

The Research-
Driven Solution
to Raise the
Quality of High
School Core
Courses

QualityCore[®]



Biology

End-of-Course Test Blueprint



Test Blueprint QualityCore® End-of-Course Assessment Biology

The QualityCore® End-of-Course (EOC) system is modular, consisting of either two 35–38 item multiple-choice components or one 35–38 item multiple-choice component combined with a constructed-response component. This approach to measuring achievement of ACT Course Standards allows users to select the configuration that best meets their particular needs, while still receiving scores on a standardized QualityCore scale.

The EOC Test Blueprint tables below show how the test items are distributed across reporting categories and depth-of-knowledge levels. The tables display ranges of the percentages of operational multiple-choice items and the number of operational constructed-response items per test. Sample standards by reporting category are provided, along with definitions of the depth-of-knowledge thinking processes covered by the assessment. The constructed-response scoring guide is also presented.

Reporting category	Percent of multiple-choice items	Number of constructed-response items
Biology Process (A.1–A.4*)	10–20	—
Biochemistry; Cell (A.5–B)	20–35	1
Genetics; Evolution (C, D)	25–40	1
Animal/Plant Systems and Ecology (E, F)	25–40	1
Total	100	3

* Code indicates specific ACT Course Standards with which the reporting category is aligned.

Depth of Knowledge	Percent of multiple-choice items	Number of constructed-response items
Level 1 — Recall	15–30	—
Level 2 — Skill/Concept	40–60	—
Level 3 — Strategic Thinking	15–30	3
Total	100	3

Sample ACT Course Standards by Reporting Category

Biology Process

- Demonstrate knowledge of inquiry techniques
- Use mathematics and measurement; use graphical and mathematical models
- Identify criteria necessary to characterize life; define biological organization levels

Biochemistry; Cell

- Describe atomic structure, bonding between atoms, organic and inorganic compounds, enzymes, and ATP
- Explain properties of water and describe pH of a solution
- Identify cell types and describe functions of cellular organelles
- Describe movement of substances into and out of cells
- Describe cellular respiration
- Describe cell division and mitosis

Genetics; Evolution

- Describe basic structure and function of DNA, RNA, and proteins
- Describe meiosis
- Use correct terminology when working with genetic crosses
- Define evolution and theory of natural selection
- Identify requirements to be a species
- Explain shared evolutionary relationships between organisms

Animal/Plant Systems and Ecology

- 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
- Describe energy flow through ecosystems using food webs, food chains and pyramids
- Describe population growth patterns and carrying capacity
- Explain ecological succession

Thinking Processes

ACT uses the depth-of-knowledge (DOK) levels (Webb, 2002) to describe the thinking processes assessed by the EOC tests. Webb developed descriptions of the DOK levels specifically for science. He noted that some action verbs, such as “explain,” “describe,” and “interpret,” can be classified at different levels, depending on the object of the action.[†]

Level 1: Recall requires the recall of information such as a fact, term, definition, or simple procedure. Students must demonstrate a rote response or perform a simple procedure. Level 1 items require students to:

- Recall or recognize information, such as a fact, term, or property
- Represent in words or diagrams a scientific concept or relationship
- Provide or recognize a standard scientific representation for a simple phenomenon

Level 2: Skill/Concept requires mental processing that goes beyond recalling or reproducing an answer. Students must make some decisions about how to approach a problem. The cognitive demands are more complex than in Level 1. Level 2 items require students to:

- Specify and explain the relationship between facts, terms, properties, or variables
- Describe and explain examples of science concepts
- Select a procedure according to specified criteria and perform it

[†] Webb, Norman L. (2002). Depth-of-Knowledge Levels for Four Content Areas. Retrieved from <http://facstaff.wcer.wisc.edu/normw/All%20content%20areas%20%20DOK%20levels%2032802.doc>

- Formulate a routine problem given data and conditions
- Organize, represent, and interpret data

Level 3: Strategic Thinking requires planning, thinking, explaining, justifying, using evidence, conjecturing, and postulating. The cognitive demands are complex and abstract, going beyond Level 2. Level 3 items require students to:

- Identify research questions and design investigations for a scientific problem
- Solve nonroutine problems using multiple concepts
- Develop a scientific model for a complex situation
- Form conclusions from experimental data or observations
- Interpret information from complex graphs
- Cite evidence and develop logical arguments
- Explain phenomena in terms of concepts

QualityCore Science Constructed-Response Holistic Scoring Guide

For each of the three constructed-response items, a score (ranging from 1 to 4) is given using this scoring guide. No score is given to an essay that is blank, off-topic, illegible, or written in another language.

Score of 4: A response at this level provides evidence of thorough knowledge and understanding of the subject matter.

- The content of the response is correct and thorough, with no significant errors.
- The response contains elaboration and/or detail that demonstrates insight into scientific concepts and principles, and contains no misconceptions.
- The explanation in the response is clear and is enhanced by correct use of appropriate scientific terminology to communicate understanding.

Score of 3: A response at this level provides evidence of competent knowledge and understanding of the subject matter.

- The content of the response is generally correct and complete.
- The response contains some elaboration and/or detail that demonstrates sufficient understanding of scientific concepts and principles, and it may contain a few minor misconceptions.
- The explanation in the response is mostly clear and is supported by some correct use of appropriate scientific terminology to communicate understanding.

Score of 2: A response at this level provides evidence of basic knowledge and understanding of the subject matter.

- The content of the response is partially correct, and it may be incomplete.
- The response contains a little elaboration and/or detail to demonstrate some understanding of scientific concepts and principles, but it may contain some significant misconceptions.
- The explanation in the response is sometimes clear and sometimes demonstrates correct use of appropriate scientific terminology to communicate understanding.

Score of 1: A response at this level provides evidence of minimal knowledge and understanding of the subject matter.

- The content of the response is mostly incorrect, and it is incomplete.
- The response contains little or no elaboration and/or detail to demonstrate understanding of scientific concepts and principles, and it contains evidence of significant misconceptions.
- The explanation in the response is mostly unclear and demonstrates little or no correct use of appropriate scientific terminology to communicate understanding.

ACT endorses the *Code of Fair Testing Practices in Education* and the *Code of Professional Responsibilities in Educational Measurement*, guides to 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*. A copy of each *Code* may be obtained free of charge from ACT Customer Services (68), P.O. Box 1008, Iowa City, IA 52243-1008, 319/337-1429.