LESSON 4

Interpret Three-Dimensional Diagrams

Use with *Student Book* pp. 88–89

SCIENCE CONTENT TOPICS: ES.b.4, ES.c.3
SCIENCE PRACTICES: SP.1.a, SP.1.b, SP.1.c, SP.3.b, SP.3.d, SP.7.a

1 Review the Skill

A **three-dimensional diagram** shows the structure of something. Such diagrams may have sections cut away so that you can see what the inside of the object looks like. When you **interpret three-dimensional diagrams**, you can get information about an object's hidden layers and parts and thus understand it better. Familiar structures might look different in three-dimensional diagrams. Labels and callouts identify the parts of the diagram and explain how they are related.

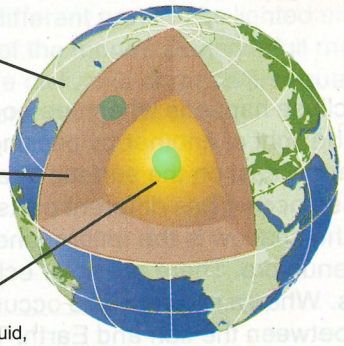
2 Refine the Skill

By refining the skill of interpreting three-dimensional diagrams, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Study the three-dimensional diagram below. Then answer the questions that follow.

a Labels identify and describe the parts of the object in the diagram. They are generally only a few words long and give the name or a brief description of a structure.

b Callouts are blocks of text that describe part of a figure in detail. They may describe how parts of an object work. Leader lines point from labels and callouts to parts of the diagram they identify or describe.

LAYERS OF EARTH



Crust
The crust is Earth's outermost layer. All living things on Earth live on or in the crust.

Mantle
The mantle is a thick layer of hot, solid rock. The rock in this layer is constantly flowing, even though it is solid.

Core
The core is the inner most layer of Earth. It is made up of iron and nickel. Part of it is liquid, and part of it is solid.

MAKING ASSUMPTIONS

A scale diagram is one in which the relative sizes of the parts of the diagram are the same as in real life. Unless a diagram states that it is to scale, assume that it is not.

1. Which interpretation can be made based on the diagram?

   A. The mantle layer can be seen from Earth's surface.
   B. The core is less dense than the mantle.
   C. Temperature inside Earth decreases with depth.
   D. The crust makes up only a minute portion of Earth.

2. The conclusion can be drawn that Earth's landforms are

   A. found only in Earth's mantle.
   B. located in the liquid part of Earth's core.
   C. part of Earth's crust.
   D. located in the solid part of Earth's core.

Spotlighted Item: **HOT SPOT**

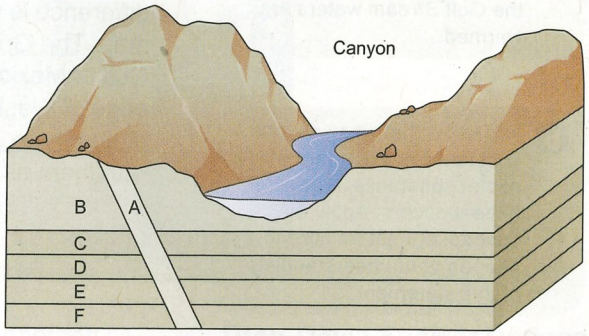
DIRECTIONS: Read the passage and question. Then answer by marking the appropriate hot spot or hot spots.

USING ROCK LAYERS TO FIND RELATIVE AGE

Before radiometric dating allowed scientists to determine the exact age of rocks, relative dating was their only tool. To tell the relative ages of rocks, they relied on the following principles:

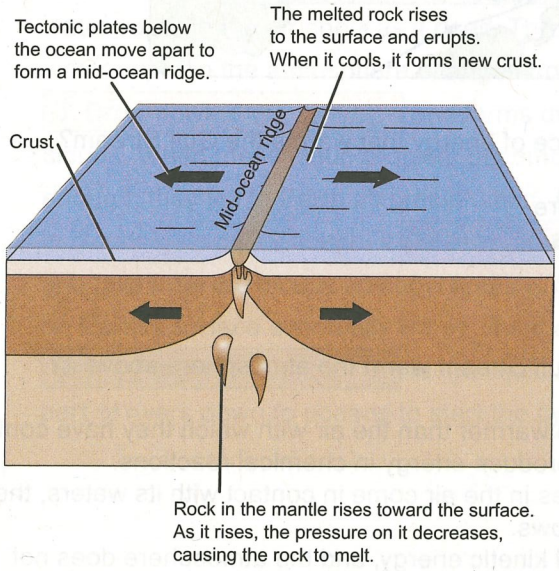
- In a sequence of undisturbed rock layers, each layer is older than the one above it.
- Layers of rock are deposited horizontally.
- Rock is deposited in continuing layers. If a layer is cut by a canyon or fault, the canyon or fault is younger than the rock it cuts across.
- Where one feature in rock cuts across another, the feature that is cut across is older.

12. The diagram shows a simple representation of layers of rock in a landform. Apply the principles for determining relative rock age to make an interpretation about the layers of rock represented. Mark an *X* on the letter of any feature of the rock that is younger than Feature D.



DIRECTIONS: Study the diagram, read each question, and choose the **best** answer.

CRUST FORMATION AT MID-OCEAN RIDGE



13. Based on the diagram, where does the rock that becomes new crust originate?

A. deep within the core
B. in the crust
C. in sediment far from the ridge
D. in the mantle

14. How is convection—heat transfer that occurs in liquids as particles from warmer areas move to cooler areas—involved in the crust-formation process represented in the diagram?

A. Heat is transferred from particles within the crust to particles within the mantle.
B. Melted rock from Earth's hot mantle rises to Earth's cooler surface.
C. Heat from a warmer tectonic plate is transferred to a cooler tectonic plate.
D. Particles in air above the surface of the ocean are heated by warmer particles in the ocean waters.

LESSON 4

Interpret Three-Dimensional Diagrams

SCIENCE CONTENT TOPICS: ES.b.4, ES.c.3
SCIENCE PRACTICES: SP.1.a, SP.1.b, SP.1.c, SP.3.b, SP.6.c, SP.7.a

1 Learn the Skill

Like cutaway illustrations, many **three-dimensional diagrams** show part of an object or a structure cut away so that the inside of the object is visible. Typically, these diagrams show layers or relationships among interior parts of a structure or an object. To **interpret three-dimensional diagrams**, pay attention to how the outside of the object relates to the inside features shown in the diagram and how the inside features relate to one another.

2 Practice the Skill

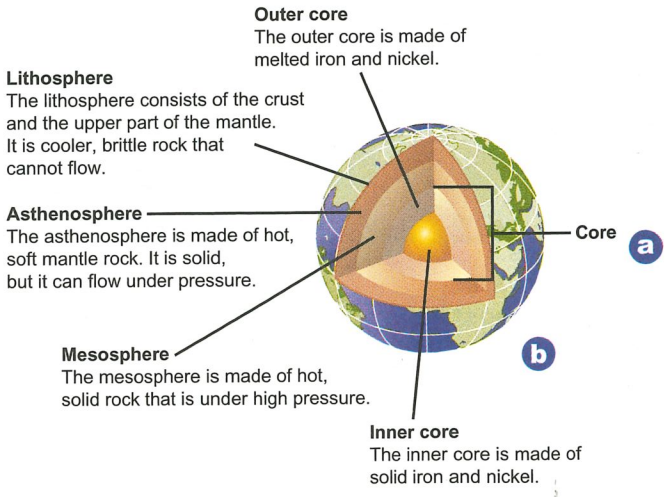
By practicing the skill of interpreting three-dimensional diagrams, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Study the three-dimensional diagram below. Then answer the question that follows.

EARTH'S LAYERS

Scientists think of Earth's structure in terms of layers, based on composition and physical strength. Related to the characteristic of composition, scientists identify three layers of Earth. The crust is made of rock that is not very dense. The mantle is made of denser, hotter solid rock. The core is made of iron and nickel. Related to the characteristic of physical strength, scientists identify Earth's layers differently, as shown in the diagram.

a Brackets are used to show that a label or callout applies to a region of a diagram.

b Diagrams often show an easily recognizable part of an object. This diagram shows continents. This frame of reference can help you figure out how the parts of the diagram are related.



TEST-TAKING TIPS

When examining a three-dimensional diagram on the GED® Test, first become familiar with its various parts before answering any questions about it.

1. Based on the passage and diagram, which statement describes layers of Earth?

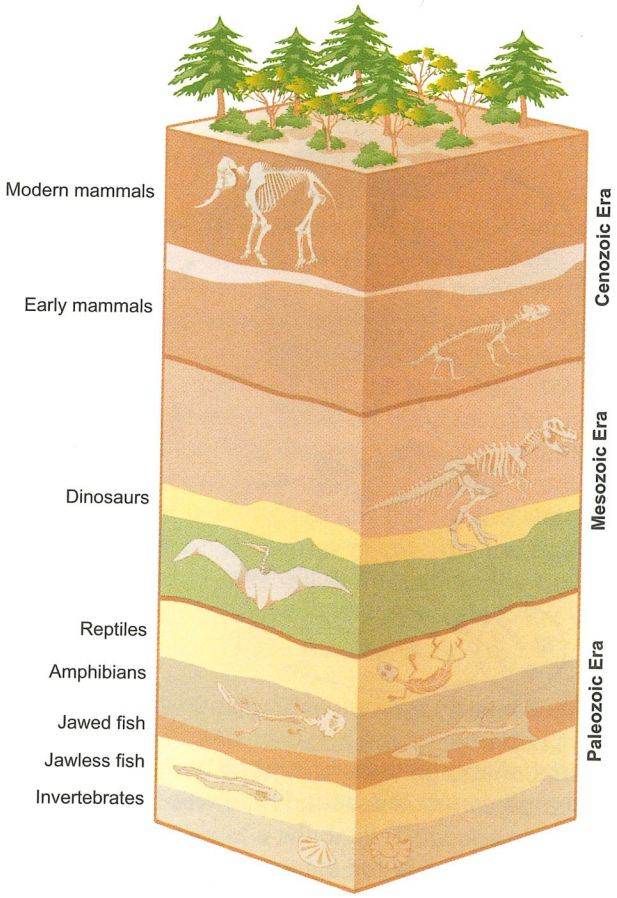
   A. The lithosphere is thicker than the crust.
   B. The inner core is cooler than the crust.
   C. The mantle and outer core are completely liquid.
   D. The lithosphere and asthenosphere have the same composition.

3 Apply the Skill

DIRECTIONS: Study the information and diagram, read the question, and choose the **best** answer.

DETERMINING AGES OF ROCKS

Scientists use observations of rock, radiometric dating, and fossils to determine the ages of rock layers. In an undisturbed column of rock, the oldest layer is at the bottom, and the youngest is at the top. The sequence of geological events, therefore, can be seen in the rock. The times in Earth's history when certain plants or animals lived is also known. Therefore, fossils found in rock, as demonstrated in the diagram, can help approximate the rock's age. Radiometric dating can identify the exact age of rock through the use of radioactive isotopes. Isotopes are forms of an element with the same number of protons but different numbers of neutrons. Some isotopes decay, or lose their radioactivity, at a different rate. When scientists know the amount of a radioactive isotope in a rock, the known rate of decay for the isotope, and the amount of the isotope and the product of its decay in a rock, they can pinpoint the age of the rock.



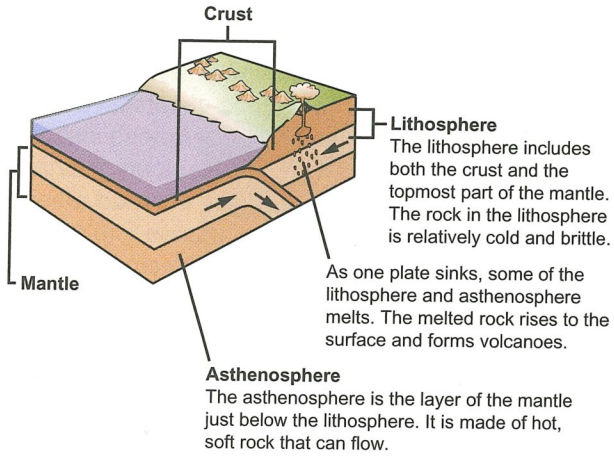
2. Based on the diagram, when in geologic time did jawless fish likely come into existence?

   A. the middle of the Paleozoic Era
   B. the end of the Paleozoic Era
   C. the middle of the Mesozoic Era
   D. the end of the Cenozoic Era

DIRECTIONS: Study the information and diagram, read the question, and choose the **best** answer.

TECTONIC PLATE MOVEMENT

Earth's crust is broken into several large pieces called tectonic plates. The tectonic plates move slowly—about as fast as fingernails grow. As the plates move, they collide, pull apart, or scrape past each other. The movements and interactions of tectonic plates are responsible for the formation of many landforms, such as mountains, and for most earthquakes and volcanic eruptions. The diagram relates tectonic plate movement to Earth's layers and formation of volcanoes.



3. Based on the diagram, what conclusion can be drawn about volcanoes?

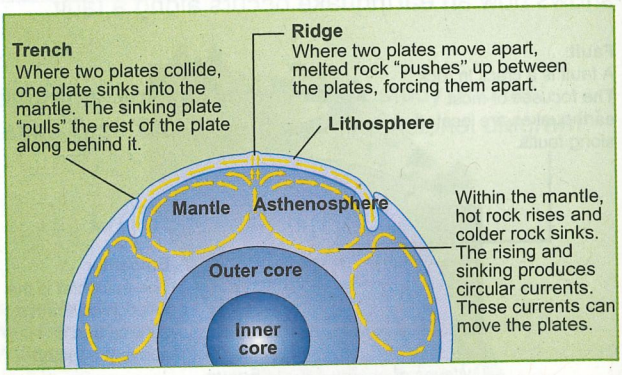
   A. Formation of volcanoes is unrelated to plate movement.
   B. Volcanoes form when the lithosphere melts.
   C. Most volcanoes are far from the ocean.
   D. The rock in a volcano comes mainly from the lowest part of the mantle.

3 Master the Skill

DIRECTIONS: Study the information and diagram, read each question, and choose the **best** answer.

MOVEMENT OF TECTONIC PLATES

Earth's crust is broken into several large pieces called tectonic plates. There are about 12 large plates and several smaller plates. These plates are constantly moving in different directions, as indicated by the diagram.



9. Based on the diagram, what causes tectonic plates to move?

   A. earthquakes that occur where plates collide
   B. friction between plates
   C. melted rock rising from the core
   D. motions of rock in the mantle

10. Based on the passage and diagram, tectonic plates are located in which of Earth's layers?

    A. lithosphere
    B. lower mantle
    C. asthenosphere
    D. outer core

11. What is a trench?

    A. It is the edge of a tectonic plate.
    B. It is the surface of a tectonic plate.
    C. It is the area where one plate moves under another.
    D. It is the area where two plates move apart.

LESSON 1

Understand Scientific Theories

Use with *Student Book* pp. 82–83

SCIENCE CONTENT TOPICS: ES.b.4, ES.c.1
SCIENCE PRACTICES: SP.1.a, SP.1.b, SP.1.c, SP.3.a, SP.3.b, SP.4.a, SP.5.a, SP.7.a

1 Review the Skill

Scientists are always making observations about the natural world. Based on these observations, they ask questions and carry out investigations to explain what they observe. Each question they ask can be turned into a hypothesis—a proposed response to the question. A **scientific theory** restates one or more hypotheses that have been validated by testing. When you **understand scientific theories**, you comprehend both a statement about the natural world and an explanation of how and why.

A scientific theory is not the same as a scientific law. A scientific law states an observation about something in the natural world, but it does not give an explanation.

2 Refine the Skill

By refining the skill of understanding scientific theories, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Read the passage below. Then answer the questions that follow.

THEORY OF CONTINENTAL DRIFT

a Scientific theories begin with a question. Here, Wegener thought the continents looked like they were once joined. He asked: If that were so, how did the continents get to the places where they are today?

Almost one century ago, scientist Alfred Wegener wondered why some continents looked like they were once joined. He then developed the hypothesis that 250 million years ago, the continents of today were one landmass. He called it Pangaea. Wegener hypothesized that Pangaea broke apart long ago. Over millions of years, the new continents slowly drifted to where they are now.

b Experimentation helps a scientist support or refute a hypothesis. A correct hypothesis can become part of a scientific theory.

Many other scientists disagreed with Wegener. Yet Wegener persisted. He gathered evidence to support his hypothesis that the continents move slowly over time. That evidence became part of his theory of continental drift.

TEST-TAKING TIPS

When answering multiple-choice questions, read the question and pause before reading the answer choices. Predict the correct answer, and then look for the answer closest to your prediction.

1. What was Wegener's hypothesis?

   A. Continents have many different shapes.
   B. Continents broke apart and moved to their present positions.
   C. Today's continents will one day form another Pangaea.
   D. The continents of today are larger than continents of the past.

2. What did Wegener need to add to his hypothesis for it to become a theory?

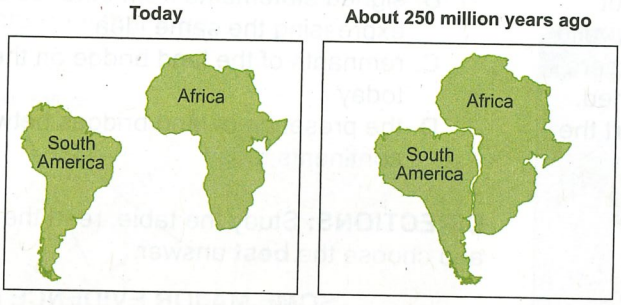
   A. an explanation for how the continents move
   B. evidence supporting his hypothesis
   C. support from many other scientists
   D. an outdated theory from which to build his new theory

3 Master the Skill

Spotlighted Item: DROP-DOWN

DIRECTIONS: Study the diagram. Then read the incomplete passage that follows. Use information from the diagram to complete the passage. For each drop-down item, choose the option that **best** completes the sentence.

MOVING CONTINENTS



3. One day, Alfred Wegener was looking at an atlas when his eye fell on the coasts of South America and Africa. They are on opposite sides of the Atlantic Ocean. Yet he noticed that they [3. Drop-down 1]. Wegener concluded that the two landmasses probably were [3. Drop-down 2] millions of years ago. The idea seemed incredible because the continents are so far apart today. The continents would have had to [3. Drop-down 3]. To establish a scientific theory about his idea, Wegener first had to [3. Drop-down 4].

Drop-Down Answer Options

3.1
A. are the same shape
B. have the same composition
C. seem to fit together
D. have similar climates

3.2
A. nonexistent
B. joined
C. the same distance apart
D. smaller

3.3
A. change their shapes
B. form at different times
C. be the only landmasses on Earth
D. move from one place to another

3.4
A. form and test a scientific hypothesis
B. disprove other scientific laws
C. prove this movement had continued
D. gain the acceptance of all other scientists

DIRECTIONS: Read the passage and question, and choose the **best** answer.

COSMIC BACKGROUND RADIATION

The Big Bang theory, which proposes an explanation of the universe's origin, is supported by various evidence, including the presence of cosmic background radiation. In the 1940s, a scientist noted that the Big Bang should have left hot, high-energy radiation throughout the universe. As the universe aged, this energy would have cooled. Scientists predicted that by present day, this background radiation would exist in the form of microwaves. In the 1960s, two other scientists detected this radiation. Later, satellites confirmed that cosmic background radiation is fairly uniform throughout the universe—a remnant of the Big Bang.

4. Why is cosmic background radiation evidence for the Big Bang theory?

A. Radiation left over from the Big Bang could be detected only from Earth.
B. The Big Bang would have spread this type of radiation throughout the universe.
C. The existence of cosmic background radiation confirms the age of the universe.
D. Microwave radiation is the only type that would have been created by the Big Bang.

UNIT 3