

Instructional Guidance based on Student Performance on the Spring 2014 Science Tests

Science
Standards of Learning

End-of-Course, Earth
Science, Biology, and
Chemistry



Presentation may be paused and resumed using the arrow keys or the mouse.

Section 1: Earth Science

Section 2: Biology

Section 3: Chemistry

Click on a link to navigate to a specific content area.

Earth Science: Areas Needing Improvement

Students had difficulty with items that require at least a two-step analytic process.

Students had difficulty with items that require fine discrimination of related concepts and using the application of those concepts to answer a question.

Students had difficulty with items that required using a “big-picture” understanding (residual knowledge) of a unified understanding of Earth Science concepts.

Earth Science: Areas Needing Improvement

Students had difficulty with items that require a broad understanding of the unifying role of convection across areas of the Earth science including Earth's interior, the atmosphere, and oceans. (SOL ES.7, ES.10 and ES.12)

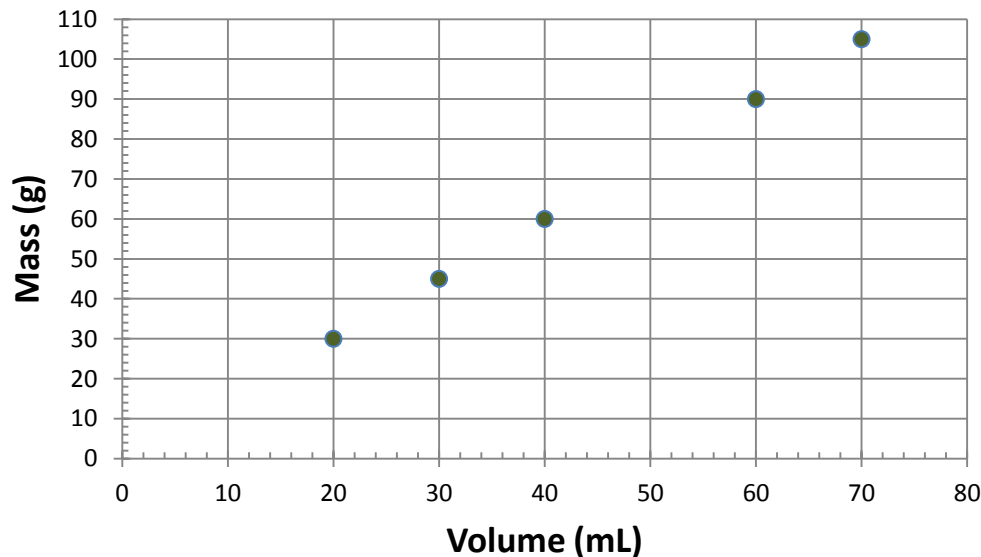
Students had difficulty with items that require a deeper understanding of Earth-materials (rocks, minerals, and fossils). (SOL ES.4, ES.5, ES.9)

Students had difficulty with items related to cross sections of rock sequences and interpreting the order of geologic events from diagrams. (SOL ES.2, ES.5, ES.7, ES.9)

Earth Science Example Item

There are five beakers, each containing a different volume of the same liquid. This graph shows the mass of the liquid in each beaker at a constant temperature.

Density of a Liquid



What is the approximate density of the liquid?

1.5 g/mL

Earth Science Example Item

Using the list of organisms shown, match the organism to the geologic time in which it first appeared.

Geologic Time	Organism
Cenozoic	Humans
Mesozoic	Dinosaurs
Paleozoic	Arthropods (shrimp and crab-like animals)
Precambrian	Multicellular organisms

List of Organisms

Humans	Arthropods (shrimp and crab-like animals)
Multicellular organisms	Dinosaurs

Earth Science Example Item

Which is a characteristic of all foliated metamorphic rocks?

- a. They are composed primarily of quartz and calcite.
- b. They have a higher density than igneous rocks.
- c. They have layers or bands of recrystallized minerals.
- d. They have a dull luster due their grainy texture.

Earth Science Example Item

Identify this type of rock.



Image courtesy of [Minerals Education](#).

- a. granite
- b. sandstone
- c. shale
- d. conglomerate

Earth Science Example Item

The point at the surface of the Earth directly above where an earthquake originates is called the –

- a. focus
- b. epicenter
- c. seismic zone
- d. strike-slip fault

Earth Science Example Item

Which of these is a major mechanism of energy transfer in the oceans, atmosphere, and Earth's interior?

- a. convection
- b. subduction
- c. ionization
- d. stratification

Biology: Areas Needing Improvement

Students had difficulty with items that require at least a two-step analytic process.

Students had difficulty with items that require fine discrimination of related concepts and using the application of those concepts to answer a question.

Students had difficulty with items that required using a “big-picture” understanding (residual knowledge) of a unified understanding of Biology concepts.

Biology: Areas Needing Improvement

Students had difficulty with items that required application of science processes and practices such as determining the materials to use in a laboratory and making observations and inferences. (BIO.1)

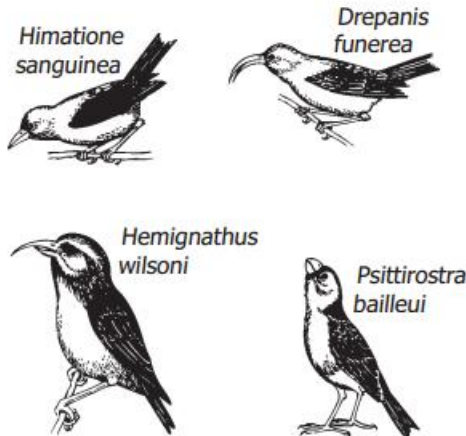
Students had difficulty with items that required understanding and application of biological concepts such as energy flow in an ecosystem and the application of Chargaff's rule. (BIO.5., BIO.8)

Students had difficulty with items that required the differentiation between chemical structures or organisms. (BIO.2, BIO.4)

Biology: Example Item

Which statement is an inference based on the images of these Hawaiian Honeycreeper birds?

Hawaiian Honeycreepers



- a. These birds have varying beak lengths.
- b. *Psittirostra bailleui* has a short beak.
- c. The tails of *Himatione sanguinea* and *Drepanis funerea* are of similar length.
- d. *Drepanis funerea* and *Hemignathus wilsoni* likely feed on insects and nectar.

Biology: Example Item

Which three materials are most likely NOT needed when preparing a wet mount slide of an onion root tip?

bunsen burner

cover slip

dye solution

litmus paper

onion root tip

pipette

slide

test tube

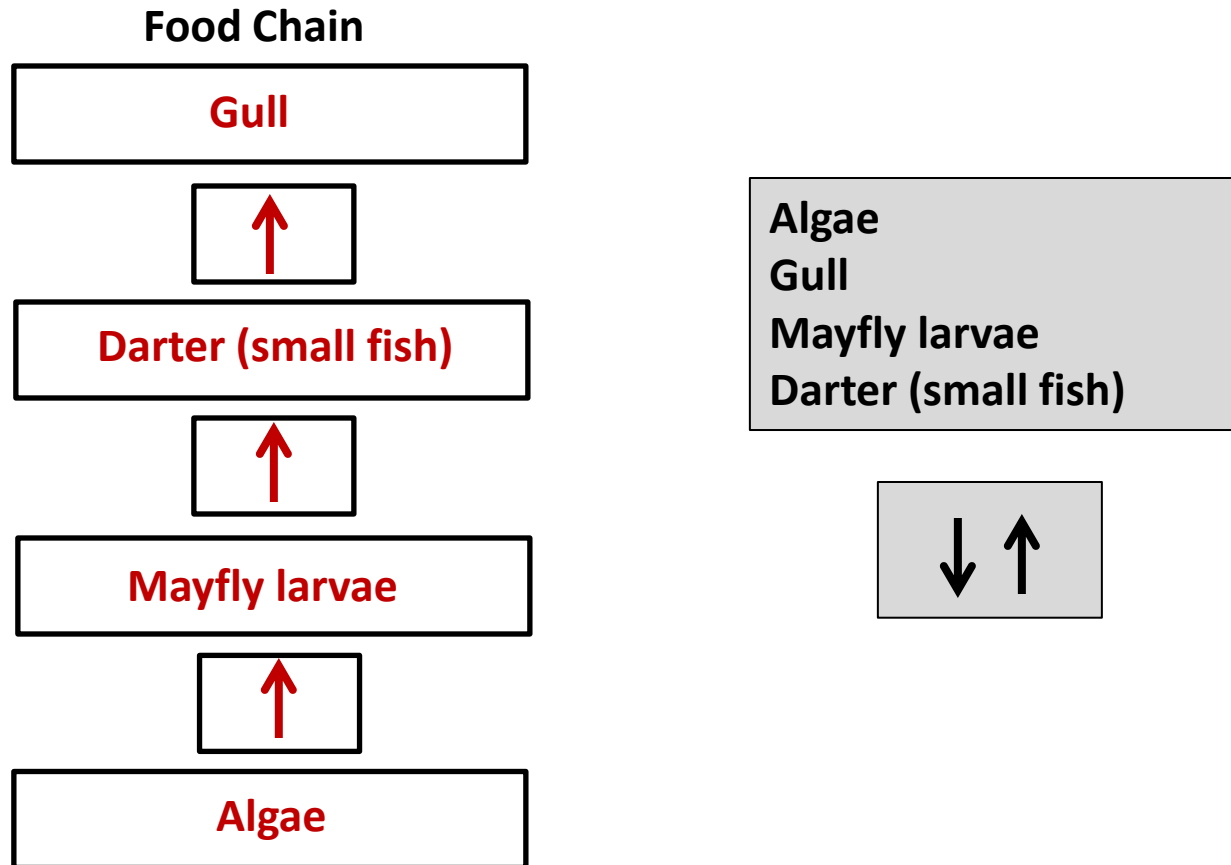
forceps

water



Biology: Example Item

Create a food chain using the organisms shown in the list. Indicate energy flow using the arrows. The producer should be at the bottom of the food chain.



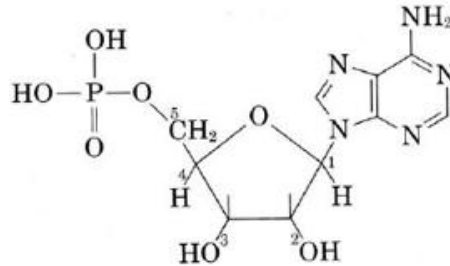
Biology: Example Item

A segment of DNA has 28% cytosine and 28% guanine. A scientist used Chargaff's rule to determine the percentages of adenine and thymine in a chromosome. What percentages of adenine and thymine are in the chromosome?

Adenine: %

Thymine: %

Biology: Example Item



The molecule shown is a component of macromolecules that directly function to serve as the genetic code. These macromolecules belong to which group?

- a. Lipids
- b. Proteins
- c. Carbohydrates
- d. Nucleic acids**

Biology: Example Item

Which statement is true about viruses and animal cells?

- a. Viruses and animal cells are both complete, living organisms.
- b. Viruses and animal cells both reproduce by mitosis.
- c. Viruses and animal cells both contain mitochondrion.
- d. Viruses and animal cells both contain genetic code in nucleic acid.

Chemistry: Areas Needing Improvement

Students had difficulty with items that require at least a two-step analytic process.

Students had difficulty with items that require fine discrimination of related concepts and using the application of those concepts to answer a question.

Students had difficulty with items that required using a “big-picture” understanding (residual knowledge) of a unified understanding of Chemistry concepts.

Chemistry: Areas Needing Improvement

Students had difficulty with items that required them to convert to appropriate units before performing their calculations.

Students had difficulty with items that required understanding and application of chemistry concepts such as determining bond type and appropriately naming the compound.

Students had difficulty with items that required use a broad understanding of the multiple areas of chemistry and to some degree, previous learning.

Chemistry: Example Item

A gas in an expandable container has a volume of 318 mL at a temperature of 125°C. What is the volume of this gas at 228°C?

mL

Possible Answers:

400

400.

401

400.3

400.2

410

Chemistry: Example Items

An experiment produced 0.10 g CO₂ with a volume of 0.056 L at STP. If the accepted density of CO₂ at STP is 1.96 g/L, what is the approximate percent error?

A 110%

B 92%

C 71%

D 8.2%

Additional Practice:

The accepted density of a liquid is 1.25 g/mL. A chemist measures 13.3 g of the liquid in a volume of 10.0 mL during an investigation. What is the percent error from the investigation?

6.40%, 6.4%, 6.400%, 6.41%, 6.5%, 6.401%

Chemistry: Example Item

What is the name for the compound FeCl_2

- a. Iron(II) chloride
- b. Iron dichloride
- c. Iron(I) chloride
- d. Iron chloride

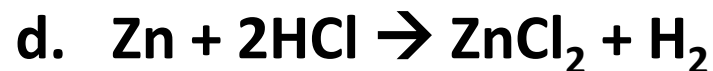
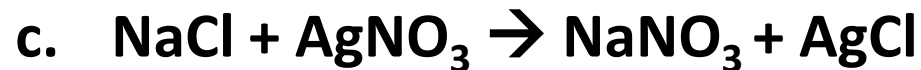
Chemistry: Example Item

When 45.0 g of water are vaporized at its boiling point of 100 C°, it requires 101.7 kJ of energy. What is the molar heat of vaporization of water in kJ/mol?

- a) .044 kJ/mol
- b) 2.26 kJ/mol
- c) 40.7 kJ/mol
- d) 253 kJ/mol

Chemistry: Example Item

In which chemical reaction does neutralization occur?



Practice Items

This concludes the student performance information for the spring 2014 end-of-course Earth Science, Biology, and Chemistry SOL tests.

Additionally, test preparation **practice items** for these tests can be found on the Virginia Department of Education Web site at:

<https://www.doe.virginia.gov/teaching-learning-assessment/student-assessment/sol-practice-items-all-subjects>

Contact Information

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