EST II Chemistry test covers the main topics of the subject: atomic theory and chemical bonding, chemical behavior (aqueous solutions and gaseous state), chemical reactions, quantitative chemistry, chemical kinetics and chemical equilibrium, thermochemistry, the Periodic Table and periodic trends and experimental chemistry. EST II Chemistry test assesses the depth of knowledge in this particular subject by continuously assessing essential cognitive skills—knowledge, application, reasoning.

The following table shows the matching between the EST II Chemistry test and the concepts covered in the common core standards.

EST		Common core		
Topics	Content	Topics	Concepts	
Atomic Theory and Chemical Bonding	Atom structure (electrons, neutrons, protons), atomic mass, atomic number, atomic models and structure, covalent bonding, ionic bonding, metallic bonding, electron configuration, electron dot diagram, quantum numbers, isotope, Lewis structure, particle charge, polarity, valence electrons, intermolecular forces, VSEPR	Matter and its Interactions	Atomic Concepts	Atomic models, modern atomic model, atomic charge, subatomic particles (charge, mass...), electron configuration, atomic mass, average atomic mass, isotopes, valence electrons.
			Chemical Bonding	Ionic and molecular compounds, bond polarity, valence electron configuration, electron dot structure, electronegativity,
Physical Behavior of Matter	Molecular polarity, density, boiling and freezing point, solutions, solubility, concentration (molarity, percent by volume, percent by mass), kinetic energy, ideal gas, kinetic molecular theory for gases, gases law, ideal gas, molar volume			
Chemical Behavior (aqueous solutions and gaseous state)	Molarity, molar solution, mole, non-polar, polar, solute, solvent, solution, density, solubility, solubility factors, kinetic theory of gases, gas laws, partial pressures, ideal gas, change of physical states (phase diagram)			

Chemical Reactions	Acid-base neutralization, Arrhenius, pH concept and indicator, brönsted-lowry, strong acid, strong base, weak acid, weak base, dissociation constants, types of reaction, titration, titration curve, half-reaction, oxidation, reduction, oxidation number, oxidizing agent, redox reaction, reducing agent, activity series, precipitation reaction	Matter and its Interactions	Oxidation – Reduction	Transfer of e ⁻ in redox reactions, half reactions, oxidation, reduction, oxidation numbers, redox reactions in electrochemical cells. Electrochemistry / Electrolysis and conversion of energy
			Acids, Bases and Salts	Arrhenius theory for acids and bases, electrolyte, dissociation, conduction of an electric current vs, ion concentration, hydronium ion, neutralization, salt formation, titration, pH concept, acidity and alkalinity, H ⁺ donor and H ⁺ acceptor
Quantitative Chemistry	Mole, empirical formula, molar mass, molar volume, molecular formula, molecular mass, percentage composition, stoichiometric coefficients, balancing chemical equations, percent composition, limiting and excess reactants, mole fraction, mean molar mass, percent yield		Moles/ Stoichiometry	Empirical and molecular formulas, balancing chemical equations, conservation of atoms, molar mass, mole concept, percent composition,
			Periodic Table	Location of elements, classification of elements (physical properties), characteristic trends (atomic radius, electronegativity, first ionization energy, metallic and non-metallic properties
Periodic Table and Periodic Trends	Similarities and trends in chemical and physical properties of elements, chemical reactivity, simple organic and inorganic compounds and nomenclature.		Organic Chemistry	Naming organic compounds using IUPAC system, Isomers, hydrocarbons

<p>Chemical Kinetics and Chemical Equilibrium</p>	<p>Thermochemical equation, conservation of energy, ΔH notation, enthalpy, reaction rates, collision theory (significance with respect to reaction rates), factors affecting reaction rates, reaction mechanisms (including role and applications of catalysts), kinetic energy (KE), potential energy (PE), reaction intermediate, rate-determining step, dynamic equilibrium, equilibrium constant, expression, equilibrium shift, Le Châtelier's principle.</p>	<p>Matter and its Interactions</p>	<p>Kinetics/Equilibrium</p>	<p>Collision theory, rates of chemical reactions, factors affecting rates of chemical reactions, chemical equilibrium, reversible reactions, Le Chatelier's principle, potential energy diagram, catalyst, activation energy, enthalpy</p>
<p>Experimental Chemistry</p>	<p>Lab safety, lab equipment, solution preparation, separation techniques, experimental errors, basic environmental phenomena, draw out conclusions from experimental results (data)</p>	<p><i>Analysis, Inquiry and Design</i></p>		

The following table shows how the topic “Atomic Theory and Chemical Bonding” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Atomic Theory and Chemical Bonding	Atom structure (electrons, neutrons, protons), atomic mass, atomic number, atomic models and structure, covalent bonding, ionic bonding, metallic bonding, electron configuration, electron dot diagram, quantum numbers, isotope, Lewis structure, particle charge, polarity, valence electrons, intermolecular forces, VSEPR	Matter and Its Interactions	<p>Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science:</p> <p><i>Atomic Concepts</i></p> <ul style="list-style-type: none"> - Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. - Use atomic and molecular models to explain common chemical reactions. <p><i>Chemical Bonding</i></p> <ul style="list-style-type: none"> - Explain chemical bonding in terms of the behavior of electrons.

The following table shows example question items from the EST II Chemistry test that correspond to “Atomic Theory and Chemical Bonding”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>The type of attraction between the positive ions of the metal and the sea of the electrons in a metallic bonding is</p> <p>(A) magnetic. (B) electrostatic. (C) electromagnetic. (D) ionic (E) covalent</p> <p><i>Answer B</i></p>	Knowledge

<p>Which electron configuration represents an atom in the excited state?</p> <p>(A) $1s^2 2s^2 2p^3$ (B) $1s^2 2s^2 2p^6$ (C) $1s^2 2s^1 2p^1$ (D) $1s^2 2s^2 2p^6 3s^1$ (E) $1s^2 2s^1$</p> <p><i>Answer C</i></p>	<p>Application</p>
<p>Refer to the following. Choose the best answer from the given list of possible choices.</p> <p>(A) Carbon (B) Nickel (C) Hydrogen (D) Neon (E) Potassium</p> <p>The element forming a tetrahedral structure with sp^3 hybrid orbital when bonded with the appropriate atoms of fluorine</p> <p><i>Answer A</i></p>	<p>Reasoning</p>

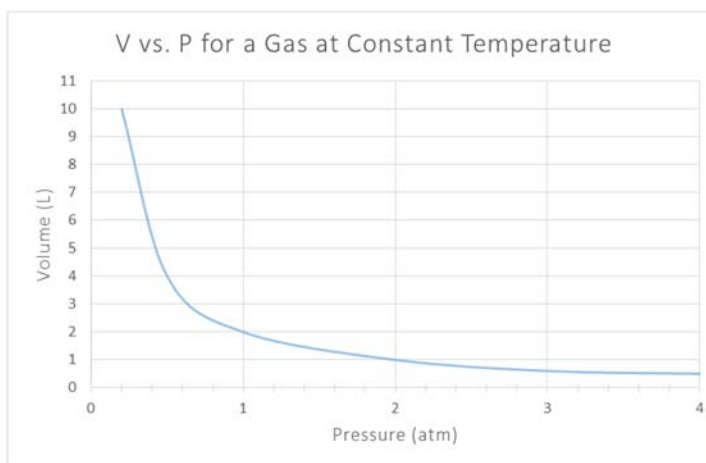
The following table shows how the topic “Chemical Behavior (aqueous solutions and gaseous state)” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Chemical Behavior (aqueous solutions and gaseous state)	Molarity, molar solution, mole, non-polar, polar, solute, solvent, solution, density, solubility, solubility factors, kinetic theory of gases, gas laws, partial pressures, ideal gas, change of physical states (phase diagram)	Matter and Its Interactions	<p>Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science:</p> <p><i>Physical Behavior of Matter</i></p> <ul style="list-style-type: none"> - Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. - Use kinetic molecular theory (KMT) to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance.

The following table shows example question items from the EST II Chemistry test that correspond to “Chemical Behavior (aqueous solutions and gaseous state)”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>Refer to the following. Choose the best answer from the given list of possible choices. Each possible answer may be used once, more than once, or not at all.</p> <p>(A) moles/liter of solution (B) grams/mol (C) moles/kilogram of solvent (D) °C/molal (E) no unit</p> <p>What is the correct unit for the types of concentration below?</p> <ul style="list-style-type: none"> - molality <i>Answer C</i> - molar mass <i>Answer B</i> 	Knowledge

<p>Lead (II) sulfide (PbS) has a K_{sp} value of 3.0×10^{-28}. What is the concentration of lead (II) ions in a saturated solution of PbS at 25°C?</p> <p>(A) $1.5 \times 10^{-14} \text{ M}$ (B) $1.7 \times 10^{-14} \text{ M}$ (C) $16 \times 10^{-56} \text{ M}$ (D) $6 \times 10^{-28} \text{ M}$ (E) $1.7 \times 10^{-28} \text{ M}$</p> <p><i>Answer B</i></p>	<p>Application</p>
<p>The gas law describing this graph is</p> <p>(A) Charles's law. (B) Dalton's law. (C) Boyle's law. (D) Gay-Lusac's law. (E) Avogadro's law.</p> <p><i>Answer C</i></p>	<p>Reasoning</p>



The following table shows how the topic “Chemical Reactions” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Chemical Reactions	Acid-base neutralization, Arrhenius, pH concept and indicator, brönsted-lowry, strong acid, strong base, weak acid, weak base, dissociation constants, types of reaction, titration, titration curve, half-reaction, oxidation, reduction, oxidation number, oxidizing agent, redox reaction, reducing agent, activity series, precipitation reaction	Matter and Its Interactions	<p>Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science:</p> <p><i>Oxidation Reduction</i></p> <ul style="list-style-type: none"> - Observe and describe transmission of various forms of energy. <p><i>Acids, Bases and Salts</i></p> <ul style="list-style-type: none"> - Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

The following table shows example question items from the EST II Chemistry test that correspond to “Chemical Reactions”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>Indicate the type of reaction of the following.</p> $\text{CH}_3\text{COOH} + \text{NH}_3 \rightarrow \text{CH}_3\text{COO}^- + \text{NH}_4^+$ <p>(A) precipitation reaction (B) acid base reaction (C) decomposition reaction (D) combustion reaction (E) double displacement reaction</p> <p><i>Answer B</i></p>	Knowledge

<p>A solution with $[H^+] = 3 \times 10^{-9}$ has a pH between</p> <p>(A) 7 and 8 (B) 4 and 5 (C) 5 and 6 (D) 8 and 9 (E) None of the above.</p> <p><i>Answer D</i></p>	<p>Application</p>
<p>What are the oxidized and reduced elements in this unbalanced reaction?</p> $MnO_4^- + SO_2 \rightarrow Mn^{2+} + SO_4^{2-}$ <p>(A) MnO_4^- and SO_2 respectively (B) Mn^{2+} and SO_4^{2-} respectively (C) SO_2 and MnO_4^- respectively (D) SO_2 and SO_4^{2-} respectively (E) MnO_4^- and Mn^{2+} respectively</p> <p><i>Answer C</i></p>	<p>Reasoning</p>

The following table shows how the topic “Quantitative Chemistry” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Quantitative Chemistry	Mole, empirical formula, molar mass, molar volume, molecular formula, molecular mass, percentage composition, stoichiometric coefficients, balancing chemical equations, percent composition, limiting and excess reactants, mole fraction, mean molar mass, percent yield	Matter and Its Interactions	<p>Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science:</p> <p><i>Moles/ Stoichiometry</i></p> <ul style="list-style-type: none"> - Apply the principle of conservation of mass to chemical reactions.

The following table shows example question items from the EST II Chemistry test that correspond to “Quantitative Chemistry”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>The formula applied to calculate the % yield for a chemical reaction is</p> <p>(A) (Actual amount of reactant / theoretical amount of reactant) x 100</p> <p>(B) (Actual amount of product / theoretical amount of reactant) x 100</p> <p>(C) (Actual volume of product / theoretical volume of product) x 100</p> <p>(D) (Actual amount of product / theoretical amount of product) x 100</p> <p>(E) (Actual mass of product / theoretical mass of product) x 100</p> <p><i>Answer D</i></p>	Knowledge

<p>What is the balancing coefficient of hydrogen fluoride in the following unbalanced chemical equation?</p> $\text{SiO}_2 + \text{HF} \rightarrow \text{SiF}_4 + 2\text{H}_2\text{O}$ <p>(A) 1 (B) 3 (C) 4 (D) 2 (E) 6</p> <p><i>Answer C</i></p>	<p>Application</p>
<p>How many moles of NaOH are needed to neutralize 1.6 mol of H₂SO₄?</p> <p>(A) 1.6 mol (B) 3.2 mol (C) 0.8 mol (D) 6.4 mol (E) 8 mol</p> <p><i>Answer B</i></p>	<p>Reasoning</p>

The following table shows how the topic “Periodic Table and Periodic Trends” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Periodic Table and Periodic Trends	Similarities and trends in chemical and physical properties of elements, chemical reactivity, simple organic and inorganic compounds and nomenclature.	Matter and Its Interactions	<p>Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science:</p> <p><i>Periodic Table</i></p> <ul style="list-style-type: none"> - Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. <p><i>Organic Chemistry</i></p> <ul style="list-style-type: none"> - Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

The following table shows example question items from the EST II Chemistry test that correspond to “Periodic Table and Periodic Trends”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>The name of the ionic compound having the formula unit (CuCl₂) is</p> <p>(A) copper chloride. (B) copper (II) chlorate. (C) cupric chromate. (D) copper (II) chloride. (E) copper (I) chlorine.</p> <p><i>Answer D</i></p>	Knowledge

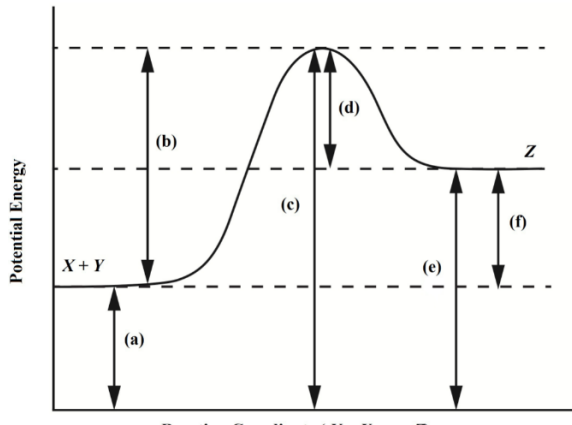
<p>Choose the element with the higher ionization energy.</p> <p>(A)S (B)P (C)Cd (D)Ta (E)K</p> <p><i>Answer A</i></p>	<p>Application</p>
<p>The order of the following chemical elements Na,K,Rb,Cs represents:</p> <p>(A)increasing first ionization energy. (B)decreasing first ionization energy. (C)increasing electronegativity. (D)decreasing atomic radius. (E)random and lack of order of any periodic trend.</p> <p><i>Answer B</i></p>	<p>Reasoning</p>

The following table shows how the topic “Chemical Kinetics and Chemical Equilibrium” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Chemical Kinetics and Chemical Equilibrium	Thermochemical equation, conservation of energy, ΔH notation, enthalpy, reaction rates, collision theory (significance with respect to reaction rates), factors affecting reaction rates, reaction mechanisms (including role and applications of catalysts), kinetic energy (KE), potential energy (PE), reaction intermediate, rate-determining step, dynamic equilibrium, equilibrium constant, expression, equilibrium shift, Le Châtelier’s principle.	Matter and Its Interactions	<p>Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science:</p> <p><i>Kinetics / Equilibrium</i></p> <ul style="list-style-type: none"> - Use kinetic molecular theory (KMT) to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance. - Explain heat in terms of kinetic molecular theory. - Observe and describe transmission of various forms of energy.

The following table shows example question items from the EST II Chemistry test that correspond to “Chemical Kinetics and Chemical Equilibrium”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>Which statement describes characteristics of an endothermic reaction?</p> <p>(A) The sign of ΔH is positive, and the products have less potential energy than the reactants.</p> <p>(B) The sign of ΔH is positive, and the products have higher potential energy than the reactants.</p> <p>(C) The sign of ΔH is negative, and the products have less potential energy than the reactants.</p> <p>(D) The sign of ΔH is negative, and the products have higher potential energy than the reactants.</p> <p>(E) The sign of ΔH is positive.</p> <p><i>Answer B</i></p>	Knowledge

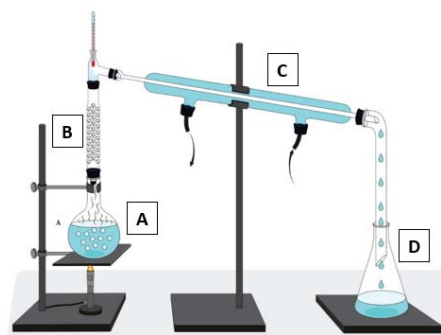
<p>Which reaction is represented by the following expression of the equilibrium constant ?</p> $K_{eq} = \frac{[CO]^2 \times [O]^2}{[CO_2]^2}$ <p>(A) $2CO_2 \rightleftharpoons O_2 + 2CO$ (B) $CO_2 \rightleftharpoons O_2 + 2CO$ (C) $O_2 + 2CO \rightleftharpoons 2CO_2$ (D) $O_2 + CO \rightleftharpoons CO_2$ (E) None of the above</p> <p><i>Answer A</i></p>	<p>Application</p>
<p>What type of reaction is this?</p> <p>(A) athermic (B) exothermic (C) endothermic (D) reversible reaction (E) None of the above.</p> <p><i>Answer C</i></p>	<p>Reasoning</p> 

The following table shows how the topic “Experimental Chemistry” coincides with the next generation science standards.

EST		Common core	
Topic	Content	Topic	Standard
Experimental Chemistry	Lab safety, lab equipment, solution preparation, separation techniques, experimental errors, basic environmental phenomena, draw out conclusions from experimental results (data)	Analysis, Inquiry, and Design	<ul style="list-style-type: none"> - Use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions. - Understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning. - Apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

The following table shows example question items from the EST II Chemistry test that correspond to “Experimental Chemistry”. Cognitive levels are indicated for each item.

Questions	Cognitive level
<p>The following setup below stands for</p> <p>(A) Fractional distillation (B) Simple distillation (C) Titration setup (D) Synthesis reaction setup (E) None of the above.</p> <p><i>Answer A</i></p>	Knowledge



<p>Consider the following table:</p> <table border="1" data-bbox="415 261 1213 540"> <thead> <tr> <th colspan="2">Air pressure with increasing altitude</th> </tr> <tr> <th>Altitude (in kilometers)</th> <th>Air pressure (in kPa)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>101</td> </tr> <tr> <td>2</td> <td>83</td> </tr> <tr> <td>4</td> <td>64</td> </tr> <tr> <td>6</td> <td>51</td> </tr> <tr> <td>8</td> <td>41</td> </tr> <tr> <td>10</td> <td>32</td> </tr> </tbody> </table> <p>What does this data reveal about the relation between air pressure and altitude?</p> <p>(A) The data is insufficient. (B) There is no relation. (C) They are directly proportional. (D) They are inversely proportional. (E) As the air pressure increases, the altitude increases as well.</p> <p><i>Answer D</i></p>	Air pressure with increasing altitude		Altitude (in kilometers)	Air pressure (in kPa)	0	101	2	83	4	64	6	51	8	41	10	32	<p>Application</p>
Air pressure with increasing altitude																	
Altitude (in kilometers)	Air pressure (in kPa)																
0	101																
2	83																
4	64																
6	51																
8	41																
10	32																
<p>After heating the Erlenmeyer flask, the technician removed it from the water bath and let it cool down, then added 15 mL of room temperature distilled water. What was the reason for his actions?</p> <p>(A) to dilute the mixture (B) to increase the volume of the mixture (C) to let the mixture cool faster (D) to facilitate the decomposition of the excess acetic anhydride (E) A and C</p> <p><i>Answer D</i></p>	<p>Reasoning</p>																

Common Core vs EST II – Math

EST II Math tests (level 1 and level 2) covers the main topics of the subject: numerations and operations, algebra and functions, coordinates system, plane and solid shapes, trigonometry, and data analysis, statistics and probability. Both Math levels cover the same topics but with different weight of coverage (refer to *EST Reference Document*). EST II Math tests assess the depth of knowledge in this particular subject by continuously assessing essential cognitive skills—knowledge, application, reasoning.

The following table shows how the topic “Numerations and Operations” coincides with the common core standards

Numerations and Operations	
EST Content	Common Core Standards
Elementary number theory and operations	<p>High School Level</p> <p><i>The Real Number System</i></p> <ul style="list-style-type: none"> • Extend the properties of exponents to rational exponents • Use properties of rational and irrational numbers <p><i>Quantities</i></p> <ul style="list-style-type: none"> • Reason quantitatively and use units to solve problems <p>Middle School Level</p> <ul style="list-style-type: none"> • Use place value understanding and properties of operations to perform multi-digit arithmetic. (<i>Number and operations in base ten</i>) • Develop understanding of fractions as numbers (<i>Number and operations - fractions</i>) • Write and interpret numerical expressions (<i>Operations and algebraic thinking</i>) • Know that there are numbers that are not rational, and approximate them by rational numbers (<i>The number system</i>) • Work with radicals and integer exponents (<i>Expressions and equations</i>)

Ratio, proportion and percentage	<p>Middle School Level</p> <ul style="list-style-type: none"> • Understand ratio concepts and use ratio reasoning to solve problems (Ratios and proportional relationships) • Analyze proportional relationships and use them to solve real-world and mathematical problems (Ratios and proportional relationships)
Complex numbers	<p>High School Level</p> <p><i>The Complex Number System</i></p> <ul style="list-style-type: none"> • Perform arithmetic operations with complex numbers • Represent complex numbers and their operations on the complex plane • Use complex numbers in polynomial identities and equations
Matrices	<p>High School Level</p> <p><i>Matrices Quantities</i></p> <ul style="list-style-type: none"> • Perform operations on matrices and use matrices in applications
Sequences (Geometric and Arithmetic)	<p>High School Level</p> <p><i>Build a function that models a relationship between two quantities</i></p> <ul style="list-style-type: none"> • Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms*
Series	<p>High School Level</p> <p><i>Write expressions in equivalent forms to solve problems</i></p> <ul style="list-style-type: none"> • Derive the formula for the sum of a finite geometric series and use the formula to solve problems*
Vectors	<p>High School Level</p> <p><i>Vector Quantities</i></p> <ul style="list-style-type: none"> • Represent and model with vector quantities • Perform operations on vectors

The following table shows example question items from the EST II Math level 1 test that correspond to “Numerations and Operations”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>If y varies directly with z and inversely with v, then which of the following could be a correct expression of z as a function of y and v?</p> <p>A. $z = 3yv$ B. $z = \frac{1y}{6v}$ C. $z = \frac{7v}{6y}$ D. $z = 8\frac{y}{v}$ E. $z = \frac{1}{6}(y + v)$</p> <p><i>Answer A</i></p>	Knowledge
<p>If $3^n \times 9^m \times 27^p = 1$, then which of the following is the correct expression of n in terms of m and p?</p> <p>A. $n = \frac{1}{mp}$ B. $n = -3m - 2p$ C. $n = 1 - 2m - 3p$ D. $n = -m - p$ E. $n = -2m - 3p$</p> <p><i>Answer E</i></p>	Application

<p>In a certain country, the ratio of male individuals who got infected by the COVID-19 virus to the female individuals who got infected by the same virus is 6 to 4. Moreover, it was observed that only 9% of the males and 5% of the females who get infected by the virus got severe symptoms. If the number of COVID-19 cases in the country is 1200, how many females have severe symptoms?</p> <p>A. 24 B. 162 C. 600 D. 1200 E. 1800</p> <p><i>Answer A</i></p>	Reasoning
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The following table shows example question items from the EST II Math level 2 test that correspond to “Numerations and Operations”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>If $\frac{12m}{6!}$ is an integer, what is the smallest possible value of m?</p> <p>A. 12 B. 20 C. 60 D. 120 E. 720</p> <p><i>Answer C</i></p>	Knowledge

<p>If $x = \sqrt{5 - \sqrt{a}} - \sqrt{5 + \sqrt{a}}$, which of the following is the value of x^2?</p> <p>A. $-2\sqrt{a}$ B. $10 - 2\sqrt{25 - a}$ C. $10 + 2\sqrt{25 - a}$ D. $10 + 2\sqrt{a}$ E. 10</p> <p><i>Answer B</i></p>	<p>Application</p>
<p>Let $f(x) = -3 + \frac{12}{x+2}$. How many points with integer coordinates lie on the graph of function f?</p> <p>A. 1 B. 2 C. 4 D. 6 E. 12</p> <p><i>Answer E</i></p>	<p>Reasoning</p>

The following table shows how the topic “Algebra and Functions” coincides with the common core standards.

Algebra and Functions	
EST Content	Common Core Standards
Expressions	<p>High School Level</p> <p><i>Seeing Structure in Expressions</i></p> <ul style="list-style-type: none"> • Interpret the structure of expressions • Write expressions in equivalent forms to solve problems <p><i>Arithmetic with Polynomials and Rational Expressions</i></p> <ul style="list-style-type: none"> • Perform arithmetic operations on polynomials • Use polynomial identities to solve problems • Rewrite rational expressions <p>Middle School Level</p> <ul style="list-style-type: none"> • Use properties of operations to generate equivalent expressions (<i>Expressions and equations</i>)
Equations and Inequalities	<p>High School Level</p> <p><i>Creating Equations</i></p> <ul style="list-style-type: none"> • Create equations that describe numbers or relationships <p><i>Reasoning with Equations and Inequalities</i></p> <ul style="list-style-type: none"> • Understand solving equations as a process of reasoning and explain the reasoning • Solve equations and inequalities in one variable • Solve systems of equations • Represent and solve equations and inequalities graphically
Absolute value	<p>High School Level :</p> <p><i>Reasoning with Equations and Inequalities</i></p> <ul style="list-style-type: none"> • Represent and solve equations and inequalities graphically <p>Middle School Level:</p> <ul style="list-style-type: none"> • Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. • Distinguish comparisons of absolute value from statements about order. • Understand and interpret absolute value.

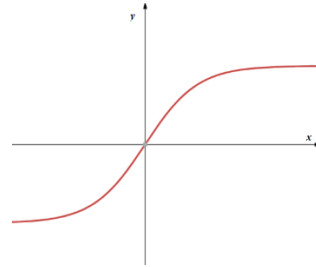
<p>Representation and modeling</p>	<p>High School Level:</p> <p><i>Building Functions</i></p> <ul style="list-style-type: none"> • Build a function that models a relationship between two quantities • Build new functions from existing functions <p><i>Trigonometric Functions</i></p> <ul style="list-style-type: none"> • Model periodic phenomena with trigonometric functions <p>Middle School Level:</p> <ul style="list-style-type: none"> • Represent and analyze quantitative relationships between dependent and independent variables (<i>Expressions and equations</i>)
<p>Properties of functions (polynomial, rational, inverse, exponential, logarithmic, trigonometric, periodic, piecewise, recursive, parametric)</p>	<p>High School Level:</p> <p><i>Arithmetic with Polynomials and Rational Expressions</i></p> <ul style="list-style-type: none"> • Understand the relationship between zeros and factors of polynomials <p><i>Interpreting Functions</i></p> <ul style="list-style-type: none"> • Understand the concept of a function and use function notation • Interpret functions that arise in applications in terms of the context • Analyze functions using different representations <p><i>Build new functions from existing functions</i></p> <ul style="list-style-type: none"> • Find inverse functions* • Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents <p><i>Linear, Quadratic and Exponential Models</i></p> <ul style="list-style-type: none"> • Construct and compare linear, quadratic, and exponential models and solve problems • Interpret expressions for functions in terms of the situation they model <p><i>Trigonometric Functions</i></p> <ul style="list-style-type: none"> • Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions * • Model periodic phenomena with trigonometric functions <p>▪ Middle School Level:</p> <ul style="list-style-type: none"> • Understand the connections between proportional relationships, lines and linear equations (<i>Expressions and equations</i>) • Define, evaluate and compare functions (Functions) • Use functions to model relationships between quantities (<i>Functions</i>)

The following table shows example question items from the EST II Math level 1 test that correspond to “Algebra and Functions”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>For how many strictly positive integer values of x is the following inequality satisfied?</p> $2(3 - x) \geq -14$ <p>A. 0 B. 1 C. 9 D. 10 E. 11</p> <p><i>Answer D</i></p>	Knowledge
<p>The product of three consecutive integers is equal to the middle integer. What is the smallest of these integers?</p> <p>A. $-1 - \sqrt{2}$ B. $1 + \sqrt{2}$ C. -1 D. 0 E. 1</p> <p><i>Answer C</i></p>	Application
<p>Let f be the function defined by $f(x) = mx^3 + px^2 + qx - 1$, where m, p, and q are real numbers. If the graph of f passes through the point $(1, 7)$, what is the average of m, p, and q?</p> <p>A. $\frac{7}{3}$ B. 2 C. $\frac{8}{3}$ D. 3.5 E. 4</p> <p><i>Answer C</i></p>	Reasoning

The following table shows example question items from the EST II Math level 2 test that correspond to “Algebra and Functions”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>If $\log_2 x = 2$ and $\log_x 15 = y$, then what is the value of $x + y$?</p> <p>A. 0.512 B. 1.953 C. 4 D. 4.512 E. 5.953</p> <p><i>Answer E</i></p>	Knowledge
<p>The radiation level A in a certain laboratory where a technical problem caused an explosion rises exponentially according to the relation $A = Be^{0.5t}$ where t is measured in minutes. Approximately how many minutes after the measurements started did the radiation level reach triple its initial value?</p> <p>A. 1.386 minutes B. 1.5 minutes C. 2.197 minutes D. 3 minutes E. 4.889 minutes</p> <p><i>Answer C</i></p>	Application
<p>Due to some disease, the level of a particular hormone X in the body of a patient at a certain hospital fluctuates according to the model $f(t) = 3 \sin(0.2t - 250) + 14$, where $f(t)$ represents the level of the hormone in appropriate units and t represents the time in hours since 8:00 a.m. Monday morning (that is $t = 0$ represents 8:00 a.m. Monday morning). Approximately on which day and at what time would the hormonal level reach its maximum peak for the second time since Monday morning?</p> <p>A. Monday at 9:00 a.m. B. Tuesday at 2:00 a.m. C. Tuesday at 4:30 p.m. D. Tuesday at 9:30 p.m. E. Wednesday at 4:30 p.m.</p> <p><i>Answer C</i></p>	Reasoning

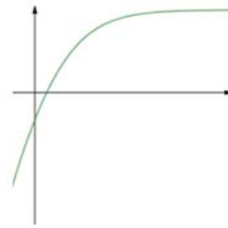


The graph given above is that of a function f . Which of the following could be the graph of the function h defined by $h(x) = f(x) \cdot e^{-x}$?

A.



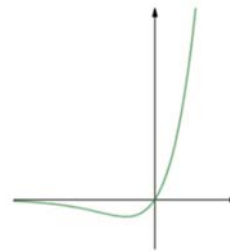
B.



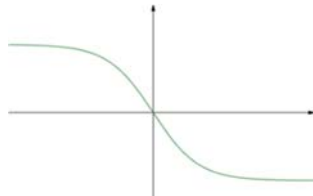
C.



D.



E.



Answer A

The following table shows how the topic “Plane Shapes / Measurement” coincides with the common core standards.

Plane Shapes / Measurement	
EST Content	Common Core Standards
Length and distance	<p>Middle School Level</p> <ul style="list-style-type: none"> Understand and apply the Pythagorean theorem (<i>Geometry</i>)
Perimeter/Area	<p>High School Level</p> <p><i>Expressing geometric properties with equations</i></p> <ul style="list-style-type: none"> Use coordinates to compute perimeters of polygons and areas of triangles and rectangles <p>Middle School Level</p> <ul style="list-style-type: none"> Geometric measurement: understand concepts of area and perimeter (<i>Measurement and data</i>) Convert like measurement units within a given measurement system (<i>Measurement and data</i>)
Angles and triangles	<p>High School Level:</p> <p><i>Congruence</i></p> <ul style="list-style-type: none"> Know precise definition of angle* Understand congruence in terms of rigid motions Prove geometric theorems <p><i>Similarity, Right Triangles and Trigonometry</i></p> <ul style="list-style-type: none"> Prove theorems involving similarity Define trigonometric ratios and solve problems involving right triangles
Quadrilaterals	<p>High School Level:</p> <p><i>Congruence</i></p> <ul style="list-style-type: none"> Prove geometric theorems <p>Middle School Level:</p> <ul style="list-style-type: none"> Reason with shapes and their attributes (<i>Geometry</i>)
Radius, diameter and circle	<p>High School Level:</p> <p><i>Congruence</i></p> <ul style="list-style-type: none"> Know precise definition of circle <p><i>Circles</i></p> <ul style="list-style-type: none"> Understand and apply theorems about circles Find arc lengths and areas of sectors of circles

The following table shows example question items from the EST II Math level 1 test that correspond to “Plane Shapes / Measurement”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>Circles C, P, and Q have radii 1, 2, and 3 respectively. If the three circles are tangent to each other, what is the nature of the triangle formed by joining the three centers of the circles?</p> <p>A. Isosceles B. Right angled C. Right isosceles D. Equilateral E. Cannot be determined with the information given</p> <p><i>Answer B</i></p>	Knowledge
<p>A circle inscribed in a square has an area of 36π. What is the length of the diagonal of the square?</p> <p>A. 8.485 B. 12 C. 16.97 D. 36 E. 50.912</p> <p><i>Answer C</i></p>	Application
<p>The perimeter of a regular hexagon is 24 and the perimeter of a regular octagon is 5. What is the ratio of the length of one side of the hexagon to the length of one side of the octagon?</p> <p>A. 0.15625 B. 0.2083 C. 1.2 D. 2.75 E. 6.4</p> <p><i>Answer E</i></p>	Reasoning

The following table shows how the topic “Coordinate System” coincides with the common core standards.

Coordinate System	
EST Content	Common Core Standards
Lines	<p>High School Level</p> <p><i>Congruence</i></p> <ul style="list-style-type: none"> • Know precise definition of perpendicular line, parallel line, and line segment, based on the undefined notions of points, line, distance along a line, and distance around a circular arc.
Circle/Parabola/ Ellipse/Hyperbola	<p>High School Level</p> <p><i>Expressing geometric properties with equations</i></p> <ul style="list-style-type: none"> • Translate between the geometric description and the equation for a conic section • Use coordinates to prove simple geometric theorems algebraically
Transformation	<p>High School Level</p> <p><i>Congruence</i></p> <ul style="list-style-type: none"> • Represent transformations in the plane* • Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself* • Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments* • Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another <p><i>Similarity, Right triangles and Trigonometry</i></p> <ul style="list-style-type: none"> • Understand similarity in terms of similarity transformations
Polar coordinates	<p>High School Level</p> <p><i>Expressing geometric properties with equations</i></p> <ul style="list-style-type: none"> • Use coordinates to prove simple geometric theorems algebraically

The following table shows example question items from the EST II Math level 1 test that correspond to “Coordinate System”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>A line in the plane passes through the 3 distinct points (a, b), (c, d), and (e, f). Then all of the following give a correct relation between a, b, c, d, e, and f except:</p> <p>A. $\frac{c-a}{d-b} = \frac{c-e}{d-f}$</p> <p>B. $\frac{d-b}{d-f} \times \frac{c-e}{a-c} = 1$</p> <p>C. $\frac{d-b}{d-f} \times \frac{c-e}{c-a} = 1$</p> <p>D. $\frac{c-a}{d-b} + \frac{c-e}{f-d} = 0$</p> <p>E. $\frac{d-b}{d-f} - \frac{c-a}{c-e} = 0$</p> <p><i>Answer B</i></p>	Knowledge
<p>C is a circle tangent to the two straight lines of equations $y = 2$ and $y = -4$. Which of the following could be the equation of the circle?</p> <p>A. $(x + 1)^2 + y^2 = 9$</p> <p>B. $(x - 1)^2 + (y + 1)^2 = 3$</p> <p>C. $(x + 4)^2 + (y + 2)^2 = 9$</p> <p>D. $(x + 1)^2 + y^2 = 3$</p> <p>E. $(x + 2)^2 + (y + 1)^2 = 9$</p> <p><i>Answer E</i></p>	Application

The following table shows example question items from the EST II Math level 2 test that correspond to “Coordinate System”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>If the parametric equations of a certain line D are $x = 4t - 1$ and $y = 4$, which of the following lines is perpendicular to D?</p> <p>A. The line with equation $y = -0.25x + 1$ B. The line with equation $y = -0.25$ C. The line with equation $y = x$ D. The x -axis E. The y -axis</p> <p><i>Answer E</i></p>	Knowledge
<p>Consider the transformation in the plane that takes any point (x, y) into the point $(x + 7, y + 7)$ in the plane. If the transformation is applied to a parallelogram ABCD and a new parallelogram MNOP is obtained by the transformation, which of the following statements will be true?</p> <p>I. MNOP has the same area as ABCD. II. The perimeter of MNOP is 7 units more than the perimeter of ABCD. III. The measures of the smaller angles in MNOP and ABCD are the same.</p> <p>A. I B. III C. I and II D. I and III E. I, II, and III</p> <p><i>Answer D</i></p>	Application

<p>A parabola in the plane passes through the points $(-700, 40)$ and $(200, 40)$. Which of the following can be the coordinates of its vertex?</p> <ul style="list-style-type: none">A. $(-250, 40)$B. $(-250, 11)$C. $(-500, 11)$D. $(-500, 40)$E. $(-700, 200)$ <p><i>Answer B</i></p>	<p>Reasoning</p>
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The following table shows how the topic “Solid Shapes” coincides with the common core standards.

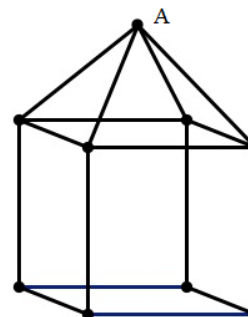
Solid Shapes	
EST Content	Common Core Standards
Volume/ Surface area	<p>High School Level:</p> <p><i>Geometric measurement and dimensions</i></p> <ul style="list-style-type: none"> • Explain volume formulas and use them to solve problems • Visualize relationships between two-dimensional and three dimensional objects <p><i>Modeling with geometry</i></p> <ul style="list-style-type: none"> • Apply geometric concepts in modeling situations <p>Middle School Level</p> <ul style="list-style-type: none"> • Geometric measurement: understand concepts of volume (<i>Measurement and data</i>) • Solve real-world and mathematical problems involving area, surface area and volume (<i>Geometry</i>) • Convert like measurement units within a given measurement system (<i>Measurement and data</i>) • Solve real-world and mathematical problems involving volume of cylinders, cones and spheres (<i>Geometry</i>)
Coordinates in three dimensions	<p>High School Level:</p> <p><i>Geometry</i></p> <ul style="list-style-type: none"> • Understand and apply the Pythagorean theorem

The following table shows example question items from the EST II Math level 1 test that correspond to “Solid Shapes”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>The volume of a certain pyramid of rectangular base is 12. We alter its dimensions in such a way that the volume does not change. If the height has been doubled, which of the following could be possible alterations to the length L and the width W of the base of the pyramid?</p> <p>A. Multiply L by 12 and divide W by 6 B. Multiply L by 1 and divide W by 0.5 C. Multiply L by 9 and divide W by 18 D. Divide both L and W by 0.5 E. Multiply both L and W with 0.5</p> <p><i>Answer C</i></p>	Knowledge
<p>A plane intersects a sphere of radius 4cm in a circle. Which of the following cannot be the area of this circle?</p> <p>A. $4\pi \text{ cm}^2$ B. $8\pi \text{ cm}^2$ C. $12\pi \text{ cm}^2$ D. $16\pi \text{ cm}^2$ E. $24\pi \text{ cm}^2$</p> <p><i>Answer E</i></p>	Application
<p>Consider all spheres of nonzero volume having as their center the point A in space. How many of these spheres can have a surface area whose value is numerically equal to the volume of the sphere?</p> <p>A. None B. 1 C. 2 D. 3 E. Further information is required to determine the answer</p> <p><i>Answer B</i></p>	Reasoning

The following table shows example question items from the EST II Math level 2 test that correspond to “Solid Shapes”. Cognitive levels are indicated for each item.

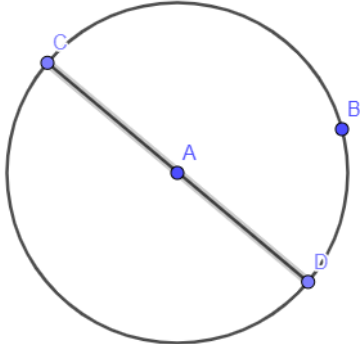
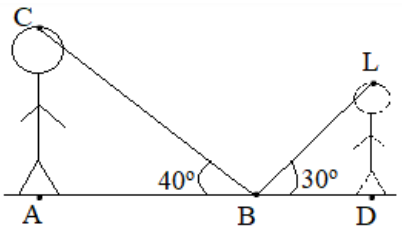
Question	Cognitive level
<p>Given two points $A(1, -2, 1)$ and $B(5, 6, z_B)$, find a value of z_B if the distance in space between the two points is equal to 9.</p> <p>A. 1 B. 2 C. 3 D. -1 E. -2</p> <p><i>Answer B</i></p>	<p>Knowledge</p>
<p>A large container of water has the shape of a cube topped with a pyramid as shown in the figure below (not drawn to scale). The container can be filled entirely with 100 m^3 of water. The cube has a side of 3 m. What is the height of the container (from the base plane to point A)?</p> <p>A. 24.333 m B. 27.333 m C. 33.333 m D. 36.333 m E. 73 m</p> <p><i>Answer B</i></p>	<p>Application</p>



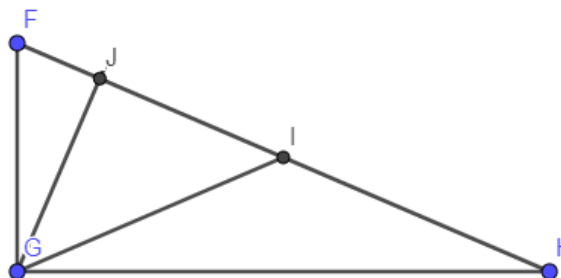
The following table shows how the topic “Trigonometry” coincides with the common core standards.

Trigonometry	
EST Content	Common Core Standards
Right triangles	<p>High School Level:</p> <p><i>Extend the domain of trigonometric functions using the unit circle</i></p> <ul style="list-style-type: none"> • Use special triangles to determine geometrically the values trigonometric lines and use the unit circle to express the values of associated arcs <p><i>Similarity, Right Triangles and Trigonometry</i></p> <ul style="list-style-type: none"> • Define trigonometric ratios and solve problems involving right triangles
Pythagorean identity and identities	<p>High School Level:</p> <p><i>Trigonometric Functions</i></p> <ul style="list-style-type: none"> • Prove and apply trigonometric identities
Measures (radians and degrees)	<p>High School Level:</p> <p><i>Extend the domain of trigonometric functions using the unit circle</i></p> <ul style="list-style-type: none"> • Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle
Sine law, cosine law and double angle formulas	<p>High School Level:</p> <p><i>Similarity, Right Triangles and Trigonometry</i></p> <ul style="list-style-type: none"> • Apply trigonometry to general triangles

The following table shows example question items from the EST II Math level 1 test that correspond to “Trigonometry”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>In the adjacent figure, B is a point on the circle of center A and diameter DC such that $BC = 20$ and $BD = 15$. What is the perimeter of triangle BDC?</p> <p>A. 17.5 B. 35 C. 60 D. 150 E. 60π</p> <p><i>Answer C</i></p>	 <p data-bbox="1577 391 1766 773">Knowledge</p>
<p>Celine and Lia are standing on a horizontal track at points A and D respectively. Celine is 1.5m tall and Lia is 1.2m tall (that is $AC = 1.5\text{m}$ and $DL = 1.2\text{m}$). Celine’s shadow occupies the length AB and Lia’s shadow occupies the length BD on the ground so the two shadows meet at their heads. The angles between the ground and the ray from the top of the head of each individual to the touching point of the shadows is shown. How far apart are Celine and Lia standing?</p> <p>A. 1.788 m B. 2.078 m C. 2.7 m D. 3.344 m E. 3.866 m</p> <p><i>Answer E</i></p>	 <p data-bbox="1197 1250 1533 1315">FIGURE IS NOT DRAWN TO SCALE</p> <p data-bbox="1577 773 1766 1356">Application</p>

<p>The triangle shown in the adjacent figure (not drawn to scale) is right angled at G with $GF = 4$ and $\angle GFH = 60^\circ$. I is the midpoint of segment FH and GJ is the altitude drawn from G to FH. What is the area of triangle GJI?</p> <p>A. 3.46 B. 4.62 C. 6 D. 6.93 E. 13.86</p> <p><i>Answer A</i></p>	<p>Reasoning</p>
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The following table shows example question items from the EST II Math level 2 test that correspond to “Trigonometry”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>What is the degree measure of $\arccos(\sin 60^\circ)$?</p> <p>A. 30° B. 45° C. 60° D. 75° E. 90°</p> <p><i>Answer A</i></p>	<p>Knowledge</p>

<p>For $0 < x < \frac{\pi}{2}$, if $\sin x = \frac{a}{3}$, what is $\sec x$?</p> <p>A. $\frac{3}{\sqrt{9-a^2}}$</p> <p>B. $\frac{\sqrt{9-a^2}}{3}$</p> <p>C. $\frac{3}{a}$</p> <p>D. $\frac{\sqrt{9-a^2}}{a}$</p> <p>E. $\frac{a}{\sqrt{9-a^2}}$</p> <p><i>Answer A</i></p>	<p>Application</p>
<p>If $1 - 2 \sin^2 \theta = -\frac{1}{3}$, what is the value of $\frac{\sin \theta}{2 \cos 2\theta}$? $(0 \leq \theta \leq 90^\circ)$</p> <p>A. -2.4</p> <p>B. -1.2</p> <p>C. $\frac{3}{2}$</p> <p>D. $-\frac{3}{2}$</p> <p>E. 1</p> <p><i>Answer B</i></p>	<p>Reasoning</p>

The following table shows how the topic “Data Analysis, Statistics and Probability” coincides with the common core standards.

Data Analysis, Statistics and Probability	
EST Content	Common Core Standards
Mean/Median/Mode /Range/Interquartile range/Standard deviation	<p>High School Level <i>Interpreting categorical and quantitative data</i></p> <ul style="list-style-type: none"> • Summarize, represent and interpret data on a single count or measurement variable • Summarize, represent and interpret data on two categorical and quantitative variables <p>Middle School Level: <i>Statistics and Probability</i></p> <ul style="list-style-type: none"> • Develop understanding of statistical variability • Summarize and describe distributions • Use random sampling to draw inferences about a population • Draw informal comparative inferences about two populations
Graphs and plots	<p>High School Level <i>Interpreting Categorical and Quantitative Data</i></p> <ul style="list-style-type: none"> • Summarize, represent and interpret data on a single count or measurement variable • Summarize, represent, and interpret data on two categorical and quantitative variables
Least-squares regression (linear, quadratic, exponential)	<p>High School Level <i>Interpreting Categorical and Quantitative Data</i></p> <ul style="list-style-type: none"> • Interpret linear models
Probability (combination and permutation)	<p>High School Level <i>Conditional Probability and the Rules of Probability</i></p> <ul style="list-style-type: none"> • Understand independence and conditional probability and use them to interpret data • Use the rules of probability to compute probabilities of compound events in a uniform probability model <p>Middle School:</p> <ul style="list-style-type: none"> • Investigate chance processes and develop, use and evaluate probability models (<i>Statistics and probability</i>)

The following table shows example question items from the EST II Math level 1 test that correspond to “Data Analysis, Statistics and Probability”. Cognitive levels are indicated for each item.

Question	Cognitive level
<p>Mr. Hernandez has 8 Christmas greeting cards and he wants to send them to 5 of his friends. How many ways can he send a greeting card?</p> <p>A. 6720 B. 3136 C. 112 D. 56 E. 40</p> <p><i>Answer A</i></p>	Knowledge
<p>In a certain company of 400 employees, 70% wear face masks at all times. Out of those who do not wear face masks, 15% got the disease. Out of those who do wear a mask, only 5% got the disease. If an employee is chosen at random from this company, what is the probability that he or she got the disease?</p> <p>A. 0.20 B. 0.08 C. 0.09 D. 0.12 E. 0.35</p> <p><i>Answer B</i></p>	Application

The following table shows example question items from the EST II Math level 2 test that correspond to “Data Analysis, Statistics and Probability”. Cognitive levels are indicated for each item.

Question	Cognitive level																		
<p>Which of the following data sets has the smallest standard deviation?</p> <p>A. -3, -3, 0, 1, 1, 5 B. 9, 9, 9, 9, 9, 9, 9 C. -10, -9, -8, -7, 0, 10 D. 1, 5, 5, 5, 5, 5, 5 E. 0, 0, 0, 0, 0, 2, 3</p> <p><i>Answer B</i></p>	Knowledge																		
<table border="1" data-bbox="354 735 1549 886"> <thead> <tr> <th>Time (minutes)</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>Number of bacteria left</td> <td>1,200</td> <td>1,120</td> <td>980</td> <td>740</td> <td>600</td> <td>510</td> <td>210</td> <td>50</td> </tr> </tbody> </table> <p>After developing an anti-bacterial agent against a certain bacterium called X, the company wants to test the efficiency of the agent. So, a group of scientists add the agent to a petri dish that initially contains 1,200 bacteria and record the number of bacteria remaining every minute. The results are given in the table above. The scientists use quadratic regression model for the data. According to their regression equation, when will the number of bacteria reach one-third of the actual initial value, that is one-third of 1,200?</p> <p>A. at 3.5 minutes B. at 4 minutes C. at 5 minutes D. at 5.5 minutes E. at 6 minutes</p> <p><i>Answer C</i></p>	Time (minutes)	0	1	2	3	4	5	6	7	Number of bacteria left	1,200	1,120	980	740	600	510	210	50	Application
Time (minutes)	0	1	2	3	4	5	6	7											
Number of bacteria left	1,200	1,120	980	740	600	510	210	50											

<p>A is the set of integers x such that $-3 \leq x \leq 20$. We select one number from this set randomly. What is the probability that the square of this number is also in this set?</p> <p>A. $\frac{5}{23}$</p> <p>B. $\frac{5}{22}$</p> <p>C. $\frac{8}{22}$</p> <p>D. $\frac{8}{23}$</p> <p>E. $\frac{1}{3}$</p> <p><i>Answer E</i></p>	<p>Reasoning</p>
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