

## Lesson 9.1 Structures in the Universe

This lesson will help you practice working with concepts related to structures in the universe. Use it with core lesson 9.1 Structures in the Universe to reinforce and apply your knowledge.

### Key Concept

The universe is billions of years old and contains stars, solar systems, galaxies, and all the matter that exists within them.

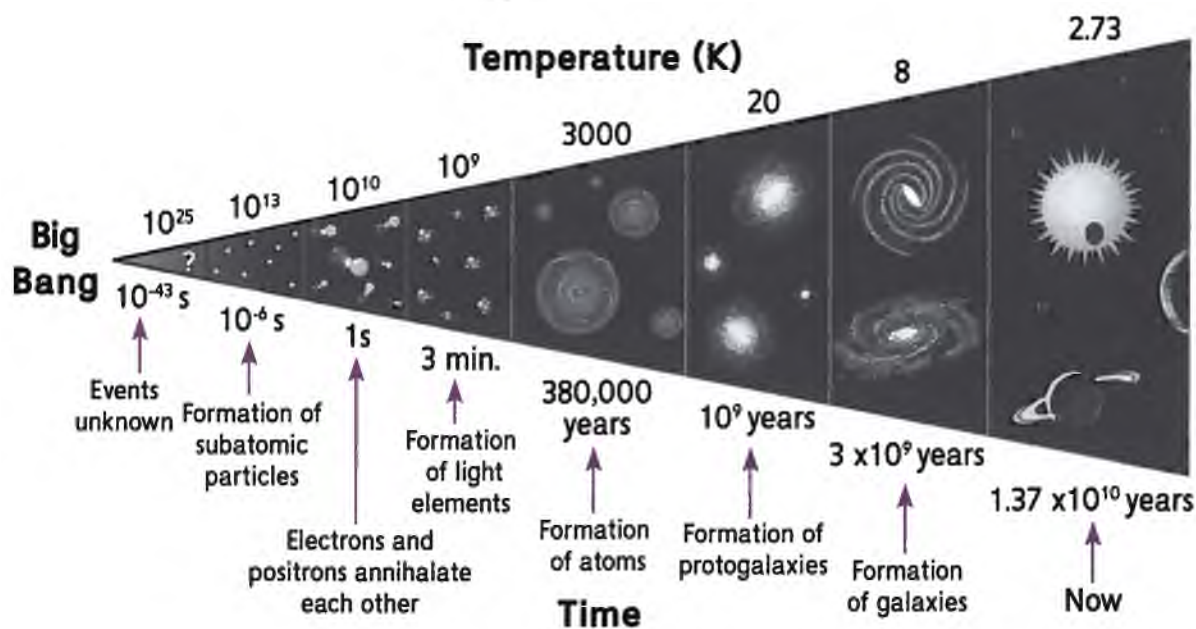
### Core Skills & Practices

- Identify the Strengths and Weaknesses of One or More Experimental Designs
- Analyze Structures

## The Universe

The Universe consists of everything that exists throughout space, from our sun and solar system, to galaxies, stars, matter, and energy.

**Directions:** Use the timeline below to answer questions 1-2.



1. According to the timeline, which statement is true?
  - A. All events that occurred three minutes after the Big Bang have been proven true.
  - B. The development of protogalaxies took much longer than the formation of atoms.
  - C. The matter that formed stars and planets did not exist until  $1.37 \times 10^{10}$  years passed.
  - D. The Big Bang theory holds that the temperature of the universe has decreased over time.
2. Which of these events occurred when the universe was 3 billion years old?
  - A. Earth formed
  - B. atoms formed
  - C. galaxies formed
  - D. elements formed

**Directions:** Answer the questions below.

3. Place the sequence of events in the life cycle of a star in the correct order. Write the phrases in the appropriate numbered box below.

red giant	fusion	protostar	nebula	white dwarf
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1.	2.	3.	4.	5.
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## The Stars

Stars appear to be small lights in the night sky, but they are actually hot, burning balls of gases that generate heat and light. Stars are categorized according to mass, temperature, age, diameter, and the amount of light they give off.

**Directions:** Answer the questions below.

4. Which of these is a direct result of a supernova?
- A. development into a white dwarf
  - B. complete destruction of a galaxy
  - C. production of heavy, metallic elements
  - D. formation of a recognizable star pattern in the sky
5. Every star in every galaxy in the universe is a source of energy. Within each star, including the Sun, nuclear energy heats the star and keeps it from collapsing due to the force of gravity. Meanwhile, each star's own energy and the \_\_\_\_\_ between the star and other stars work together to keep the star within a path inside its own galaxy.
6. Which statement accurately expresses the nature of a protostar?
- A. A protostar is a star that has gone supernova.
  - B. Protostars have a ball-like center and a disk that remains stationary in space.
  - C. The spherical and glowing center that forms in a nebula, is a protostar.
  - D. All protostars will eventually develop into red giants.
7. A black hole is the collapsed leftovers of a supernova. Some scientists believe a black hole is like a strong funnel that may pull in material from nearby stars. Not even light can escape from a black hole. Which of these common items most resembles the actions of a black hole?
- A. a blizzard
  - B. an iceberg
  - C. a waterfall
  - D. a whirlpool



### Test-Taking Tip

When answering fill-in-the-blank questions, always review the answer before handing in your test. Fill-in-the-blank questions form complete sentences. Does your answer sound like a complete sentence? If not, revise the answer to make a logical sentence.

## Lesson 9.1 Structures in the Universe

### Types of Galaxies

A galaxy is composed of stars, dust, and gases that are held together by gravity. All galaxies are large and contain from a few million to more than a trillion stars.

**Directions:** Answer the questions below.

8. Choose the option that correctly completes each sentence.

Galaxies are groups of stars, dust and gas that are held together by **1** Select... . Most galaxies are **2** Select... galaxies with arms that spin out from a center core. Our own galaxy is called **3** Select... . Our galaxy has many other suns with planets. Our own Sun is only one of more than 100 billion **4** Select... .

**1** Select... ▼

- A. mass
- B. motion
- C. gravity
- D. electrical charge

**3** Select... ▼

- A. Tarantula
- B. Andromeda
- C. the Big Dipper
- D. the Milky Way

**2** Select... ▼

- A. spiral
- B. quasar
- C. irregular
- D. elliptical

**4** Select... ▼

- A. stars
- B. nebula
- C. planets
- D. comets

9. A proposal is made to send rockets carrying telescopes, cameras, and data sensors into space. The plan calls for the rockets to be launched in different directions to gather information that would give scientists a more complete picture of the Milky Way and enable them to fully map all of its stars and orbiting planets. What obstacles make such a project impractical?

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10. Which of these properties is common to planets, stars, and galaxies?

- A. They radiate light.
- B. They have gravity.
- C. They give off intense heat.
- D. They are spherical in shape.

## Structures in the Solar System Lesson 9.2

This lesson will help you practice working with concepts related to Earth's solar system. Use it with core lesson 9.2 Structures in the Solar System to reinforce and apply your knowledge.

### Key Concept

Earth is part of a solar system and interacts with other parts of its solar system.

### Core Skills & Practices

- Cite Specific Textual Evidence to Support a Finding or Conclusion
- Use Ratio and Rate Reasoning

### Earth's Solar System

Our solar system consists of eight planets, their moons, and other objects that orbit the Sun.

**Directions:** Use the table to answer questions 1-2.

Planet	Distance from Sun (AU)	Orbital Period (Earth Years)	Period of Rotation (Earth Days)	Mass (Earth = 1)
Venus	0.72	0.62	243	0.815
Earth	1	1	1	1
Jupiter	5.20	11.86	0.41	318
Neptune	30.06	164.8	0.72	17

1. An astronomer is comparing how fast Venus, Earth, Jupiter, and Neptune each spin on their axes. Write the names of the four planets in order from slowest to fastest in the boxes provided.

Slowest

1.

2.

3.

Fastest

4.

2. Neptune is about \_\_\_\_\_ times farther away from the Sun than Jupiter.



### Test-Taking Tip

When a test requires you to put steps or items in a cause-and-effect sequence, it is sometimes helpful to work backwards. Find the last item or the final result. Then work backwards from there. Find the item that caused the final result. Continue until you have all the items placed in order. Then look at the items from the first item to the last to make sure that each item would cause the next item to happen.



## Lesson 9.2 Structures in the Solar System

Directions: Use the information to answer questions 3-4.

More than 40,000 asteroids orbit the Sun between the orbits of Mars and Jupiter. Together, the mass of all the asteroids is about one-thirtieth the mass of Earth's moon. Some astronomers hypothesize that asteroids are fragments that never combined to form a planet. Others suggest that they are the remains of a planet that came apart as a result of a collision with a comet. It is possible that asteroids can be pulled out of their orbits to become moons of nearby planets. Two moons of Mars may be asteroids that were captured.

3. Write a definition of an asteroid that could be added to the beginning of the passage.  
  

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4. Which information from the passage most directly refutes the claim that asteroids once formed a planet?
  - A. There are more than 40,000 asteroids.
  - B. The mass of all the asteroids is only a fraction of the mass of Earth's moon.
  - C. Most asteroids orbit the Sun between the orbits of Mars and Jupiter.
  - D. Asteroids can be pulled out of their orbits to become moons of nearby planets.

### Earth's Movement and the Moon

Earth rotates on its axis as it revolves around the Sun, just as the Moon rotates on its axis as it revolves around Earth.

**Directions:** Answer the following questions.

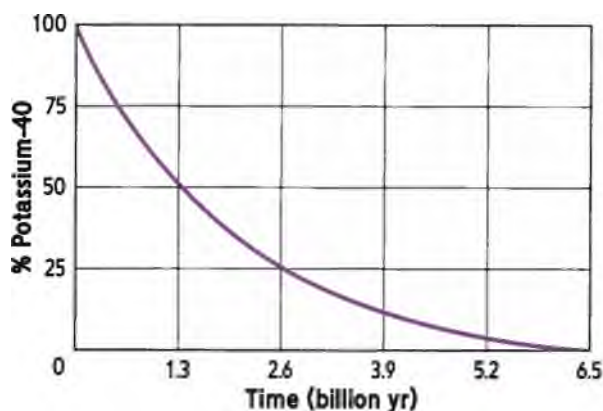
5. Which phenomenon on Earth would change if Earth started spinning more slowly on its axis?
  - A. A year would be shorter.
  - B. Seasons would not exist.
  - C. A day would last longer.
  - D. Eclipses would not occur.
6. A location on Earth is experiencing winter. Which statement about the location is true?
  - A. It is at its farthest point from the Sun.
  - B. It is on the part of Earth tilted away from the Sun.
  - C. It is on the side of Earth facing away from the Sun.
  - D. It is being blocked by the Sun by the Moon.
7. Weight is a result of the force of gravity on a mass. The force of gravity varies among different planets and their moons. The gravitational force you would experience depends both on the mass of the object and its diameter. The force of gravity at the surface of the Moon, for example, is only one-sixth Earth's gravity. Although an object's mass would remain the same if it were brought to the Moon, its weight would change. Based on this information, what additional information would you need to calculate the weight of an astronaut on the Moon?
  - A. The distance to the Moon
  - B. The diameter of the Moon
  - C. The astronaut's mass on Earth
  - D. The astronaut's weight on Earth

## Earth's Age

Earth is estimated to be approximately 4.6 billion years old, and its history is divided into segments called eons, eras, periods, and epochs.

**Directions:** Use the diagram to answer questions 8-9.

Potassium-40 is a radioactive isotope commonly used in radiometric dating to find the age of rocks on Earth. The process involves determining how much potassium-40 has decayed since the rock was formed. The graph represents the decay of potassium-40.



8 What percent of the original sample remains after 5.2 billion years?

- A. 25 percent C. 3.125 percent  
B. 6.25 percent D. 12.50 percent

9. Scientists select particular isotopes based on their half-life. According to the graph, the half-life of potassium-40 is \_\_\_\_\_ years. If a sample begins with 500 g of potassium-40, explain how to find the mass that remains after 2.6 billion years.

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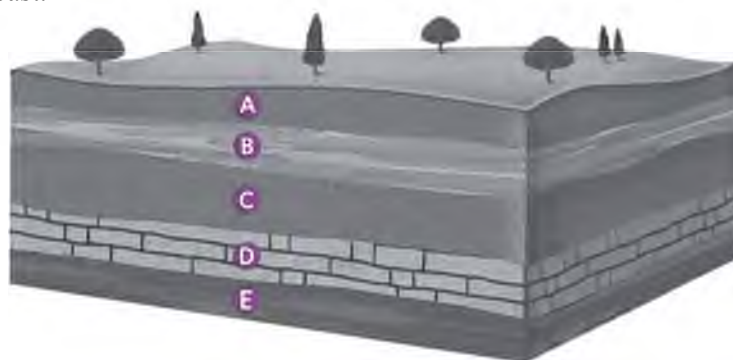
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**Directions:** Use the diagram to answer questions 10-11.

A group of researchers identified the layers of rock shown in the diagram. They are analyzing the layers to learn about Earth's past.



10. Which conclusion can they reach, based on the layers?

- A. Layer D is the oldest layer.  
B. Layer A is older than Layer B.  
C. Layer C formed later than Layer E.  
D. Layers B and E formed at the same time.

11. The researchers are studying fossils found in each of the rock layers. Which of the following can the researchers determine through relative dating?

- A. The year in which each organism died  
B. The order in which the organisms lived  
C. How old each organism was when it died  
D. How long it took for each organism to fossilize