



2026 | 2027

Student Guide to International Subject Tests

What's Inside

- Information about the subject tests
- Example questions
- Test-taking strategies

ACT[®] International
Subject Tests



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Introduction

The ACT International Subject Tests (AIST) are a set of unique, research-based assessments. Developed in partnership with the nation's leading educators, the assessments offer a comprehensive, aligned approach to measuring student skills and knowledge.

The AIST are designed to be aligned to your high school curriculum. Whether you're studying the national, International Baccalaureate (IB), or prominent US standards such as Common Core or Next Generation Science Standards (NGSS), you'll find an international subject test that works for you and rewards you for your academic excellence. The ACT offers international subject tests in the following content areas: Biology, Chemistry, English 1 and 2, and Math 1 and 2.

This guide provides an overview of the content of all ACT international subject tests, as well as specific information about the individual international subject tests. It provides practice questions, including some questions from earlier tests for the specific content area being described. Additionally, you'll find some test-taking tips and strategies to use to achieve greater success on your test day.

Review carefully the contents of this booklet and consider taking the online practice test before your scheduled test. This will help better prepare you for success on test day in the subject area of your choosing.

CODE OF FAIR TESTING PRACTICES

ACT is committed to representing the diversity of society in all its aspects, including race, ethnicity, and gender. ACT employs extensive reviews and statistical procedures to ensure the fairness of test materials. ACT conducts research and periodically updates tests to provide test content that reflects classroom instruction and continues to be a relevant predictor of college and career readiness. There may be differences between the ACT practice questions in this booklet and the test you take on test day. ACT endorses the *Code of Fair Testing Practices in Education* and the *Code of Professional Responsibilities in Educational Measurement*, which guide the conduct of those involved in educational testing. ACT is committed to ensuring that each of its

testing programs upholds the guidelines in each Code. You may locate copies of both codes at <https://www.ncme.org/resources-publications/professional-learning/library>.

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Brief Description of Subject Tests

Below is a brief description of the international subject tests. More details, including example questions, appear in sections dedicated to each subject.

Biology

Biology test questions ask you to solve problems and demonstrate understanding of topics including biochemistry and the cell, genetics and evolution, animal and plant systems, and ecology.

Chemistry

Chemistry test questions ask you to solve problems and demonstrate understanding of topics such as states of matter and phase changes, mole concept, chemical formulas, chemical equations, stoichiometry, gas laws, atomic structure, periodicity, chemical bonding, and solution properties. Chemistry test questions also ask you to apply proportional reasoning and other mathematical thinking to solve problems.

English 1 and 2

ACT international subject tests for English 1 and 2 assess your knowledge, skills, and abilities as readers and writers. Questions use a diverse collection of authentic, high-quality texts that have been taught in successful classrooms across the US, including drama, fiction, nonfiction, and poetry texts, as well as film scripts. The English tests also

assess knowledge and skills required to write effectively in high school and college.

Math 1 (Algebra I, Geometry)

This test measures your algebra and geometry skills typically developed through the first years of secondary school. These skills include solving equations, drawing conclusions from data, finding areas and volumes, and making judgments about proofs. Calculators are allowed, and a reference sheet provides common formulas.

Math 2 (Algebra II, Precalculus)

On this test, you can affirm your advanced algebra and precalculus skills. These skills include understanding complex numbers, modeling with vectors and matrices, applying advanced functions, finding limits, fitting a normal distribution, and interpreting graphs of the polar coordinate plane. Calculators are allowed, and a reference sheet provides common formulas.

On Test Day

Items to Bring for Testing

- An admission ticket
- A photo ID, as specifically requested in correspondence and outlined on the ticket. This is likely to be your passport. The information on your admission ticket should exactly match the information included on your photo ID.
 - You must keep your ID and admission ticket with you at all times, especially if you leave the testing room. You may be asked to show your ID or admission ticket at any time while in the test center.
 - Do not write on your admission ticket.
- You may have a calculator for either math test and for the chemistry test. Calculators are not permitted for any other tests.
- You may wear a non-digital watch.

Calculators

You are encouraged, but not required, to bring an approved scientific calculator for the following ACT international subject tests:

- Math 1
- Math 2
- Chemistry

Scientific calculators are available as on-screen tools within all three of the international subject tests listed above. Therefore, if you don't bring an approved calculator with you to the testing location, you'll be able to use the on-screen version.

The following types of calculators are prohibited:

- Calculators with built-in or downloaded computer algebra systems. Prohibited calculators in this category include:
 - *Texas Instruments:* All model numbers that begin with TI-89 or TI-92 (**Note:** *The TI-Nspire [non-CAS] is permitted.*)
 - *Hewlett-Packard:* HP Prime, HP 48GII, all model numbers that begin with HP 40G, HP 49G, or HP 50G
 - *Casio:* fx-CP400 (ClassPad 400), ClassPad 300 or ClassPad 330, Algebra fx 2.0, all model numbers that begin with CFX-9970G
- Handheld, tablet, or laptop computers, including PDAs
- Electronic writing pads or pen-input devices. **Note:** *The Sharp EL 9600 is permitted.*
- Calculators built into cell phones or any other electronic communication devices
- Calculators with QWERTY format letter keys (not applicable to calculators provided in a secure test delivery platform; letter keys not in QWERTY format are permitted)

Note: Check the [ACT Calculator Policy](#) for the latest information.

Items NOT Allowed in the Testing Center

- Electronic devices of any kind, including smart watches with audible alarms, smart glasses, all phones, fitness bands, media players, iPads, headphones, and cameras.

- Textbooks, foreign language or other dictionaries, scratch paper, notes or other aids
- Reading material

Preparing for a Subject Test

Your ability to do well on an international subject test depends on the knowledge and skills you've gained from taking your high school classes and your familiarity with the test format and the kinds of questions you'll be asked. If you've paid attention in your class and met all requirements of your assignments and activities, you should feel confident about your ability to do well on an international subject test. Your level of comfort and confidence with a test and its format will also likely help you do well on any test you choose to take.

Test-Taking Strategies

Regardless of which ACT international subject tests you take, these general strategies are useful:

- **Think carefully and strategically:** When you take the tests, think carefully about the question and ALL the answer choices.
 - *Make educated guesses:* Eliminate choices you KNOW are wrong.
- **Pace yourself:** Work at a steady pace and keep track of time.
 - *Plan to use the allotted time as follows:*
 - Answer the easy questions first.
 - Work on less time-consuming questions next.
 - Finally, move to more challenging questions, giving them enough time.

MORE ABOUT: Careful and Strategic Thinking

Analyzing the elements:

- Pay close attention to the way questions are worded.
- Restate questions in your own words.
- Practice pulling out data, concepts, and information from questions.

- Use logic to arrive at the correct answer.

Combining strategies: Using a combination of knowledge and elimination strategies will allow you to best demonstrate what you understand about the key ideas in the subject course.

MORE ABOUT: Pacing

Identifying your strengths: Spend some time identifying your strengths as a test taker. That way, when you open your test on your test day, you can quickly read through all of the questions and determine which questions are easiest to answer correctly when you first read the question.

- If you can identify which questions you can answer more quickly, this will help you with pacing and allow you to spend more time on questions you might find to be more difficult later on in the test.

Targeting skills to improve: Similarly, determine in what areas of the test topics you most need to improve:

- For the biology and chemistry tests, you might ask yourself if you have trouble reading tables. If you do, spend extra time in the weeks leading up to the test date reading example experimental results that require you to see how the information included in a table has led researchers to the conclusions they draw. When you get to the test, you're more likely to be able to answer questions that require interpretation of data quickly as well.
- For the English international subject tests, you might ask whether you have trouble interpreting poetry. If so, in the weeks leading up to the test date, practice interpreting some poems from poetry anthologies or collections.

Example test questions: Spend some time answering a few example test questions. If you're unsure what your strengths and areas of needed improvement are, this activity can help you to identify them. (See the example test questions in each of the international subject test sections in this guide.)

Wrong answers: Remember, you're not penalized for wrong answers. If you look up and realize there are only a few minutes left before time is called but you have another 10–15 questions to answer, consider filling

in the rest of the answers as all *Bs* and *Ds* or *As* and *Cs*. This gives you a one-in-four chance of getting the rest of the answers correct.

- This strategy should only be used when you're running short of time. Nonetheless, having this knowledge in the back of your mind should lessen your anxiety. The more calm you are, the less likely you are to make mistakes.

Guessing answers: Be willing to guess on a question that you don't know and mark the question to return to later. Since you're not penalized for wrong answers, you should try to answer as many questions as possible while spending less time on topics where you know your knowledge is weaker.

Estimating time to answer: To avoid running out of time in the first place, though, divide the number of questions by the amount of time you'll have to answer them. For tests with about the same number of questions as time for the test, this means you have just slightly more than a minute per question.

Practice Tests

It makes sense to take a practice test to prepare yourself for the ACT international subject tests. Discuss this possibility with your instructor. This will also give you the chance to practice several test-taking strategies.

Relative Difficulty of Test Questions

As you review example questions or those on practice tests, you may wonder why some questions seem easy and some questions seem much harder. The ACT international subject tests are designed to enable test takers from across the performance continuum to demonstrate what they know and are able to do. Questions are therefore designed to measure a range of critical thinking skills and a range of cognitive complexities.

- **Recall and recognition:** Since content knowledge is so crucial in academic subjects, some questions on the test will require you to demonstrate that knowledge simply through recall or recognition of important terms, facts, and concepts.

- **Interpreting, comparing, and explaining:** In addition, competency in most subjects requires you to demonstrate the ability to interpret, compare, or explain ideas. This may involve synthesizing various pieces of information or evidence to generate reasonable, justifiable conclusions.
- **Applying your knowledge and skills:** You must also be able to apply what you've learned to specific contexts or experiments.
 - Consequently, the biology and chemistry tests also include questions that assess your ability to analyze, evaluate, design and modify experiments, and the English tests include questions that assess your ability to analyze and evaluate information or arguments in passages.
 - The math tests include problems at all levels of the *Revised Bloom's Taxonomy* from the domain that focuses on intellectual skills, critical thinking, and problem-solving abilities (remember, understand, apply, analyze, evaluate, and create). Some items require you to perform routine procedures using mathematics, more challenging items require you to make decisions about how to approach a problem, and higher-level tasks require strategic thinking, planning, explaining, and justifying with evidence.

By measuring both simple and more complex knowledge and skills, you'll have an opportunity to show what you've learned and are able to do in the topics assessed.

ACT International Subject Tests

Biology

Overview: AIST—Biology

Biology test questions ask you to solve problems and demonstrate understanding of the following topics:

- Biology processes
- Biochemistry and cells
- Genetics and evolution
- Animal and plant systems
- Ecology

Prerequisites

ACT recommends that you take courses in biology and algebra at level 1 before taking the ACT Biology International subject test.

Test Details

- **Test length:** 90 minutes (two 45-minute sessions)
- **Number of questions:** 38 per 45-minute session
- **Objectives:** The objectives of high school biology courses are to provide instruction and to emphasize the importance of the following general topics, which are assessed in the test:
 - Foundations and practices of science in general
 - Basic processes of scientific inquiry
 - Importance of mathematics and accurate measurement in the field of biology

Topics

The test covers topics studied in most high school level biology courses. Within each of these, you'll be asked to demonstrate your understanding of overarching themes and foundational concepts:

- **Biology processes:**
 - Exploring and defining the fundamental unifying concepts, organization, and inquiry techniques underlying the science of biology
- **Biochemistry and cells:**
 - Investigating life processes at the cellular level and understanding both how these processes work and how they are maintained and regulated
 - Tracing matter and energy within an organism through processes such as photosynthesis and respiration
- **Genetics and evolution:**
 - Delving into heredity by investigating how genetic structures and processes provide the mechanism for continuity and variety among organisms
 - Investigating processes that allow populations to change in response to different environmental and genetic pressures
 - Identifying and deciphering the distinguishing characteristics of all categories of living things and establishing the genetic, ancestral, and behavioral relationships among them
- **Animal and plant systems, and ecology:**
 - Exploring the structure and function of cells, tissues, organs, and systems within plants and animals
 - Analyzing the ecological processes by which living things interact with their environments and with each other

Mapping to the ACT Test: AIST—Biology

ACT international subject tests are end-of-course assessments that rigorously measure your understanding of content and practices in each subject. The tests are derived from items and research on ACT QualityCore tests, and have a score scale that links directly to the ACT test. In addition to measuring whether you've mastered ACT course standards, these tests predict success in postsecondary courses.

Content in Common

The following skill areas are addressed by the AIST biology test as well as the ACT science test:

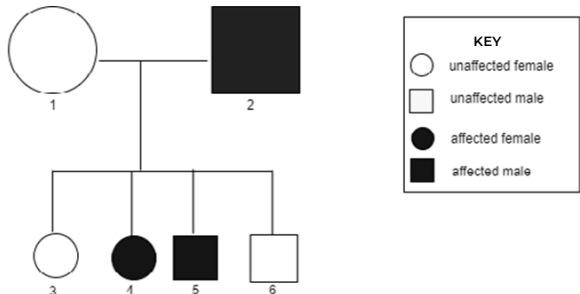
- **Physical science:** How matter transforms into energy
- **Mathematics and measurement:** Using graphical and mathematical models, particularly in relation to physical science and genetics and evolution
- **Biochemistry and cells:** Cellular respiration and chemical bonds in compounds; identifying cell types and functions of cellular organelles
- **Genetics and evolution:** Theory of natural selection, Punnett squares, relationships among organisms
- **Animal and plant systems:** Organization in organismal biology (e.g., tissues, organs, and organ systems)
- **Ecology:** Interactions between biotic and abiotic factors in ecosystems

Example Content: AIST—Biology

This table lists content on the international subject test, example test questions on the content, and skills the questions assess.

Test Content	Example Test Questions	What Example Test Questions Assess
Biology Processes (10–20%) - Scientific inquiry - Math and measurement in science - Science in practice - Foundations in biology: Criteria necessary to characterize life; define biological organization levels	- Chan wants to determine how much the mass of fungus growing on a nutrient agar plate changes over an 8-hour period. What is the most appropriate unit of measure for him to use? - Kilogram - Kilometer - Milligram - Millimeter - Which experiment design would provide scientists with the best data for investigating what type of feed yields the greatest gain in lean muscle in cattle? - Test five different types of cows with the same feed mixture and measure their weight gain at the end of a six-week trial. - Test five similar groups of cows with five different feed mixtures and measure their weight gain at the end of a six-week trial.	- This question assesses your ability to understand and to use mathematical representations. This requires that you be able to distinguish between terms relating to distance, mass, scale, and size. To answer this question correctly, you need to know <i>grams</i> refer to mass and that the prefix <i>milli</i> indicates one thousandth while the prefix <i>kilo</i> means one thousand. The correct answer is C. - This question tests your ability to design, evaluate, and revise experiments. To answer this question correctly, you must know and understand the difference between dependent and independent variables, and how to choose them. You should also be able to apply a control-of-variables approach to evaluate experimental designs. The correct answer is B.

Test Content	Example Test Questions	What Example Test Questions Assess
	C. Test five similar groups of cows with the same feed mixture and measure their weight gain at the end of a six-week trial. D. Test five different types of cows with five different feed mixtures, give each group varying amounts of feed, and measure their weight gain at the end of a six-week trial.	
Biochemistry and Cells (20–35%) - Atomic structure; chemical bonds; organic and inorganic compounds, enzymes; ATP - Properties of water; pH of solutions - Cell types; functions of cell organelles - Movement of substances in and out of cells - Cellular respiration - Cell division and mitosis	1. Which process generates most of the ATP produced during cellular respiration? A. Electron transport chain B. Fermentation C. Glycolysis D. Krebs Cycle 2. Which functional group found in amino acids is absent from monosaccharides, polysaccharides, fatty acids and glycerol? A. COOH B. NH₂ C. OH D. PO₄	1. You need to demonstrate a conceptual understanding of the inputs and outputs of the process of cellular respiration to answer this question correctly. This includes such aspects of the process as ATP synthase, proton gradients, the electron transport chain, the energy investment phase, etc. The correct answer is A. 2. This question assesses your understanding of the atomic structures of these organic compounds. To answer this question correctly, you must know that nitrogen is a major component of all proteins and is not present in the other

Test Content	Example Test Questions	What Example Test Questions Assess
Genetics and Evolution (25–40%) • Basic structure and function of DNA, RNA, and proteins • Meiosis • Terminology of genetic crosses • Evolution and the theory of natural selection • Requirements to be a species • Explain shared evolutionary relationships between organisms	1. When comparing 2 populations of animals, which state most likely indicates that they are the same species? A. They produce fertile offspring. B. They inhabit the same general area. C. Their outward appearance is similar. D. They consume the same type of diet. 2. Huntington's disease is a genetic disorder of the nervous system. This disorder is determined by 1 allele at 1 locus. What is the genotype for individual 4 in the diagram? 	chemicals listed. The correct answer is <i>B</i>. 1. This question assesses your understanding of the process of evolution as it results from 1) the potential for a species to increase in numbers, 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. The correct answer is <i>A</i>. 2. This question assesses your understanding of and ability to apply the terminology of Genetic Crosses. To answer this question correctly, you must recognize from the question and diagram that Huntington's disease is a dominant trait, and that having only one allele, <i>H</i>, will result in an offspring having the disorder. The correct answer is <i>C</i>.

Test Content	Example Test Questions	What Example Test Questions Assess
	A. HH or Hh B. HH C. Hh D. hh	
Animal and plant systems, and ecology (25-40%) - Describe types of animal and plant cells and tissues; describe photosynthesis - Identify taxonomic levels of organism classification; explain binomial nomenclature - Define ecological levels of organization; describe influence of biotic and abiotic factors on biome type	1. Based on their taxonomic classification, which two organisms share the most recent common ancestor? A. Centipede and earthworm (same kingdom) B. Alligators and crocodiles (same phylum) C. Fox and wolf (same family) D. Lemurs and racoons (same class) 2. Pistol shrimp build and maintain burrows on the ocean floor in which they and goby fish live. The goby fish provides the virtually blind shrimp protection from predators. Describe the relationship(s) between the pistol shrimp and the goby fish. A. Mutualism only B. Mutualism and predation C. Mutualism and parasitism D. Mutualism and commensalism	1. This question assesses your understanding of the taxonomic levels of organism classification. To answer the question correctly, you must understand the relationship between the taxonomic levels and genetic traits. The correct answer is C. 2. This question assesses your understanding of the complex interactions among organisms in ecosystems. To answer this question correctly, you must understand and be able to distinguish among the types of symbiotic relationships that exist within an ecosystem. The correct answer is A.

Preparing for the Test: AIST—Biology

Biology Processes

Approximately 10 to 20 percent of the biology international subject test questions will have biology processes as their focus. To best prepare yourself for the biology international subject test, seek out activities that will help you to think like a scientist. Of course, your biology course itself is designed to help you practice such skills as asking good questions and making arguments.

Multidisciplinary approach: To understand better the science of biology, take the time to explore and define some of the discipline's most fundamental unifying concepts and organization. Work to uncover the relationships among such biological disciplines as chemistry, ecology, and environmental science. This multidimensional approach to science uses scientific practices, cross-cutting concepts in science, and disciplinary core ideas that are the basis for science standards assessed by the biology international subject test.

Inquiry techniques: Additionally, the biology international subject test will assess your understanding of those inquiry techniques most associated with the discipline of biology. Consider the design of experiments you conduct in the classroom and practice interpreting the data you collect.

Mathematical representation: When you conduct such experiments, you should be able to use mathematical representations to support and revise your explanations and outcomes. For that reason, pay close attention in your math courses as well. An understanding of math will support your understanding of such chemical equations as that of cellular respiration.

Resources

- [Scientific Inquiry](#)
- [Math in Science](#)
- [Biological Organizations](#)

Biochemistry and Cells

Approximately 20 to 35 percent of the biology international subject test questions focus on cellular structures and processes. These questions assess your understanding of various life processes at the cellular level.

Life processes and DNA: You should know how these life processes function as well as how they are maintained and regulated. You should also be able to explain, using evidence, how the structure of DNA determines the structure of proteins that carry out the essential functions of life through systems of specialized cells.

Multicellular interactions: To prepare for the test, familiarize yourself with the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. You should know and understand, that is, the processes of nutrient uptake, water delivery, and organism movement in response to neural stimuli.

Modeling photosynthesis: Consider constructing models of photosynthesis to help you better understand that process. In particular, you'll need to understand the inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. The models you construct can include diagrams, chemical equations, and conceptual models.

Resources

- [Cellular Respiration](#)
- [Cellular Respiration and Photosynthesis](#)
- [Photosynthesis](#)

Genetics and Evolution

Approximately 25 to 40 percent of biology international subject test questions will focus on genetics and evolution. To answer test questions about this topic, you'll need to understand the role of cellular division and differentiation in producing and maintaining complex organisms.

Coded traits: You'll also need to understand the role of DNA and chromosomes in coding instructions for those traits passed from

parents to offspring. Prepare to apply concepts of statistics and probability to explain the variation and distribution of expressed traits in populations.

Theories and evidence: Consider forming a study group with your peers to participate in such activities as discussing how genetics and evolution theories develop. Prepare to evaluate also, using text evidence, the role of group behavior on individual and species chances to survive and reproduce. Additionally, be able to distinguish between group and individual behaviors.

Processes and changes: A number of questions on the biology international subject test will assess your knowledge of the processes that allow populations to change in response to different environmental and genetic pressures. With your study group, practice constructing cause-and-effect explanations for these processes and changes. Such activities will help to prepare you to answer questions that also assess your understanding of how these structures and processes provide the mechanism for continuity and variety among organisms.

Resources

- [DNA](#)
- [Evolution](#)
- [Mitosis and Meiosis](#)
- [Natural Selection](#)

Animal and Plant Systems, and Ecology

Approximately 25 to 40 percent of test questions will focus on animal and plant systems, and ecology. As you study these systems and other topics associated with ecology in your biology course, you'll learn to identify and decipher the distinguishing characteristics of living things.

Biodiversity and interdependent relationships: To best prepare for the biology international subject test, practice constructing arguments, based on evidence, about factors affecting biodiversity and populations in different ecosystems. To do well on the test, you'll also need to understand and be able to explain the interdependent relationships in these ecosystems, such as food chains and pyramids.

Impact of human activities: With a group of your peers, consider the impact of human activities on the environment and biodiversity.

Together, find or design activities that require you and your peers to design, evaluate, and refine solutions that reduce identified impacts.

Resources

- [Biodiversity](#)
- [The Habitable Planet](#)
- [Energy Flow and Primary Productivity](#)

Preparation Plus: AIST—Biology

In addition to the biology test preparation suggestions (above) and the general suggestions in Preparing for a Subject Test (page 8), there's another crucial area of preparation for the biology test: You need to practice analyzing and interpreting information presented in the form of graphs, tables, and diagrams.

Interpreting Graphs, Tables, and Diagrams

Structure and meaning: As you prepare for the test, pay close attention to the way data is labeled, organized, and plotted on graphs. Practice interpreting the information on a variety of graphs, charts, and diagrams, such as pie charts, scatter plots, or bar charts. This includes using keys and legends to understand the data presented in a graphic. This will help you to become familiar with what is associated with the x-axis (typically the independent variable) versus what is being measured by the y-axis (typically what is being measured, or the dependent variable).

Multiple variables in graphs: Find and analyze multiple line graphs and graphs with multiple variables measured on the y-axis. This will help you to become familiar with graphics that are frequently used in science but not often used in high school.

Tables and diagrams: For tables, notice the column and row headings that will name quantities and units or measure. Typically, you can find the independent variables on the left side of the table and the quantities measured in the experiment on the right side. To read

diagrams, look for important information in the title, captions, and labels of the diagram.

Graphic information: Make sure you spend a little time figuring out what a graph, table, or diagram is revealing to its viewer, including the relationships between variables. Having a good idea of what the graphic information presents will help you to interpret what the questions on the test are asking.

Chemistry

Overview: AIST—Chemistry

Chemistry test questions explore the makeup of the physical world, from the properties and structures of matter to the laws explaining the activity of gases, as well as the chemical structures of elements, molecules, and compounds.

Prerequisites

ACT recommends that you take courses in chemistry and algebra at level 2 before taking the ACT international subject test in chemistry.

Test Details

- **Test length:** 90 minutes (two 45-minute sessions)
- **Number of questions:** 38 per 45-minute session
- **Objectives:** The objectives of high school chemistry courses are to provide instruction and to emphasize the importance of the following general topics, which are assessed in the test:
 - Foundations and practices of chemistry in general
 - Basic processes of scientific inquiry
 - Importance of mathematics and accurate measurement in the field of chemistry

Topics

The test covers topics studied in most high school level chemistry courses. Within each of these, you'll be asked to demonstrate your understanding of overarching themes and foundational concepts:

- Understanding chemistry as inquiry
- Exploring the physical world
- Discovering the language of chemistry
- Building models of matter
- Integrating the macroscopic, microscopic, and symbolic worlds

Mapping to the ACT Test: AIST—Chemistry

ACT international subject tests are end-of-course assessments that rigorously measure your understanding of content and practices in each subject. The tests are derived from items and research on ACT QualityCore tests, and have a score scale that links directly to the ACT test. In addition to measuring whether you've mastered ACT course standards, these tests predict success in postsecondary courses.

Content in Common

The following skill areas are addressed by the AIST chemistry test as well as the ACT science test:

- **Introduction to chemistry:** Mass, weight, volume, and density; characteristics of matter; writing and balancing equations; stoichiometric calculations; limiting reagents
- **Structure of matter:** Laws of conservation, KMT, phase changes; gas laws and problems; Hund's rule, Aufbau principle; periodic table; bonds, Lewis dot diagrams; Valence Shell Electron Pair Repulsion (VSEPR)
- **Solution chemistry:** Solutions; calculating concentrations, solution stoichiometry; collision theory and reaction rates; law of mass action, LeChatelier's principle; law of conservation of energy, heat problems; acids, bases; pH, pOH

Example Content: AIST—Chemistry

This table lists content on the international subject test, example test questions on the content, and skills the questions assess.

Test Content	Example Test Questions	What Example Test Questions Assess
Introduction to Chemistry: (30–50%) • Introduction to chemistry • Mass, volume and density • Elements, atomic mass, and nomenclature • The language of chemistry • Formulas, equations • Chemical equations and stoichiometry	1. What is the volume in mL, of a sample of glycerol with a density of 1.20g/mL and a mass of 43.7g? A. 36.4 B. 42.5 C. 44.9 D. 52.4 2. Which statement correctly describes one mole of iodine (I₂)? A. Its mass is 126.9 g. B. Its mass is 380.7 g. C. It contains 6.02 x 10²³ atoms. D. It contains 6.02 x 10²³ molecules. 3. Which balanced equation is a double replacement reaction? A. $2 \text{H}_2\text{O} (\text{l}) \rightarrow 2 \text{H}_2 (\text{g}) + \text{O}_2 (\text{g})$ B. $4 \text{Fe} (\text{s}) + 3 \text{O}_2 (\text{g}) \rightarrow 2 \text{Fe}_2\text{O}_3 (\text{s})$ C. $6 \text{Ag} (\text{s}) + \text{Ca}_3(\text{PO}_4)_2 (\text{aq}) \rightarrow 3 \text{Ca} (\text{s}) + 2 \text{Ag}_3\text{PO}_4 (\text{s})$	1. This question assesses your understanding of the mathematical relationship between density, mass, and volume where density is proportional to mass and inversely proportional to volume. Using $D = M/V$, the relationship can be applied to solve the unknown volume. The correct answer is A. 2. This question assesses your understanding of conversions between mass, moles, and the number of particles of a substance, but more importantly, you must know Avogadro's constant, which describes the number of atoms or molecules in a mole of a substance as equal to 6.02×10^{23}. Since I₂ is a molecule, the answer is D.

Test Content	Example Test Questions	What Example Test Questions Assess
	D. $\text{AgNO}_3 (\text{aq}) + \text{NaCl} (\text{aq}) \rightarrow \text{AgCl} (\text{s}) + \text{NaCl} (\text{aq})$	3. This question assesses your ability to express types of balanced chemical reaction in the form of equations. You should also understand that double replacement reactions typically occur in aqueous solutions. The correct answer is <i>D</i> .
Structure of Matter (20–40%) • Properties of matter and gas • Building models of matter	1. What volume of H_2 gas is made when 30.2g of zinc reacts with an excess of HCl at STP? $\text{Zn} (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{ZnCl}_2 (\text{aq}) + \text{H}_2 (\text{g})$ A. 0.46 L B. 1.37 L C. 10.4 L D. 65.4 L 2. What is the Lewis dot structure for arsenic triiodide? A. C. B. D. <td> 1. This question assesses your ability to solve gas stoichiometry problems given data and conditions. Additional skills assessed by this item include your ability to interpret and analyze chemical equations, to select a routine problem-solving procedure for gas stoichiometry and perform it, and to correctly convert units. The correct answer is C. 2. This question assesses whether you can interpret data using Lewis dot structures and identify the correct valence electron configurations of a covalently bonded compound. You can use your knowledge of Lewis dot structures, with the help of the </td>	1. This question assesses your ability to solve gas stoichiometry problems given data and conditions. Additional skills assessed by this item include your ability to interpret and analyze chemical equations, to select a routine problem-solving procedure for gas stoichiometry and perform it, and to correctly convert units. The correct answer is C. 2. This question assesses whether you can interpret data using Lewis dot structures and identify the correct valence electron configurations of a covalently bonded compound. You can use your knowledge of Lewis dot structures, with the help of the

1. This question assesses your ability to solve gas stoichiometry problems given data and conditions. Additional skills assessed by this item include your ability to interpret and analyze chemical equations, to select a routine problem-solving procedure for gas stoichiometry and perform it, and to correctly convert units. The correct answer is *C*.

2. This question assesses whether you can interpret data using Lewis dot structures and identify the correct valence electron configurations of a covalently bonded compound. You can use your knowledge of Lewis dot structures, with the help of the

Test Content	Example Test Questions	What Example Test Questions Assess
Solutions Chemistry (20–40%) - Integrating macroscopic, microscopic and symbolic worlds - Types of solution, concentration, solubility - Kinetics, equilibrium, and thermodynamics - Salts, acids and bases - REDOX reactions and electrochemistry - Nuclear chemistry	- How many mL of 0.280 M barium nitrate are required to precipitate as barium sulfate all the sulfate ions from 15.0 mL of 0.350 M aluminum sulfate? 15.0 mL 15.8 mL 56.0 mL 56.25 mL - The chemical reaction below is known as the Haber process for producing ammonia from nitrogen and hydrogen. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ Which statement describes the effect of adding more H₂ to this reaction? - The reaction will stop. - The reaction will not change. - The equilibrium shifts to the left. - The equilibrium shifts to the right.	periodic table, to determine how three atoms of iodine (I) combine with one atom of arsenic (As). The correct answer is <i>B</i>. - This question assesses your ability to solve solution stoichiometry problems given data and conditions. Additional skills that may be assessed by this item include your ability to model scientific concepts or relationships in words or diagrams; to select a procedure according to specified criteria and perform it; to organize, represent, and interpret data; and to correctly convert units. The correct answer is <i>D</i>. - You will have to apply what you know about Le Châtelier's principle with respect to concentration when you analyze what will happen when more hydrogen gas is added to a reversible reaction. The correct answer is <i>D</i>.

Test Content	Example Test Questions	What Example Test Questions Assess
	3. What are the pOH and pH of a $4.22 \times 10^{-5}\text{M}$ aqueous sodium hydroxide solution? A. pOH = 2.37, pH = 11.63 B. pOH = 3.40, pH = 10.6 C. pOH = 4.37, pH = 9.63 D. pOH = 4.39, pH = 9.61	3. This question assesses your ability to calculate the pH and pOH of solutions. You should know that you should first use the formula $\text{pOH} = -\log [\text{OH}^-]$ to solve for pOH, and then subtract that number from 14. The correct answer is C.

Preparing for the Test: AIST—Chemistry

Introduction to Chemistry

Approximately 30%–50% of test questions will assess skills aligned with concepts covered in the introduction to chemistry category. This category is designed to help you master the fundamental basics of chemistry through exploration of unifying concepts within related disciplines such as physics, biology, biochemistry, geology, environmental science, and astronomy. This multidimensional approach to science uses scientific and engineering practices, cross-cutting concepts in science, and disciplinary core ideas that are the basis for science standards and frameworks such as Program for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), and Next Generation Science Standards (NGSS).

Basic chemistry concepts: The chemistry international subject test assesses your understanding of basic concepts that are essential for you to understand chemistry. For example, the relationship between mass, weight, volume, and density is found in many chemistry topics. Practice developing and using models that explain characteristics of matter compounds, mixtures, elements, and isotopes.

Mathematics and measurement: You'll need to apply mathematics when converting between mass, moles, and number of particles. You'll also need to be able to write and balance equations, classify and predict products of chemical reactions, and calculate percent yields of these reactions. Since stoichiometry is a common thread through many chemistry topics, it's important that you practice these types of calculations using worksheets and quality resources. Clearly, to be successful you must acquire strong measurement and mathematical skills. Find and complete activities that will help you to build confidence in those areas.

Lab experiments: As you gain experience in a lab setting, look for opportunities to perform open-ended experiments and try out different solutions to chemistry problems posed to you by your instructor. Be sure to follow the lab safety rules with regard to, for example, heating

and measuring tools to help ensure you'll also be successful when you conduct your scientific investigations.

Resources

- [Overview of High School Chemistry Topics](#)
- [Phet Interactive Simulations: Balancing Chemical Equations](#)
- [Chemistry Archive](#)

Structure of Matter

About 20%–40% of test questions will have content that focuses on concepts of structure of matter. Questions on the test that assess your understanding of the structure of matter include such topics as conservation of matter, kinetic molecular theory (KMT), and phase changes.

Kits, diagrams, and models: Your understanding of these concepts can be enhanced through the use of molecular kits, diagrams, and physical models during hands-on activities. Modeling activities (e.g., a block of ice melting into water) can help you to develop a better understanding of such concepts as how KMT relates to phase changes and the law of conservation of matter.

Lab experiments: To prepare for this section of the test, you should also know the chemical and physical properties of matter. Using hands-on lab activities that compare properties along with their physical and chemical changes may work well in reinforcing these concepts for you. Understanding and solving problems based on gas laws is an integral part of course work in the structure of matter, so also practice these calculations through worksheets and conducting gas stoichiometry experiments; this will ensure that you have mastered the problem-solving skills required to be successful on the test.

Principles, patterns, and predictions: Become familiar with concepts such as atomic orbitals and the rules and principles that apply to them (Hund's rule and Aufbau principle). This can be extended into an understanding of how the periodic table is organized, by number and pattern of electrons. Understanding electron patterns will help you to predict chemical reactivity and bond formation between various types of atoms. Consider using Lewis dot structures as you practice drawing

molecules formed by atoms bonded together. Try to solve problems with respect to your drawn shapes using the VSEPR theory. Try to first predict molecular shapes using the VSEPR theory. Having made these predictions, use molecular model kits to help you confirm your predictions.

Resources

- [Gas Stoichiometry](#)
- [The Periodic Table](#)
- [Valence-Shell Electron Pair Repulsion Theory](#)

Solutions Chemistry

Between 20% and 40% of test questions will be focused on content and skills related to solutions chemistry. To answer test questions about solutions chemistry, you'll need to understand the preparations and properties of solutions as well as the related theories, principles, and laws.

Calculations and applying concepts: You'll need to be able to calculate concentrations of solutions and solve solution stoichiometry problems. Additionally, you'll need to understand the collision theory and how to apply concepts such as the law of mass action, Le Châtelier's principle, and the law of conservation of energy to help answer questions and solve problems.

Lab skills and techniques: Work with your peers to become familiar with the characteristics of acids and bases. Practice calculating the pH and pOH and writing neutralization reactions. It's essential that you practice your laboratory skills and techniques.

Practical applications: Consider forming a study group with your peers to discuss the ways in which the scientific skills you practice in the classroom might be practically used in the real world. These kinds of discussions and practical use of skills will prepare you well for those questions that assess your understanding of solutions chemistry.

Resources

- [Preparation of Solution](#)
- [Le Chatelier's Principle](#)

- [Calorimetry and Heat Flow](#)

Preparation Plus: AIST—Chemistry

In addition to the chemistry test preparation suggestions (above) and the general suggestions in Preparing for a Subject Test (page 8), review Preparation Plus in the AIST—Biology section (page 22), which addresses interpreting graphs, tables, and diagrams. Two other crucial areas of preparation for the chemistry test are mathematical skills and laboratory skills.

Practicing Mathematical Skills

- **Chemistry calculations:** Some of the questions on the chemistry test will require you to make calculations and to analyze and interpret information. Try to master both basic and more advanced chemistry calculations before attempting the test.
 - **Basic:** Basic calculations include ensuring accuracy and precision when applying significant figures and scientific notation, correctly applying physical constants (e.g., atomic mass unit, Avogadro's number, etc.), correct use of metric base units (e.g., length, mass, time, mole, etc.), correct use of derived metric units (e.g., m^2 , m/s , etc.), correct use of metric prefixes (e.g., milli, mega, centi, deci, etc.), canceling units in advanced calculations and correct temperature conversions.
 - **Advanced:** More advanced calculations could include applying chemical formulas to solve complex and multi-step problems.
- **Scientific calculators:** Make sure you know how to use scientific calculators. Check to see, for example, if you can perform some logarithmic calculations needed for pH and pOH. Check the [ACT Calculator Policy](#) to make certain that the calculator you plan to use for the ACT chemistry international subject test is allowed (also see page 7).

Practicing Laboratory Skills

- **Collecting data in the lab:** The proper use of lab equipment is essential in collecting data that is both valid and reliable. In the chemistry test you might need to answer questions about common

sources of error as they relate to such things as systematic errors due to inaccurate information or incorrectly using equipment (parallax error in measurement).

- **Mathematical errors in the lab:** In class, you quite often perform calculations within a lab environment where you need to use both technical lab skills and mathematics. Data errors can arise from incorrect use of lab equipment or incorrectly applying a mathematical formula. Incorrect measurements, miscalculating answers, or placing the decimal in the wrong place can skew the results of experiments.
- **Observing and recording:** If you don't carefully observe and record raw data, there's a good chance there will be problems with data analysis. Keep a detailed, written log of your lab activities including techniques, procedures, calculations, and findings. This will improve accuracy and quality control and, more importantly, help you learn from your mistakes.

English 1 and 2

Overview: AIST—English 1 and 2

ACT international subject tests for English 1 and 2 assess your knowledge, skills, and abilities as readers and writers. Questions use a diverse collection of authentic, high-quality texts that have been taught in successful classrooms across the US, including drama, fiction, nonfiction, and poetry, as well as film scripts. The English tests also assess knowledge and skills required to write effectively in high school and college.

Prerequisites

ACT recommends that you take English 11 before taking the English 1 international subject test, and English 12 before taking the English 2 international subject test.

Test Details

- **Test length:** 90 minutes (two 45-minute sessions)
- **Number of questions:** 36–38 per 45-minute session
- **Objectives:** The objectives of high school English courses are to provide instruction and to emphasize the importance of the following general topics, which are assessed in the tests:
 - Reading and comprehending various modes of writing
 - Understanding and applying the mechanics of writing

Themes and Concepts

The test covers topics studied in most high-school level English courses. Within each of these topics, you'll be asked to demonstrate your understanding of overarching themes and foundational concepts related to the following:

- Reading comprehension
- Critical reading
- Modes of writing
- Mechanics of writing

Mapping to the ACT Test: AIST—English 1 and 2

ACT international subject tests are end-of-course assessments that rigorously measure your understanding of content and practices in each subject. The tests are derived from items and research on ACT QualityCore tests, and have a score scale that links directly to the ACT test. In addition to measuring whether you've mastered ACT course standards, these tests predict success in postsecondary courses.

Content in Common

The following skill areas are addressed by the AIST English 1 and 2 tests as well as the ACT English and reading tests:

- **Reading comprehension:** Using close-reading strategies to interpret increasingly challenging texts; applying knowledge of connotation and denotation to determine the meaning of words and phrases in increasingly challenging texts
- **Critical reading:** Identifying, analyzing, and evaluating the impact on meaning of character development, setting, theme, mood, and point of view in increasingly challenging texts; analyzing and evaluating how organization, word choice, and persuasive techniques impact meaning in increasingly challenging texts
- **Modes of writing:** Analyzing a variety of common poetic devices and evaluating the impact on meaning in increasingly challenging texts
- **Mechanics of writing:** Adding important information and deleting irrelevant information and details to more clearly establish a central idea; identifying and correcting errors in sentence construction and evaluating how various constructions impact meaning, style, and tone

Example Content: AIST—English 1 and 2

This table lists content on the international subject test, example test questions on the content, and skills the questions assess. Note: Supporting details from selected passages are highlighted as a way to emphasize that all answers in the English international subject tests require you to find evidence within the passages themselves (although they will not be highlighted in the actual test).

Test Content	Support/Reference to Details in Passage	Example Test Questions	What Example Test Questions Assess
Reading Comprehension (25%–50%) • Use close-reading strategies to interpret increasingly challenging texts. • Apply knowledge of connotation and denotation to determine the meanings of words and phrases in increasingly challenging texts.	1. The other day an acquaintance of mine, a gregarious and charming man, told me he had found himself unexpectedly alone in New York for an hour or two between appointments. He went to the Whitney Museum and spent the “empty” time looking at things in solitary bliss. For him it proved to be a shock nearly as great as falling in love to discover that he could enjoy himself so much alone. What had he been afraid of, I asked myself? That, suddenly alone, he would discover that he bored himself, or that there was, quite simply, no self there to meet? But having taken the plunge, he is 2. Rose was pleased with herself for thinking of the grapefruit and with the way she had said it in so bold yet so natural, a voice. Her voice could go dry altogether in school, her heart could roll itself up into a thumping ball and lodge in her throat. Her nerves were calamitous.	1. Which of the following statements best paraphrases lines 5–11? A. Taking time to experience culture can be a pleasant surprise. B. It is easier to fall in love with art when one is alone. C. Some people rarely allow themselves to experience the joys of solitude. D. Many people are afraid to spend time alone in museums. 2. As it is used in line 59, the word “calamitous” most nearly means: A. Stormy B. Not entirely reasonable C. Gratifying D. Likely to create discomfort	1. You must be able to recognize the facts and details from the passage that will help you to interpret the text. A close reading of the identified sentence provides a clue that helps to reveal the best response to this question. The correct answer is C. 2. This question tests your ability to determine the meaning of words or phrases by paying close attention to context clues in the passages you read. Remember that reading a few lines above and below the identified line in a passage will often make clear which response is correct. The answer is D.

Test Content	Support/Reference to Details in Passage	Example Test Questions	What Example Test Questions Assess
Critical Reading (35%–55%) - Identify, analyze, and evaluate impact on meaning of character development, setting, theme, mood, and point of view in increasingly challenging texts - Analyze and evaluate how organization, word choice, and persuasive techniques impact meaning in increasingly challenging texts.	1. 55 to do, had behaved exactly as it must, had been true to itself and to the sun and moon. It knew its place in the scheme of things, and its place was there, with its right destiny, in the tracks of the wagon. In my mind's eye I could see it at that very moment, miles away, plodding in the familiar shadows, panting easily with relief, after a bad night, contemplating the wonderful ways of man. 60 Caveat emptor. But from that experience I learned something about the heart's longing. It was a lesson worth many times five dollars. 2. 25 It was full of resistance, and yet it was ready to return my deep, abiding love; I could see that. It needed only to make a certain adjustment in its lifestyle, to shift the focus of its vitality from one frame of reference to another. But I had to drag my dog from its previous owner by means of a rope. Its bushy tail wagged happily all the while. 30	1. The author's attitude toward the main subject of the passage can best be described as: A. Appreciation and respect B. Disbelief and cynicism C. Amusement and nostalgia D. Boredom and indifference 2. The narrator develops the third paragraph (lines 19–29) mainly through: A. Detached philosophical musing on her inner thoughts and feelings B. A detailed outline of the dog's movements C. Antithetical statements that foreshadow the dog's later actions D. Imaginative speculation on what the dog might be thinking	1. This question asks you to analyze the author's point of view, or perspective, about the subject of a passage. Note, too, however, that this question also assesses your ability to apply your knowledge of connotation and denotation of tone words and phrases to determine the best answer to this question. The answer is A. 2. You need to understand how writers use rhetorical strategies, such as description or the use of sensory details, to have an impact on the meaning of a passage. The evidence in the passage makes clear that the correct answer is C.

Test Content	Support/Reference to Details in Passage	Example Test Questions	What Example Test Questions Assess
Modes of Writing (0%–10%) - Identify key characteristics of various literary genres; evaluate impact on meaning in increasingly complex texts - Analyze variety of common poetic devices; evaluate impact on meaning in increasingly challenging texts. - Analyze effective use of such literary devices as figurative language, sound devices, and stage directions in increasingly complex texts.	1. But let me confess that, even as a child, I was insanely jealous of the city in which I was raised, because it was my parents' other love. They loved each other (good), they loved me (very good), and they loved her (not so good). Bombay was my rival. It was on account of their romance with the city that they drew up that weekly rota (list) of shared parental responsibilities. When my mother wasn't with me— 40 when I was riding on my father's shoulders, or staring, with him, at the fish in the Taraporewala Aquarium—she was out there with her, with Bombay; out there bringing her into being. (For of course construction 2. <i>CLAUDIUS and POLONIUS withdraw</i> <i>Enter HAMLET</i> HAMLET To be, or not to be? That is the question— Whether 'tis nobler in the mind to suffer The slings and arrows of outrageous fortune, 60 Or to take arms against a sea of troubles, And, by opposing, end them? To die, to sleep— No more—and by a sleep to say we end The heartache and the thousand natural shocks That flesh is heir to—'tis a consummation 65 Devoutly to be wished! To die, to sleep. To sleep, perchance to dream—ay, there's the	1. In lines 32-43, the narrator uses which of the following literary devices to describe Bombay? A. Alliteration B. Allusion C. Personification D. Simile 2. The primary purpose of Hamlet's words in lines 57–90 is to: A. Express his indecisiveness to Claudius and Polonius B. Speak aloud his conflicted feelings about life and death c. Foreshadow how Ophelia will resolve her feelings of loneliness D. Reveal to the audience his utter exhaustion and need for sleep	1. You need first to be able to recognize key literary devices in order to be able to analyze their impact on the meaning of a passage. As is true for all questions on the English international subject tests, only answers for which there is clear evidence in the passage should be chosen. The correct answer is C. 2. This question requires you to recognize that Hamlet's speech is a soliloquy and to analyze the purpose of this speech in the play. The correct answer is B.

Test Content	Support/Reference to Details in Passage	Example Test Questions	What Example Test Questions Assess
	3. I have been one acquainted with the night. <i>a</i> I have walked out in rain, and back in rain. <i>b</i> I have outwalked the furthest city light. <i>a</i> I have looked down the saddest city lane. <i>b</i> I have passed by the watchman on his beat <i>c</i> And dropped my eyes, unwilling to explain. <i>b</i> I have stood still and stopped the sound of feet <i>c</i> When far away an interrupted cry <i>d</i> Came over houses from another street, <i>c</i> But not to call me back or say good-bye; <i>d</i> And further still at an unearthly height, <i>a</i> O luminary clock against the sky <i>d</i> Proclaimed the time was neither wrong nor right. <i>f</i> I have been one acquainted with the night. <i>f</i>	3. Which statement best describes the rhyme scheme in the poem? A. Every other line rhymes. B. The first four lines in each stanza rhyme. C. The rhyme pattern reverses itself in each stanza. D. The rhyme pattern is similar to that of a sonnet.	3. You need to identify a common poetic device, rhyme scheme, so that you might better understand its impact on the meaning of the poem as a whole. The correct answer is <i>D</i>.
Mechanics of Writing (10%–20%) • Add important information and delete irrelevant information and details to more clearly establish a central idea. • Identify and correct errors in sentence construction and evaluate how various constructions affect meaning, style, and tone.	1. At Edinburgh’s Filmhouse Cinema, a three-dimensional sculpted scene shows patrons sitting in a movie theater as horses leap out of the screen. At the Scottish Storytelling Centre, a dragon crafted from the pages of a mystery novel was found nesting in a window. At the National Museum of Scotland, a paper tail was spotted emerging from the spine of Sir Arthur Conan Doyle’s book <i>The Lost World</i>. Inside, a dinosaur charges through shredded pages of the open book. More creations appeared at several libraries and museums devoted to books and writing. <u>A total of ten sculptures were bestowed on special institutions, whose staff are thrilled by their luck.</u>	1. The writer of this passage wishes to add a transition between the underlined sentence (lines 11–13) and the sentence that precedes it. Which word or phrase will best make clear the central idea of the paragraph? A. Therefore B. Eventually C. Of course D. However	1. This question requires you to determine that the main idea of the paragraph is to emphasize the discovery of unusual objects over a period of time. To do so, you must note that several sentences begin in the same style, and the verb tense shifts from present to past. The correct answer is <i>B</i>.

Test Content	Support/Reference to Details in Passage	Example Test Questions	What Example Test Questions Assess
	2. Down in the cool basement of the hotel restaurant, Alejo Santino looked over a yellowed newspaper clipping dating back to 1961. He had not looked at it recently, although in the past had always been proud to show it to visitors. <u>And why because it was a brief moment of glory.</u> In the picture Alejo and his friend Diego were in their best dress whites standing before a glittering case of desserts. Beside them was a fat, cheery beaming face, the Soviet premier Nikita Khrushchev, who was attending a luncheon in his honor at the hotel.	2. What is the correct way to punctuate the underlined portion of lines (lines 5–6)? A. And why because it was a brief moment of glory. B. And why? Because it was a brief moment of glory. C. And why, because it was a brief moment of glory. D. And why, because it was a brief moment of glory?	2. You should understand that writers use punctuation purposefully as a means to shape the style, tone, and meaning of the texts they create. For that reason, merely knowing the rules regarding comma usage will not help you to choose the correct response. You must read the whole sentence in which this phrase belongs. The correct answer is <i>B</i>.

Preparing for the Test:

AIST—English 1 and 2

Key Ideas and Details

A number of questions on the English 1 international subject test will assess your ability to understand the overall meaning of passages, to determine main ideas and themes, to identify important details that support main ideas and themes, or to analyze the relationships among ideas, individuals, and events in the passages read.

Close reading: Of most use in preparing you to determine, analyze, interpret, and evaluate information in the various passages you will read are activities that help you develop your close-reading skills. Activities that can help you pay closer attention to the details of the text include targeted highlighting and text annotation.

Resources

- [Close Reading](#)
- [Finding the Main Idea and Supporting Details](#)
- [Finding Connections between Ideas in a Passage](#)

Craft and Structure

Various questions on the test will assess your understanding of craft and structure. Some questions might assess your ability to determine what words and phrases mean in a passage and how such meaning is created. Some might ask you to identify what type of figurative language is used. Other questions might assess your ability to infer how a narrator's or author's perspective, purpose, or intent shapes the content and style of a passage.

Context clues and genre study: Practice determining the meaning of words and phrases based on context clues. Because you will be asked these questions about a variety of modes that include narratives, poetry, drama, and informational texts, take the time to read a variety of literary and non-literary texts. Additionally, consider forming a study

group with your peers so that you might discuss such issues as how genre affects the content and style of the texts you read.

Resources

- [The Structure of Texts](#)
- [Three Lessons on Irony](#)
- [Learning Vocabulary](#)

Integration of Knowledge and Ideas

Some of the questions on the test are likely to assess your ability to identify main claims and to analyze how writers offer reasons or support for the claims they make. Practice evaluating the evidence informational arguments use in support of their claims. Practice, too, comparing two or more passages and drawing logical conclusions using information from both of them.

Resources

- [Analyzing Arguments](#)
- [Reading Multiple Accounts](#)

Mechanics of Writing

In your English courses in high school, you will typically be assessed on your ability to write unified and coherent persuasive essays that make clear claims with well-organized and developed support, and that are also mechanically correct. Adequately preparing for this task will also prepare you for the types of multiple-choice questions on the English 1 or English 2 international subject tests.

Replacing, revising, and usage: Some of the multiple-choice questions on the English 1 and English 2 international subject tests might ask you to determine whether new sentences might better state an idea from the passage. Additionally, you might be asked to revise writing that is unclear or confusing. Other questions may ask you to identify what punctuation is needed in a particular sentence.

Resources

- [Writing Tips](#)

- [4-Ted Ed Lessons on Grammar and Word Choice](#)

Preparation Plus: AIST—English 1 and 2

Pay attention to the English 1 and 2 test preparation suggestions (above) and the general suggestions in Preparing for a Subject Test (page 8).

Practice Tests

Among the general test preparation suggestions, pay particular attention to practice tests. These will give you the best idea of what you'll encounter on the English tests: You need to practice analyzing and interpreting information presented in the form of example sentences and text passages. Discuss this possibility with your instructor.

Math 1 and 2

Overview: AIST—Math 1 and 2

The subject area tests in mathematics are rigorous assessments of mathematics taught in secondary school. Math 1 focuses on the first years of study in algebra and geometry. Math 2 focuses on more advanced algebra with trigonometry and precalculus. For both tests, you'll need to apply what you have learned in order to solve problems with a range of complexities. You'll need to use content understanding, estimation skills, insights from representations, and reasoning to solve problems.

Calculators are encouraged, and a reference sheet provides common formulas (see page 7).

Prerequisites

If you've studied advanced algebra, trigonometry, and precalculus, then the Math 2 score will allow you to demonstrate these higher-level skills. If you have not studied these topics, then the Math 1 test will be a more appropriate choice and give a better measure of your ability.

Math 1

You can show what you know and can do using algebra and geometry typically learned through the first years of secondary school. The topics measured on the assessment range from solving equations to drawing conclusions from data, from finding areas and volumes to making judgments about proof.

Test Details

- **Test length:** 60 minutes
- **Number of questions:** 50 multiple-choice questions, with approximately the following breakdown:
 - 30 questions assessing Algebra I topics
 - 20 questions for geometry topics

Math 2

On this test, you can demonstrate your knowledge of advanced algebra and precalculus topics. These topics range from understanding complex numbers to modeling with vectors and matrices, from applying advanced functions to finding limits, from fitting a normal distribution to interpreting graphs in the polar coordinate plane.

Test Details

- **Test length:** 60 minutes
- **Number of questions:** 50 multiple-choice questions, with approximately the following breakdown:
 - 25 questions assessing Algebra II topics
 - 25 questions for precalculus topics

Topics

The test covers topics studied in most high-school level mathematics courses. Within each of these topics, you'll be asked to demonstrate your understanding of overarching themes and foundational concepts, as listed below.

Math 1: Algebra 1

- Solve equations and inequalities in 1 variable and graph solutions on the number line.
- Solve absolute-value equations.
- Solve a formula for a specified variable.
- Write linear equations and inequalities to capture relationships from real-world situations and graph in the coordinate plane.
- Find an equation of a line that goes through 2 given points, or through a given point with a given slope.
- Translate between different representations of a line, including graph, table, verbal description, and different forms of equation.
- Represent direct and inverse variation.
- Solve systems of 2 equations in 2 variables; understand solution methods.
- Apply function concepts and determine if a relationship is a function.

- Find domain and range.
- Evaluate functions at given values.
- Find rate of change in a function and connect this to slope for linear functions.
- Translate between different representations of a function, including graph, table, set of ordered pairs, verbal description, and equation.
- Factor trinomials; recognize perfect-square trinomials.
- Recognize and factor difference of squares.
- Solve quadratic equations using different methods.
- Identify graphs of quadratic functions.
- Relate factors, solutions, zeros, and intercepts.
- Use properties of exponents.
- Manipulate radical and rational expressions.
- Interpret data representations.
- Identify arithmetic sequences.
- Identify patterns and patterns of growth in a set of data.
- Find the probability of simple events.
- Distinguish between independent and dependent events.
- Identify an approximate line of best fit to model data and use a model to make predictions.

Math 1: Geometry

- Use inductive and deductive reasoning to make valid conclusions.
- Apply theorems, definitions, and axioms to solve problems and draw conclusions.
- Interpret a mathematical proof in different forms.
- Use properties of quadrilaterals to solve problems and identify valid reasoning.
- Use coordinate methods and geometric relationships to deduce whether 2 lines are parallel or not.
- Use various methods, including SSS, SAS, ASA, AAS, and HL, to deduce that triangles are congruent and corresponding parts are congruent.
- Use various methods, including AA, SAS, and SSS, to deduce that triangles are similar, corresponding sides are proportional, and corresponding angles are congruent.
- Understand and interpret geometric language.
- Use angle relationships to solve problems and draw conclusions.

- Use relationships when a transversal crosses 2 parallel lines to solve problems and draw conclusions.
- Interpret geometric constructions.
- Identify and make deductions about a locus (the set of possible positions) in a plane or in 3-dimensional space.
- Use relationships involving medians, altitudes, perpendicular bisectors, and angle bisectors to solve problems and draw conclusions.
- Apply the triangle inequality theorem about the relative size of angles and the relative size of opposite sides.
- Recognize Pythagorean relationships in complex diagrams and real-world contexts, and use this to solve problems and draw conclusions.
- Relate interior and exterior angles and angle sums to the number of sides of a polygon.
- Recognize isosceles triangles in complex contexts and use properties to solve problems and draw conclusions.
- Recognize relationships between lines and line segments associated with circles, central angles, inscribed angles, intercepted arcs, and inscribed polygons and use properties to solve problems and draw conclusions.
- Identify and classify 2- and 3-dimensional shapes and use their properties to solve problems.
- Recognize cross sections of prisms, cylinders, pyramids, and cones and use relationships to solve problems and draw conclusions.
- Determine points or lines of symmetry and apply properties of symmetry to solve problems and draw conclusions about figures.
- Identify congruent figures and corresponding parts.
- Identify similar figures and use ratio-and-proportion reasoning to solve mathematical and real-world problems, including situations with a geometric-mean relationship such as a right triangle and its altitude.
- Identify transformations and transformed figures.
- Understand relationships between corresponding lengths, areas, and volumes for similar figures in terms of scale factor.
- Use length, width, perimeter, circumference, area, surface area, and volume relationships and formulas to solve problems and draw conclusions.

- Find geometric probability and draw conclusions.
- Use coordinates to solve problems about geometric figures, including the effects of reflections, rotations, translations, and dilations.
- Find distance and midpoint and use distance and midpoint relationships to solve problems and draw conclusions.
- Identify parallel and perpendicular lines on the basis of slope.
- Find trigonometric ratios for right triangles, in particular for 45-45-90 and 30-60-90 triangles.
- Recognize right triangles in real-world contexts and use trigonometric ratios to find side lengths or angle measures.

Math 2: Algebra II

- Model relationships from a context as equations and inequalities.
- Solve compound linear inequalities with implied or explicit “and” and “or” connectors.
- Solve linear inequalities containing absolute value.
- Solve systems of equations in 3 variables.
- Identify solutions to systems of equations and inequalities from a graph.
- Find maximum and minimum values of a linear function over a region defined by linear inequalities.
- Solve quadratic equations and inequalities; understand different methods.
- Interpret the discriminant.
- Solve quadratic equations with complex number solutions.
- Perform operations with complex numbers.
- Solve quadratic systems.
- Recognize functions as compositions of other functions, in particular for translation and reflection, and connect to graphs.
- Classify conic sections from their equations in standard form.
- For circles and parabolas, translate between equations, graphs, and descriptions in terms of the characteristics.
- For a polynomial function, determine or approximate zeros, local minima and maxima, domain, and range.
- Relate factors, solutions, zeros, and intercepts.
- Determine the number and multiplicity of rational zeros for a polynomial function.

- Find all rational zeros of a polynomial function.
- Manipulate rational expressions and solve rational equations.
- Manipulate expressions with rational exponents and radicals.
- Solve equations expressed in terms of rational exponents and radicals.
- Identify graphs of exponential and logarithmic functions.
- Convert equations between exponential and logarithmic form.
- Apply the law of sines and law of cosines.
- Find the measure of angles in standard position in degrees or radians.
- Find values of sine and cosine functions for general angles and relate to coordinates on the unit circle.
- Model relationships with sine and cosine functions and their transformations.
- Find and interpret domain, range, period, and amplitude for sine and cosine functions and their transformations.
- Determine the number of ways an event can happen using counting techniques such as the Fundamental Counting Principle, permutations, and combinations.
- Find probabilities using properties of events including independence and mutual exclusivity.
- Solve problems involving conditional probability.
- Represent sample spaces and events in terms of unions, intersections, and complements and use these relationships to find probabilities of compound events.
- Find terms and term-positions in arithmetic and geometric sequences.
- Interpret sigma notation and find sums of finite arithmetic and geometric sequences.
- Add, subtract, and multiply matrices.
- Calculate determinants of 2×2 and 3×3 matrices.
- Find the inverse of 2×2 matrices.
- Use inverse matrices to solve systems of linear equations.

Math 2: Precalculus

- Identify and graph piecewise-defined functions including greatest integer, step, and absolute value functions.

- Find inverses (or partial inverses) and transformations of various functions including polynomial, rational, radical, absolute value, and trigonometric.
- For ellipses and hyperbolas, translate between equations, graphs, and descriptions in terms of the characteristics.
- Solve systems of conics.
- Solve polynomial equations exactly or approximately to find rational, real, and complex solutions; understand different methods.
- Identify polynomial functions and graphs given characteristics such as degree, sign of lead coefficient, zeros, and multiplicities.
- Classify functions as even, odd, or neither; identify symmetry.
- Expand polynomials or find terms using the binomial theorem and Pascal's triangle.
- Use limits to approximate the slope of a curve at a point.
- Use limits to approximate the area under a curve.
- Identify rational functions and graphs given characteristics such as intercepts, symmetry, asymptotes, and removable discontinuities.
- Find characteristics of rational and radical functions such as intercepts, symmetry, asymptotes, removable discontinuities, domain, and range.
- Evaluate exponential functions and use properties of exponents to rewrite in different forms.
- Evaluate logarithmic functions, including those with base e , and use properties of logarithms to rewrite in different forms.
- Solve exponential and logarithmic equations and real-world problems such as compound interest and exponential growth/decay.
- Identify graphs of trigonometric functions and characteristics such as period, amplitude, amount of stretch, phase shift, vertical translation, and midline.
- Use and interpret trigonometric identities including double-angle and half-angle, sum and difference, and $\sin^2(x) + \cos^2(x) = 1$.
- Identify and graph inverse sine, cosine, and tangent functions and use them to solve trigonometric equations.
- Determine quartiles and interquartile range of a set of data.
- Understand and apply the concepts of standard deviation and z-scores to data sets.
- Estimate population characteristics based on samples.

- Recognize different types of sampling procedures and identify strengths and limitations.
- Use properties of the normal distribution to approximate percent of data within a given interval.
- Find the sum of an infinite geometric series.
- Determine or approximate the limit of an infinite sequence or determine that it does not exist.
- Interpret arguments that use mathematical induction.
- Use matrices as transformations of the plane.
- Find the reduced row-echelon form of an augmented matrix to solve systems of equations.
- Graph polar functions and points in the polar coordinate plane.
- Convert points and functions between rectangular and polar forms.
- Find powers and roots of complex numbers in polar form using De Moivre's theorem.
- Find the magnitude and direction of a vector.
- Identify the results of vector addition, subtraction, and scalar multiplication with coordinates and graphically.
- Resolve a vector into horizontal and vertical components.
- Find the angle between vectors using the dot product.
- Solve real-world problems involving vector displacements such as path of airplane in wind.
- Identify parametric equations of lines and graphs of parametric equations.

Mapping to the ACT Test:

AIST—Math 1 and 2

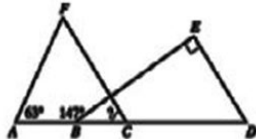
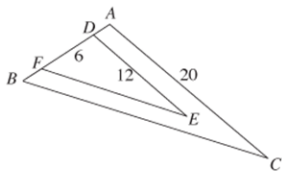
ACT international subject tests are end-of-course assessments that rigorously measure your understanding of content and practices in each subject. The tests are derived from items and research on ACT QualityCore tests, and have a score scale that links directly to the ACT test. In addition to measuring whether you've mastered ACT course standards, these tests predict success in postsecondary courses.

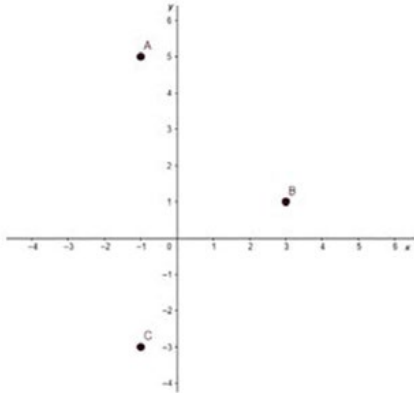
Example Content: AIST—Math 1 and 2

This table lists content on the international subject test, example test questions on the content, and skills the questions assess.

Test Content	Example Test Questions	What Example Test Questions Assess
Algebra I - Evaluate functions at given values. - Find rate of change in a function and connect this to slope for linear functions. - Add, subtract, and multiply monomials, binomials, trinomials, and polynomials. - Find domain and range.	1. What is the value of the function $f(x) = \frac{2}{x} + \frac{3}{x^2} + \frac{4}{x^3}$ when $x = 5$? A. $\frac{3}{5}$ B. $\frac{3}{10}$ C. $\frac{29}{30}$ D. $\frac{69}{125}$ 2. What is the rate of change in the equation $\frac{3}{5}y + 2x = 10$? A. $-\frac{10}{3}$ B. $\frac{3}{5}$ C. 2 D. 5	1. To answer this question correctly, you must understand function notation and must be able to apply properties of fractions and exponents to find the correct value. The answer is <i>D</i>. 2. You must be familiar with the structure of linear equations and be able to rearrange them algebraically using properties. You must understand that the rate of change of a linear equation is the slope. The answer is <i>A</i>.

Test Content	Example Test Questions	What Example Test Questions Assess
	3. What is the product of $x + 2y + z$ and $2z^2 + 1$? A. $x + 2y + 2z^3 + 1$ B. $2xz^2 + 4yz^2 + 2z^3 + 1$ C. $2xz^2 + 4yz^2 + 2z^3 + x + 2y + z$ D. $2xz^2 + 4yz^2 + 2z^2 + x + 2y + z$	3. In this question, you must recognize that the distributive property of multiplication can be applied to polynomials and work through the algebraic steps. Careful work will be required to determine the correct coefficients for each term in the product. The answer is C.
	4. Give the domain and range of the function $f(x) = \frac{1}{\sqrt{4x-16}}$. A. Domain: $(-\infty, \infty)$ Range: $(0, \infty)$ B. Domain: $(0, \infty)$ Range: $(0, \infty)$ C. Domain: $(4, \infty)$ Range: $(-\infty, \infty)$ D. Domain: $(4, \infty)$ Range: $(0, \infty)$	4. This question tests your understanding of domain and range as well as strategies for finding them. You may approach this algebraically while others will find the domain and range graphically. The answer is D.

Test Content	Example Test Questions	What Example Test Questions Assess
Geometry • Use angle relationships to solve problems and draw conclusions. • Identify similar figures and use ratio-and-proportion reasoning to solve mathematical and real-world problems, including situations with a geometric-mean relationship such as a right triangle and its altitude. • Use coordinates to solve problems about geometric figures, including the effects of reflections, rotations, translations, and dilations.	1. In the figure below, A, B, C, and D are collinear, segment FC is parallel to segment ED, segment BE is perpendicular to segment ED, and the measures of angle FAB and angle FBA are as marked. What is the measure of angle FCB?  A. 33° B. 57° C. 63° D. 84° 2. In the figure below, angle ABC is congruent to angle DFE, angle BAC is congruent to angle FDE, D and F are on segment AB, segment AD is congruent to segment FB, and distances in centimeters are as shown. What is the length of segment AD, in centimeters?  A. 4 B. 3 C. 2 D. 1	1. In this question, you need to identify angle relationships in two overlapping triangles. Careful work will be required to solve for the desired angle. The answer is B. 2. You must first identify that these two nested triangles are similar in order to approach this question. You will need to find the similarity ratio and apply it to the missing sides. The answer is C.

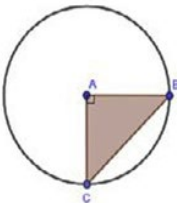
Test Content	Example Test Questions	What Example Test Questions Assess
Write equations for circles in standard form and solve problems using equations and graphs.	3. Which of the following is an equation of the circle with its center at (0,0) that passes through (3,4) in the standard (x,y) coordinate plane? A. $x - y = 1$ B. $x - y = 25$ C. $x^2 + y^2 = 25$ D. $x^2 + y^2 = 5$ 4. What is the equation of a circle going through A, B, and C?  A. $x^2 + y^2 = 16$ B. $(x + 1)^2 + (y - 1)^2 = 4$ C. $(x - 1)^2 + (y + 1)^2 = 4$ D. $(x + 1)^2 + (y - 1)^2 = 16$	3. In this question, you should be familiar with the structure of circle equations in order to identify which equation fits the criteria. If you're unfamiliar with the structure, you may notice that (3,4) will be a solution to the equation and find the correct answer by substitution. The answer is C. 4. This question requires you to construct the equation of a circle using strategies in the coordinate plane. You will need to find the center and radius of a circle going through the 3 given points and then apply those properties to the equation. The answer is D.

Test Content	Example Test Questions	What Example Test Questions Assess
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- Find geometric probability and draw conclusions.
- Recognize right triangles in real-world contexts and use trigonometric ratios to find side lengths or angle measures.

5.

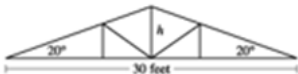
A point will randomly be selected in the area of Circle A. Points B and C are on the circle. Angle A is a right angle. What is the probability the point will also be in the area of triangle ABC?



- A. $\frac{1}{4}$
- B. $\frac{1}{2\pi}$
- C. $\frac{r}{4\pi}$
- D. $\frac{1}{\pi r^2}$

6.

Which of the following expressions is the closest approximation to the height h , in feet, of the roof truss shown



- A. $15 \tan 20^\circ$
- B. $15 \sin 20^\circ$
- C. $30 \tan 20^\circ$
- D. $30 \sin 20^\circ$

5. This question combines a simple probability situation with a geometric context. You must be comfortable with defining unknowns since no concrete length measurements are given. You need to use your understanding of probability as a fraction of desired outcomes over possible outcomes and apply it to area concepts. The answer is B.
6. This question requires you to apply trigonometric ratios to a real-world situation to generate an expression for a missing side in the figure. The answer is A.

Test Content	Example Test Questions	What Example Test Questions Assess
Algebra II • Model relationships from a context as equations and inequalities. • Perform operations with complex numbers.	1. Hunter's Transport Company has 7 trucks that can haul 6 tons each, 5 trucks that can haul 10 tons each, and 9 drivers. The company has a contract to transport 360 tons of gravel per day to a road construction site. The 6-ton trucks can make 8 trips a day, while the 10-ton trucks can make 6 trips a day. A 6-ton truck costs \$30 per day, and a 10-ton truck costs \$42 per day. If all 9 drivers work on this job, using how many trucks of each type will minimize the cost? A. Four 6-ton trucks and five 10-ton trucks B. Five 6-ton trucks and four 10-ton trucks C. Six 6-ton trucks and three 10-ton trucks D. Seven 6-ton trucks and two 10-ton trucks 2. If $c - d = 7$ and $c = 3 - 4i$, what is d? A. $-4 - 4i$ B. $-4 + 4i$ C. $4 - 4i$ D. $4 + 4i$	1. This question will test your ability to make sense of a complex real-world situation where a system will enable a solution path. You must demonstrate solid mathematical practices to create the system and work through the solution process. The answer is <i>D</i>. 2. You will demonstrate your proficiency with operations and substitution with complex numbers in this question. The answer is <i>A</i>.

Test Content	Example Test Questions	What Example Test Questions Assess
- Manipulate expressions with rational exponents and radicals. - Find values of sine and cosine functions for general angles and relate to coordinates on the unit circle.	3. What is the value of $\left[8\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)\right]^{\frac{2}{3}}$? A. $1 + i\sqrt{3}$ B. $2(1 + i\sqrt{3})$ C. $2(\sqrt{3} + i)$ D. $4(1 + i\sqrt{3})$	3. Simplifying this expression will require you to have an understanding of the unit circle applied to trigonometric functions as well as the properties of rational exponents. The answer is <i>B</i>.
Precalculus Find the sum of an infinite geometric series.	1. Which of the following is the value of the expression $\sum_{n=1}^{\infty} \frac{1}{2}(-3)^{-n}$? A. $-\frac{1}{4}$ B. $-\frac{1}{8}$ C. $\frac{1}{8}$ D. $\frac{3}{4}$	1. You will need to use your understanding of infinite series to determine the value of this expression. Many will use the formula for an infinite geometric series while some may use convergence concepts with partial sums. The answer is <i>B</i>.

Test Content	Example Test Questions	What Example Test Questions Assess
Evaluate logarithmic functions, including those with base e, and use properties of logarithms to rewrite in different forms.	2. Which of the following expressions is equivalent to $\log_b a^3 - \log_b a^2$? A. $\log_b a$ B. $\log_b a^5$ C. $\log_b a^6$ D. $\log_b a^{\frac{3}{2}}$	2. In this question, you will need to apply the properties of logarithms by noticing that the two bases, while being unknown, are the same. The answer is A.

Preparing for the Test:

AIST—Math 1 and 2

The most important consideration for preparing to take the math international subject tests will be to complete rigorous assignments that are aligned to standards and cover the topics measured on each test.

Topic-based study group: Think about forming a study group with your peers to review and to discuss the Math 1 and 2 topics listed in this section. Then provide for yourselves plenty of opportunities to study, review, and then explain each topic to each other.

Computer tools: Consider using a computer on which you can apply what you've learned in a digital space:

- **Graphing software:** Use tools such as graphing software to strengthen coordinate plane and geometric concepts.
- **Spreadsheets:** Spreadsheets are an important skill for college and career success. Excel and Google Sheets are great computer tools that allow you to work collaboratively with your peers to learn how to develop your spreadsheet skills.
- **Programming:** Many introductory programming exercises are based in math concepts and can be used as a way to reinforce variable and function concepts. For example, one assignment could involve writing a program that will apply the quadratic formula for given values of a , b , and c . This will demonstrate to you and your peers the value of functional thinking and save some tedious calculation time by using a computer, and it can be very rewarding to use a program that you yourself create in order to make your work go more quickly.
- **Statistics:** Statistical concepts are also an excellent fit for a computer since you can use tools used by real statisticians such as the R programming language, as well as real data sets that are far too large to compute with by hand.

Below are some additional ideas to strengthen key areas for each test.

Math 1

As a foundation for all topics on the Math 1 test, you should have:

- **Number sets:** A solid understanding of the basic properties of various number sets such as integers, rational numbers, and real numbers.
- **Order of operations:** A mnemonic or other method of remembering order of operations so you can apply it to complicated expressions.
- **Variables:** A complete understanding of what variables are and how we can use them to represent numbers and generalize situations.
- **Coordinate planes:** Experience working with coordinate planes and the ability to visualize problems in the coordinate plane.

Examining real-world linear modeling: To deepen your understanding of the purpose of studying linear equations, locate real-world examples of linear modeling being used. Linear modeling is one of the most widely used models, so there are plenty of real-world examples of both accurate and inaccurate usage. Try to find both accurate and inaccurate cases so you can think critically about flaws, assumptions, and simplifications in those models.

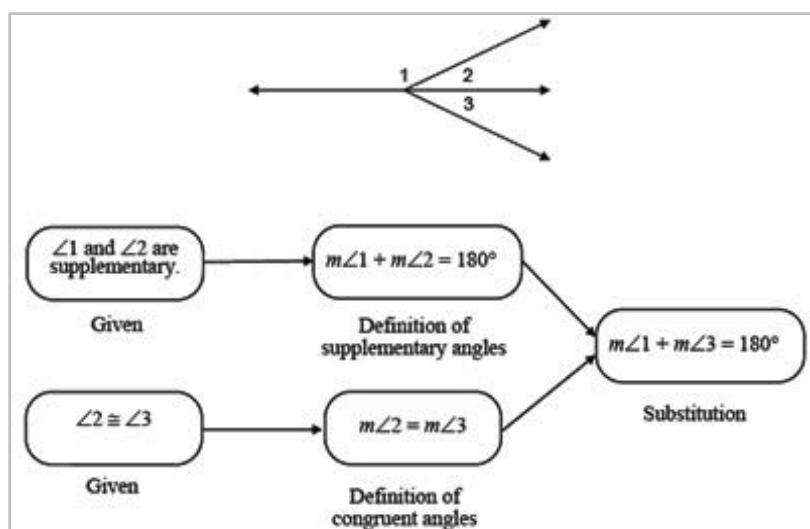
Predicting relationships with parameters of equation: Be able to explain what the different parameters of equations indicate and use them to predict relationships such as parallel and perpendicular lines. Practice with graphing software such as GeoGebra or Desmos when possible because this allows you to experiment quickly and build intuition around these concepts.

Declaring number properties in proof exercises: For radical and rational equations and functions, it's important for you to have a solid grasp on some of the basic number properties, particularly integers and fractions. Spend time reviewing integer multiples, factoring, simplifying fractions, and using exponent properties, including fractional and negative exponents.

- A common issue on the math international subject tests arises when you apply false properties to expressions, such as canceling variables when not appropriate, for example concluding $(x+2)/(x-1) \rightarrow -2$. One way to address this is to practice two-column proof exercises where you must declare your steps using named or written

properties. This technique will be helpful as you practice writing Geometry proofs as well.

Using tools to create logic chains: Be familiar with the terms *converse*, *inverse*, and *contrapositive* and be able to apply them to both mathematical and non-mathematical statements. Internet articles are a rich source of non-mathematical statements for critiquing logic. Practice creating logic chains with tools such as the two-column proof and flow chart formats. Geometry proofs are the course objective but include algebraic statements and non-mathematical logic chains for variety.



Decomposing shapes: Practice solving a wide variety of plane geometry problems since there are many relationships that you need to be familiar with. With your study group, walk through proofs of some of these plane geometry problems as a way to understand more complicated situations. Being able to decompose shapes is critical so that you won't get overwhelmed if asked to decompose a shape on the test itself.

Using manipulatives for intuiting congruence: For congruence, use physical or digital manipulatives as much as possible to build your intuition. You should also be able to think of relationships between objects without measurement using geometry concepts. Euclid's classic text, *The Elements*, is an excellent source for demonstrating geometric concepts without measurements.

Writing equivalent forms: You should be able to understand the effects of reflections, rotations, translations, and dilations algebraically—e.g., a point at (a,b) reflected across the y -axis goes to $(-a,b)$. This is another topic where taking the time to practice writing the equivalent forms will help you better understand the concept.

Math 2

Demonstrating usefulness: Practice graph visualizations to help you to understand the complex plane as an extension of the standard (x,y) coordinate system. Apply what you learn to specific problems, such as finding the total voltage of alternating current circuits so you can see that these concepts are useful. This approach should also be taken with vectors and matrices. The physics of motion is an excellent demonstration of the usefulness of vectors and computer network graphs can be a very interesting application of matrices.

Applying various models to real-world situations: Real-world applications are also useful for introducing exponential, logarithmic, and periodic models. Try to find and examine different real-world situations where a model is needed and determine whether to apply a linear, quadratic, exponential, logarithmic, periodic, or some other kind of model. Demonstrate the best answers with data. This can be a good research task to work on with your study group: One student tries to predict the answer intuitively, one student studies the factors of the situation, and one student finds previously developed models for that situation to compare results.

Expressing limits graphically: In precalculus, limits can be a challenging topic conceptually. Practice demonstrating the concept graphically. Don't be afraid to rewrite expressions in different forms. Finding clever ways to solve limits can pay off on the test.

Implementing ideas in a real-world way: Engage in the techniques and use the tools of real-world mathematics. Practice using spreadsheets, a computer algebra system, or a programming language to implement some of the ideas you have learned in your math courses.

Resources

- Applications: [3 Act Math](#)

- Graphing software: [GeoGebra](#), [Desmos](#)
- Mathematical reference: [Wolfram Mathworld](#), [Wolfram|Alpha](#)
- Math exercises: [Khan Academy](#)
- Computer Algebra systems: [SageMath](#)
- Programming exercises: [Codecademy](#)
- Data sets and statistical questions: [Kaggle](#)
- Drawing tools: [drawio.com](#)

