

Student Name \_\_\_\_\_

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# DC Science

The District of Columbia Assessment of  
the Next Generation Science Standards

**Grade 8  
Test Booklet**

*Practice Test*



# Unit 1

Welcome! Today you will take unit 1 of the DC Science Assessment Practice Test.

To respond to the tasks on this test, you may be asked to review information in the form of text, images, data tables, and graphs. Analyze all the information and tasks carefully and then respond to each task. You may need to read across multiple pages to see all the information. You will be allowed to use a calculator for all units in this test.

Some tasks require more than one response. You may look back at the information as often as necessary.

For tasks that ask you to explain, describe, or answer in your own words, write your responses in the space provided. You may use scratch paper to organize your thinking before writing your response in the space provided.

For tasks that ask you to fill in the blank spaces or write answers in the correct box, you may write the letter corresponding to the response or write the entire response in the blank space.

If you are unsure about an answer, select or compose an answer you think is the best response. You can always go back to the items you are unsure of after you've answered all other questions in the unit.

Finally, before beginning the test, please write your name on the top of the cover page and wait for the test administrator to inform you to turn the page.

Students hear about a spearfishing tournament where the top prize is awarded to the team who brings back the most lionfish. They wonder why the only fish being caught in this tournament are lionfish. They learn that lionfish are native to the Pacific and Indian Oceans and had not been seen in the Atlantic Ocean or the Gulf of Mexico at all until 1980. The lionfish population in the Atlantic Ocean has greatly increased since 2010. After researching more about lionfish, the students record the facts that they found. Figure 1 shows the number of lionfish sightings at three banks<sup>1</sup> (Bank 1, Bank 2, and Bank 3) along the Florida coast in the Gulf of Mexico.

<sup>1</sup>bank—An undersea elevation.

The students learned some facts about lionfish in the Atlantic Ocean from 2015 to 2016.

**Biology**

- 50,000 eggs laid by a lionfish every 3 days
- 1 year until maturity
- 18 venomous spikes as adult

**Distribution**

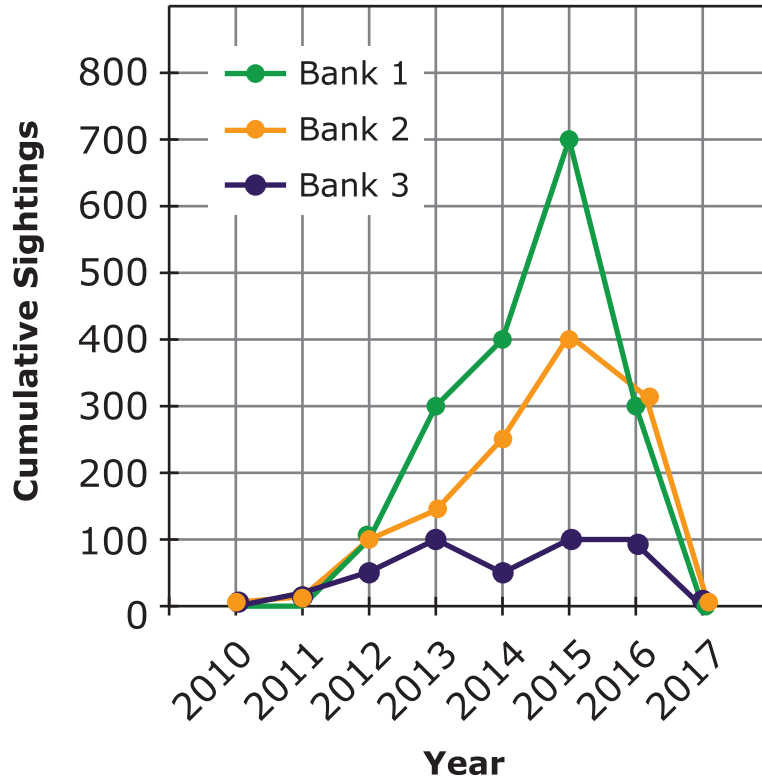
- ability to reach depths of 300 meters
- population 17 times more dense in the Atlantic Ocean than the Pacific Ocean
- no known natural predators
- over 100 prey fish species
- 1,000 lionfish can eat 5 million prey fish in 1 year

**Population Control**

- 64 restaurants serving lionfish
- 28,770 lionfish captured during sanctioned spearfishing events
- spearfishing divers can reach depths of 40 meters

Figure 1 shows lionfish sightings at three banks<sup>1</sup> (Bank 1, Bank 2, Bank 3) along the Florida coast in the Gulf of Mexico.

**Figure 1. Number of Lionfish Sightings**



<sup>1</sup>bank—An undersea elevation.

1. Based on the information provided, why are lionfish in the Atlantic Ocean a problem that needs to be controlled?
- Ⓐ Lionfish have a rapid reproductive cycle.
  - Ⓑ Lionfish are sought after by seafood restaurants.
  - Ⓒ Lionfish have venomous spikes that are hazardous to human divers.
  - Ⓓ Lionfish are an invasive species that is disrupting Atlantic Ocean ecosystems.

2. Why has the lionfish population dramatically increased in the Atlantic Ocean?

Select **two** correct answers.

- Ⓐ Lionfish are eaten by humans.
- Ⓑ Lionfish have no natural predators.
- Ⓒ Lionfish have a fast reproductive rate.
- Ⓓ Lionfish can reach depths of 100 meters.
- Ⓔ Lionfish have been present in the Atlantic Ocean since 1980.

3. Use the information in Table 1 and Figure 1 to complete the following sentences.

Write the correct answer in each box. Not all answers will be used.

- |         |         |         |            |             |
|---------|---------|---------|------------|-------------|
| A. 2010 | B. 2015 | C. 2017 | D. capture | E. invasion |
| F. zero | G. 400  | H. 850  | I. 2500    |             |

Lionfish first appeared in the Bank 1 of the sanctuary in

. Their numbers increased until

when

began. If control

measures had not been implemented, and the same population

growth rates were maintained, then scientists could have

expected about

sightings in the Bank 2

region of the sanctuary in 2017. In 2017, there were

sightings of lionfish in the sanctuary.



4. Complete the sentences to describe the impact of lionfish on Atlantic Ocean ecosystems.

Write the correct answer in each box. Each answer may be used more than once.

A. invasive

B. native

C. biodiversity

D. producers

E. decomposers

The lionfish is a(n)  predator in the Atlantic Ocean. Because of its consumption of over 100 prey fish species lionfish disrupt ecosystems by reducing the amount of . This reduction of prey fish can lead to a lack of food for  predators. To help return  to these ecosystems, humans have begun lionfish population control measures.

5. The conditions for lionfish are different in the Atlantic Ocean and Pacific Ocean. Because lionfish are native to the Pacific Ocean, they have not caused the disruption in the Pacific Ocean that they have caused in the Atlantic Ocean.

Write the correct answers in each box. All answers will be used.

A. Predators recognize lionfish and eat them.

B. Prey do not recognize lionfish or avoid them.

C. Predators do not recognize lionfish as prey.

D. Lionfish population is controlled by humans.

E. Ecosystems are more likely to have high biodiversity.

F. Fishing harvests are likely high because of stable ecosystems.

G. Prey recognize lionfish and avoid them.

**Atlantic Ocean**

**Pacific Ocean**

**GO ON TO NEXT PAGE**

- 6. Answer the following tasks about lionfish populations.
  - Why are lionfish populations living in the Pacific Ocean not as large and destructive as those living in the Atlantic Ocean and Gulf of Mexico?
  - What are **two** benefits for the lionfish living in the Atlantic Ocean and the Gulf of Mexico versus lionfish living in the Pacific Ocean?
  - Examine Figure 1. Provide **two** possible reasons the lionfish population in the Bank 3 region did not experience the same rapid growth that the other two regions experienced.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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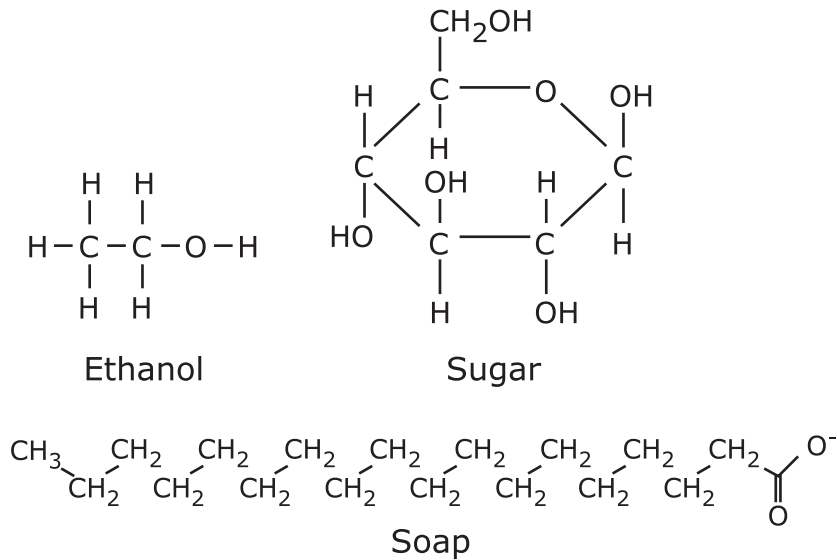
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Students use an ethanol-based hand sanitizer in a classroom where the temperature is 23°C. They notice it smells like flowers and their hands feel cold but dry quickly. They wonder about ethanol and if it is more effective than soap.

**Figure 1. Chemical Structures**



H - hydrogen C - carbon O - oxygen
--

Table 1 provides information about the physical properties of ethanol and water.

**Table 1. Physical Properties of Ethanol and Water**

	<b>Melting Point (°C)</b>	<b>Boiling Point (°C)</b>
Ethanol	-114	78
Water	0	100

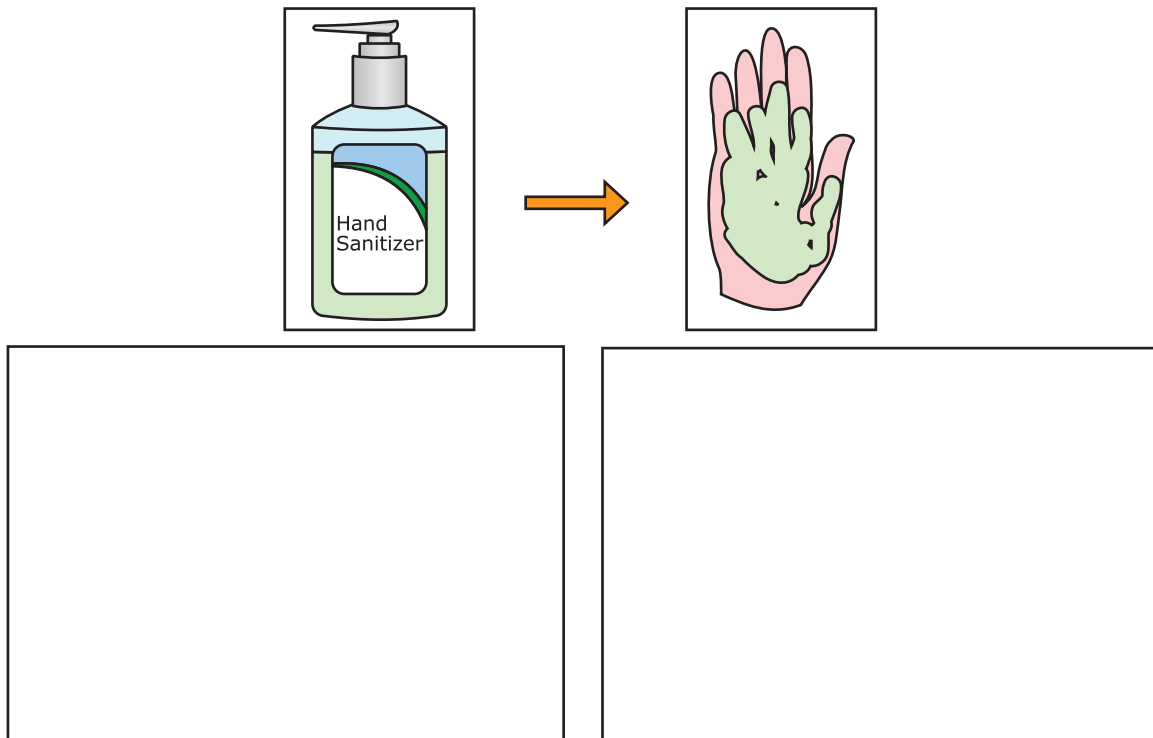
7. The process to distill ethanol is carried out at 80°C. How does heating the sample to this temperature effect the molecules in the solution? Select **three** correct answers.
- Ⓐ The added heat increases the motion of the water molecules.
  - Ⓑ The added heat increases the motion of the ethanol molecules.
  - Ⓒ The added heat causes water molecules to change state before ethanol molecules change state.
  - Ⓓ The added heat causes ethanol molecules to change state before water molecules change state.
  - Ⓔ The added heat gives the ethanol molecules in the liquid more kinetic energy than the water molecules.
  - Ⓕ The added heat gives the water molecules in the liquid more kinetic energy than the ethanol molecules.

8. Why are the properties of sugar different from ethanol, even though ethanol is created from sugar?
- Ⓐ The source of sugar is different than the source of ethanol.
  - Ⓑ The atoms in sugar are different than the atoms in ethanol.
  - Ⓒ The process for making sugar is different than the process for making ethanol.
  - Ⓓ The arrangement of atoms in sugar is different than the arrangement of atoms in ethanol.



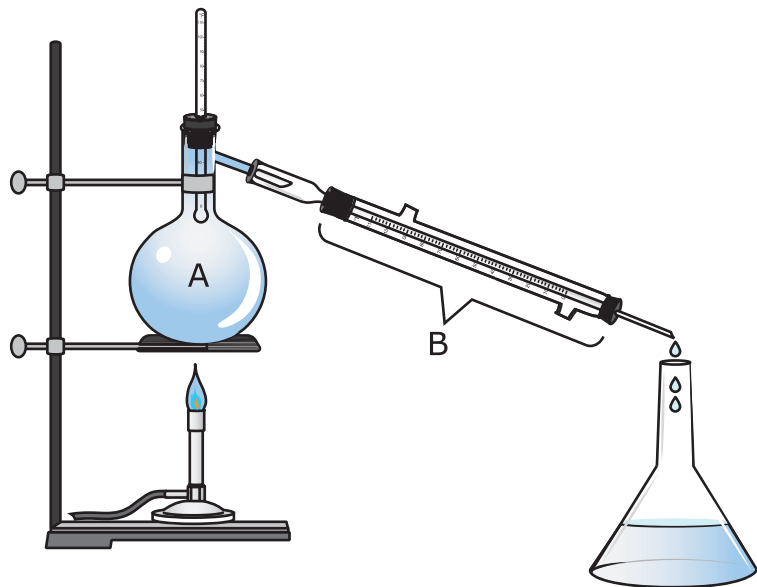
9. The average human body temperature is 37°C. Create a model that explains why the student’s hands feel cool as the ethanol dries. In the model: 1. Identify if the ethanol particle motion is greater in the bottle or when on the hand, 2. Determine how the evaporation rate of ethanol differs for the two locations, and 3. Indicate the direction of heat transfer between the hand sanitizer and the hand. Write the correct answers in each box. Not all answers will be used.

- |                                       |   |                                 |
|---------------------------------------|---|---------------------------------|
| A. Lower rate of ethanol evaporation. | B. Greater rate of ethanol evaporation. | C. Heat is absorbed by ethanol. |
| D. Greater particle motion.           | E. Lesser particle motion.              |                                 |



10. A model of the distillation process is shown. Use the table to describe the changes occurring at points A and B during the distillation process.

Place a check mark in the correct circles to describe the changes occurring at points A and B.

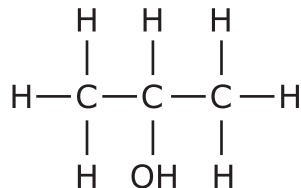


Description	A	B
Kinetic energy increases.	<input type="radio"/>	<input type="radio"/>
Kinetic energy decreases.	<input type="radio"/>	<input type="radio"/>
Ethanol begins at a higher temperature than the apparatus.	<input type="radio"/>	<input type="radio"/>
Ethanol begins at a lower temperature than the apparatus.	<input type="radio"/>	<input type="radio"/>
Heat is absorbed by ethanol.	<input type="radio"/>	<input type="radio"/>
Heat is released by ethanol.	<input type="radio"/>	<input type="radio"/>

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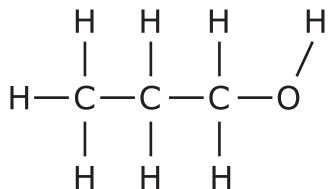
11. Other substances are refined to produce sanitizers. One example is isopropanol, whose molecular structure is shown below.

**Figure 2. Structure of Isopropanol**

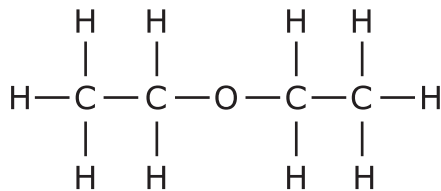


Compare the structure of the three molecules below to the structure of ethanol and isopropanol. Which of these three molecules is most likely to function as a hand sanitizer? Write the correct answer in each box to complete the sentence. Not all answers will be used.

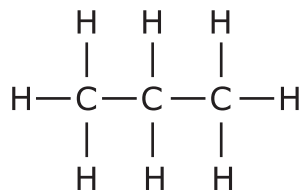
**Figure 3. Structures of Molecules X, Y, and Z**



Molecule X



Molecule Y



Molecule Z

A. molecule X

B. molecule Y

C. molecule Z

D. is made of the same atoms

E. has similar chemical groups

F. is close to the same size

It is likely that  could also be used in hand sanitizer, because this molecule  as ethanol.

12. In any solution, the kinetic energy of the molecules will vary. The molecules may have kinetic energies that are slightly above or below the average for that temperature. Relate this information to hand sanitizer.

- How does the average kinetic energy of a sample of hand sanitizer change when it is applied to the hand? Explain in terms of temperature.
- How does the behavior of molecules in the hand sanitizer change when the hand sanitizer is placed on the hand? Explain in terms of phase change.
- The student can smell the perfume in the hand sanitizer in the air when their hand is near their nose. What must happen to perfume molecules from the hand sanitizer for them to be sensed by the nose?

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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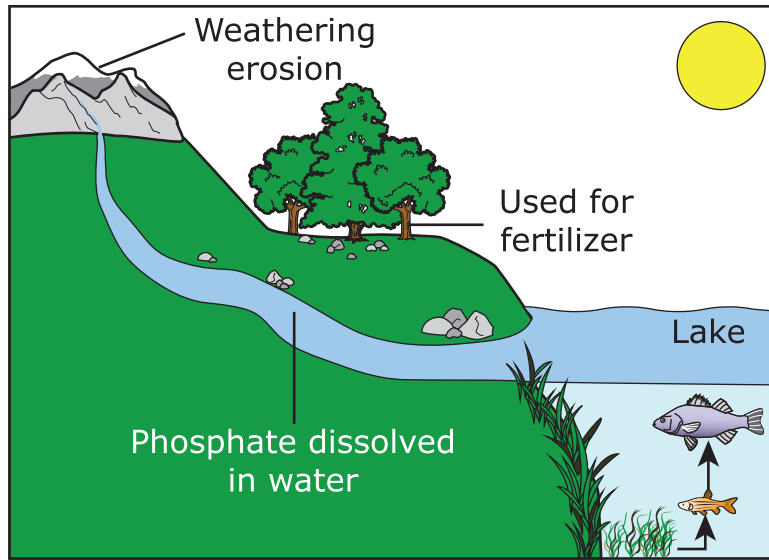
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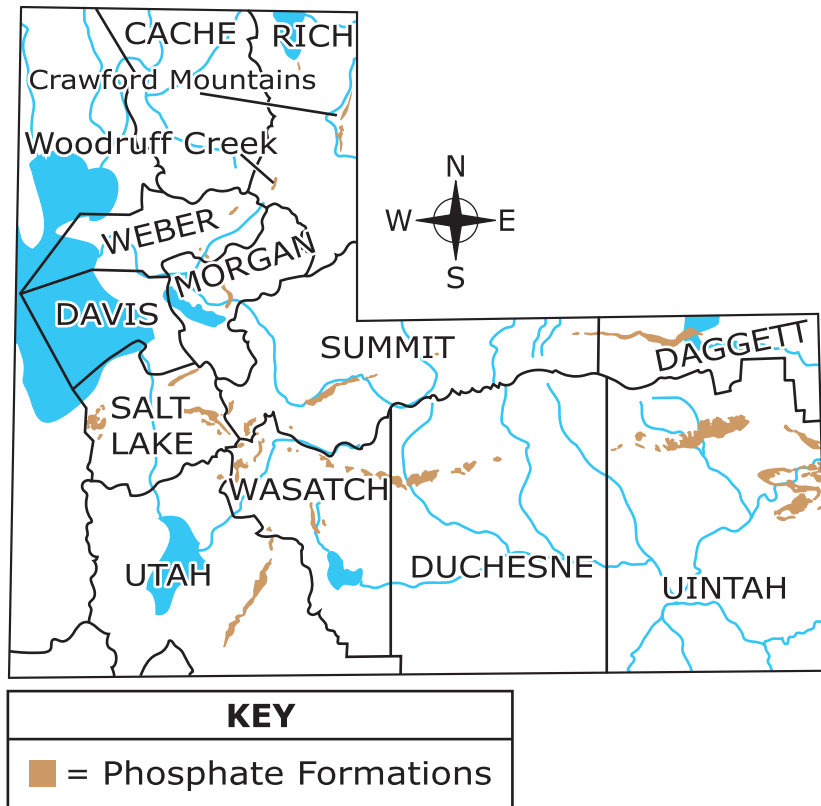
A student finds a rock and shows it to his teacher, who says it contains phosphate. The teacher explains that rocks containing phosphate are mined and broken down for use in fertilizers. The student conducts research to find out more about phosphate in the area where he lives. Phosphate is an essential mineral for living things.

**Figure 1. Phosphate in an Environment**





**Figure 2. Phosphate Deposits in Some Utah Counties**



**Table 1. Probability of Phosphate by Rock Type in Each County**

County	Igneous Rock	Sedimentary Rock
Cache	Low	Low
Daggett	Low	High
Duchesne	Low	Medium
Morgan	Low	Low
Rich	Low	Medium
Salt Lake	Low	High
Summit	Low	Low
Uintah	Low	High
Utah	Low	Low
Wasatch	Low	High
Weber	Low	Medium

13. Which of these causes the water in the river to cycle through the area in Figure 1? Select **three** correct answers.
- Ⓐ rocks
  - Ⓑ the Sun
  - Ⓒ gravity
  - Ⓓ the plants
  - Ⓔ phosphate

- 14.** A mining company is considering mining the phosphate from this mountain in Figure 1. Which is a consequence of mining phosphorus from the mountain?
- Ⓐ Trees growing in the area will not survive.
  - Ⓑ Phosphate amounts in the atmosphere will increase.
  - Ⓒ There will be lower amounts of phosphate in the river.
  - Ⓓ The phosphate will replenish itself in a short amount of time.

15. The student wants to make a model to show how natural processes affect the cycling of water in this area. Put the descriptions of the parts of the model, beginning with the first step, in the correct order. Write the correct answer in each box.

A. Clouds become heavy and precipitation falls.

B. Water vapor condenses in the atmosphere forming clouds.

C. Water collects into larger streams that flow into the river and into the lake.

D. Precipitation falls, weathering rocks and carrying rock sediment as it flows downhill.

Water in the lake is heated by Sun, evaporating and leaving phosphate minerals behind.



[Empty box for step 2]



[Empty box for step 3]



[Empty box for step 4]



[Empty box for step 5]

- 16.** Students visited different counties on the map and collected samples of rocks. Use Figure 2 and Table 1 to match the sample with how likely it is to contain phosphate. Write the correct answer in each box.

A. An igneous rock from Weber

B. A sedimentary rock from Salt Lake

C. An igneous rock from Daggett

D. A sedimentary rock from Summit

**Likely**

**Not likely**

17. Water on the map is affected by the non-living environment. Match each description to the cause that is involved. Write the correct answer in each box.

A. Phosphate in the mountain is weathered and eroded.

B. The river deposits dissolved phosphate in the lake.

C. The trees release water from their leaves into the atmosphere.

D. Water evaporates and condenses to form clouds.

E. Snow falls at high altitudes in the mountains.

**Gravity**

**The Sun**

**GO ON TO NEXT PAGE**

- 18.** The student wants to know more about the distribution of phosphate.
- Explain which Earth processes must interact to distribute phosphate throughout the area.
  - Explain which county would be a good area for farmers to plant crops. Provide details to support your answer.
  - Explain the effect that phosphate being washed into the lake will have on the lake food chain.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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# Unit 2

Welcome! Today you will take unit 2 of the DC Science Assessment Practice Test. To respond to the tasks on this test, you may be asked to review information in the form of text, images, data tables, and graphs. Analyze all the information and tasks carefully and then respond to each task. You may need to read across multiple pages to see all the information. You will be allowed to use a calculator for all units in this test.

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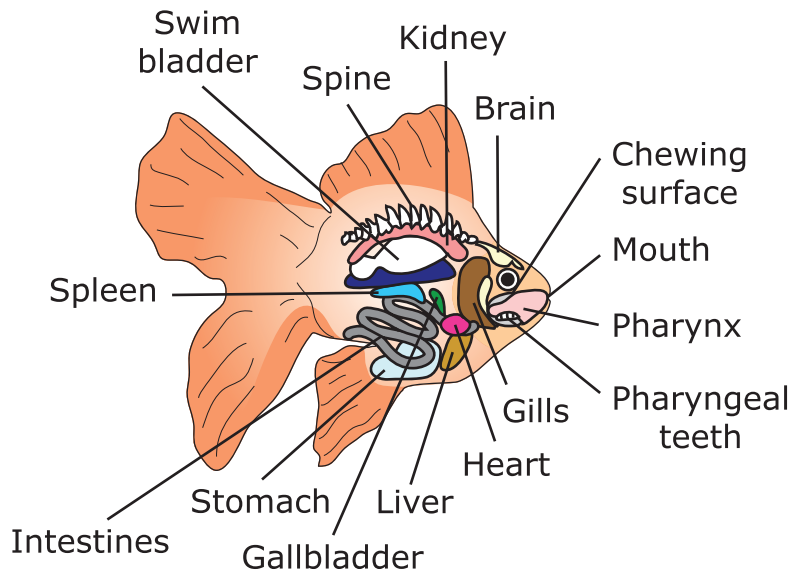
For tasks that ask you to fill in the blank spaces or write answers in the correct box, you may write the letter corresponding to the response or write the entire response in the blank space.

If you are unsure about an answer, select or compose an answer you think is the best response. You can always go back to the items you are unsure of after you've answered all other questions in the unit.

A student puts flakes of food in the class aquarium. A goldfish in the aquarium immediately changes the direction it had been swimming, moves towards the surface of the aquarium, and eats the food.

The student looks up a diagram of goldfish and learns they have the organs shown in Figure 1. They note that many of the fish’s organ systems are similar to that of a human’s.

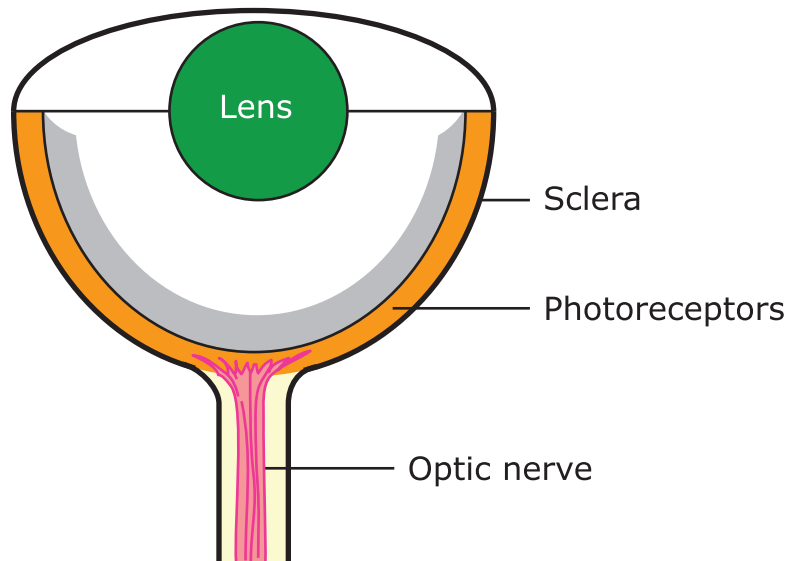
**Figure 1. Internal Goldfish Structures**



Unit 2

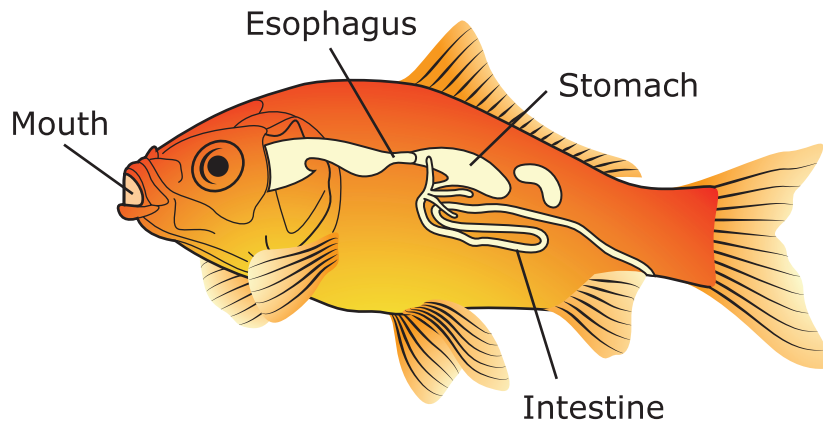
The goldfish sees the food. Goldfish have photoreceptors at the back of the eye that receive light and transfer that light to the optic nerve which runs from the back of the eye to the brain. The brain is connected to the spine that houses the spinal nerve cord. These structures are shown in Figure 2.

**Figure 2. Eye Structures in Goldfish**

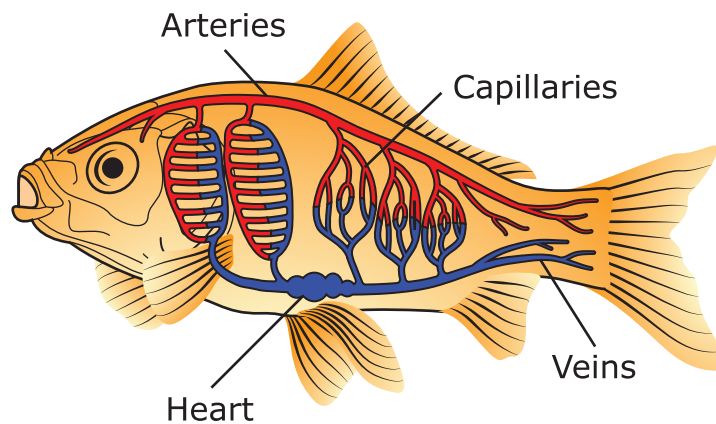


Figures 3 and 4 show the goldfish digestive and circulatory systems.

**Figure 3. Goldfish Digestive System**



**Figure 4. Goldfish Circulatory System**



- 19.** Based on Figures 1 and 2, what is the first step in the goldfish response to the food being placed in the tank?
- Ⓐ Signals are sent from the brain to the mouth.
  - Ⓑ Signals are sent from the muscles to the brain.
  - Ⓒ Special structures in the eye receive information.
  - Ⓓ Certain molecules in the mouth start the process of digestion.

20. Based on the information and on Figures 1 and 2, when food is dropped into the tank, how are sensory signals transmitted?

- Ⓐ from the mouth to the brain
- Ⓑ from the mouth to the intestines
- Ⓒ within the spine from the optic nerve to the eye
- Ⓓ within the eye and along the optic nerve to the brain

21. The goldfish changes direction to swim toward the food. Construct an explanation based on this evidence. Write the correct answer in each box.

A. stomach	B. brain	C. information	D. energy
E. elements	F. muscular system	G. circulatory system	
H. nervous system			

The information received by the eye is transferred to the groups of cells comprising the , which is a part of the  that relays  to the .

22. The student watches the goldfish and sees that there is evidence of some body systems interacting. Place **two** check marks in each row to select the body systems that are interacting.

<b>Evidence / System</b>	<b>Nervous System</b>	<b>Digestive System</b>	<b>Circulatory System</b>	<b>Muscular System</b>
Fish engages muscles to change direction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The fish engages muscles and salivary glands to eat food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



23. Explain what happens in the goldfish between the time the food is placed in the aquarium and the time it is at the surface eating the food. Place the steps in the correct order, starting at the top with the event that happens first. Write the correct answer in each box.

A. Information is passed from the eye through the optic nerve

B. Information reaches the brain

C. Light hits the photoreceptor

D. Information is processed

E. The fish moves toward the food

F. The muscles receive a signal from the brain

<b>Step 1</b>	
<b>Step 2</b>	
<b>Step 3</b>	
<b>Step 4</b>	
<b>Step 5</b>	
<b>Step 6</b>	

24. A student explains that, similar to humans, individual goldfish organ systems must work together for the cells to receive energy from the food. They also argue that organs within those systems are made up of multiple interacting tissues that help them complete their function.

- Decide whether the student’s explanation is correct or incorrect. Support your argument with evidence.
- Give examples of 2 specific organs and their function important to your argument.
- Describe the function of the tissue making up one of the organs in the system.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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Unit 2

A series of horizontal lines for writing, consisting of a top line followed by 21 evenly spaced lines, for a total of 22 lines.

Students observe a video of two astronauts on the International Space Station (ISS) demonstrating a scientific principle. The ISS is in a microgravity environment. That means that astronauts experience weightlessness in the ISS.

The students observe one astronaut push on the second astronaut's back while both are floating near each other. As a result of the push, both astronauts move away from each other in opposite directions.

Figure 1 shows the astronauts inside the ISS floating near each other.

**Figure 1. Astronauts Floating in The ISS**



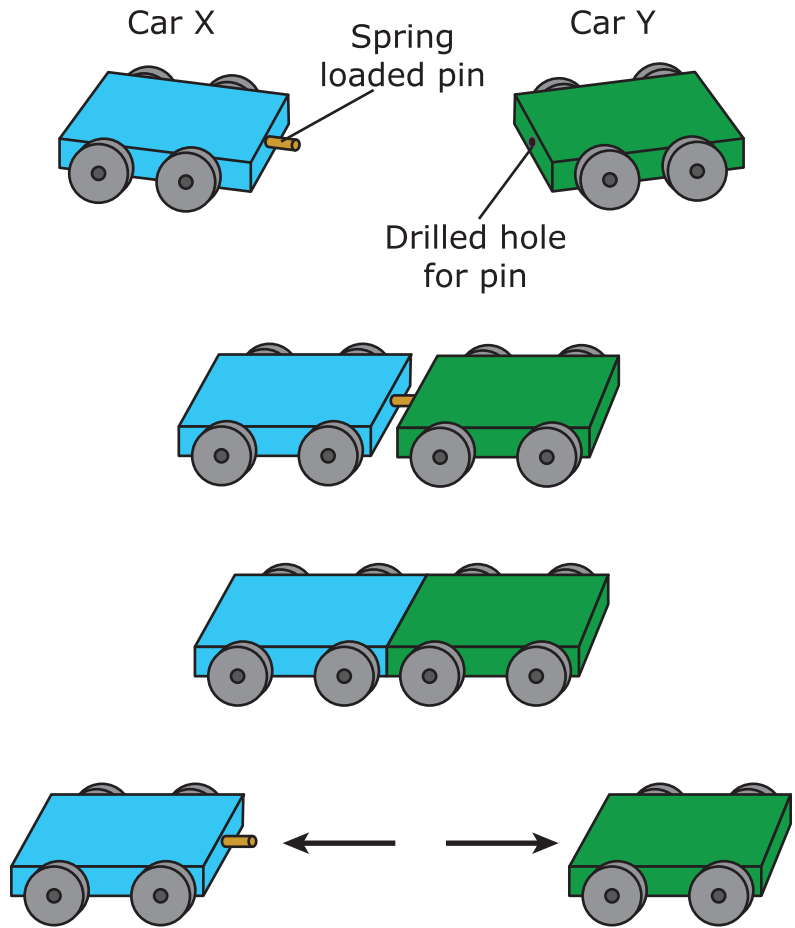
Figure 2 shows the astronauts moving away from each other.

**Figure 2. Astronauts Moving in Opposite Directions After Push**



To better understand the ISS demonstration, the students constructed two cars from wood blocks. A hole was drilled into a side of each block. A spring attached to a pin was inserted into one block and used to exert an initial force after the cars were released. The setup is shown in Figure 3.

**Figure 3. Student Setup**



The students changed some variables and repeated the investigation several times. Table 1 shows the average data collected.

**Table 1. Observed Data**

Trial	Mass (kg)		Distance (m)	
	Car X	Car Y	Car X	Car Y
1	0.15	0.15	1.50	1.50
2	0.15	0.30	1.80	0.75
3	0.30	0.15	0.75	1.80
4	0.30	0.30	0.75	0.75

25. When making contact with the outside surfaces of the ISS astronauts usually place their toes under a foothold or handhold bar. Why is this procedure necessary?
- Ⓐ To protect astronauts from stray particles in space.
  - Ⓑ To reduce the frictional forces acting on the astronauts.
  - Ⓒ To prevent astronauts from damaging the surface of the ISS.
  - Ⓓ To keep the astronauts from being affected by a reaction force from the ISS.

26. Which variables have the greatest effect on the distance traveled by each astronaut in the demonstration described by Figure 1 and Figure 2?

Select **two** correct answers.

- Ⓐ The speed of the ISS.
- Ⓑ The force of the push.
- Ⓒ The weight of the ISS.
- Ⓓ The mass of each astronaut.
- Ⓔ The gravity acting on the astronauts.



27. A student conducts a fifth trial with Car X having a mass of 0.45 kg and Car Y having a mass of 0.15 kg. Construct a statement that best describes the results.

**Table 2. Observed Data**

Trial	Mass (kg)		Distance (m)	
	Car X	Car Y	Car X	Car Y
1	0.15	0.15	1.50	1.50
2	0.15	0.30	1.80	0.75
3	0.30	0.15	0.75	1.80
4	0.30	0.30	0.75	0.75
5	0.45	0.15	?	?

Circle the correct answer from each list to complete the sentences.

It is likely the results will show that Car X traveled 

more
less

 than

0.75 m and Car Y traveled about 

0.5 m
2.0 m

. The force that

caused the motion was 

the same for both cars
different for both cars

.

28. Students propose additional modifications before conducting more trials. Determine the outcome that results from each modification listed below.

Write the correct answers in each box.

A. Increase surface friction

B. Use a stiffer spring

C. Oil the wheels

**Increases distance both cars travel**

**Decreases distance both cars travel**

29. Compare the activity represented in Figures 1 and 2 to the activity represented in Figure 3. Complete the statement describing the similarities in the two activities.

Write the correct answer in each box.

A. frictional

B. acceleration

C. a force

D. an action-reaction

Each activity demonstrates

producing motion. In both activities

force affects motion.

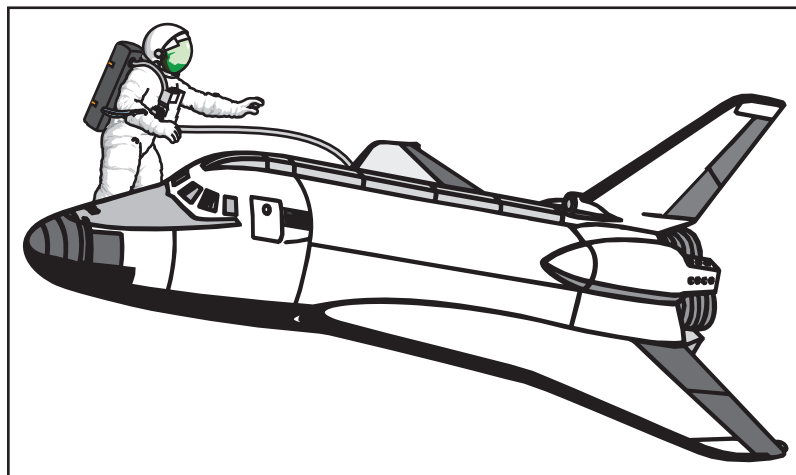
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30. When an astronaut goes for a walk in outer space, they must push away from the spacecraft as shown in the picture below. Explain how you would design a solution to minimize the effect of the the action-reaction force on the astronaut.

- Describe the effects on an astronaut who pushes away from the spacecraft while floating in space.
- Explain how the interaction between the astronaut and the spacecraft is different from two astronauts pushing off each other in space.
- Describe how you would keep the spacecraft from changing its motion after the astronaut pushes off.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

**Figure 5. Astronaut and Shuttle**



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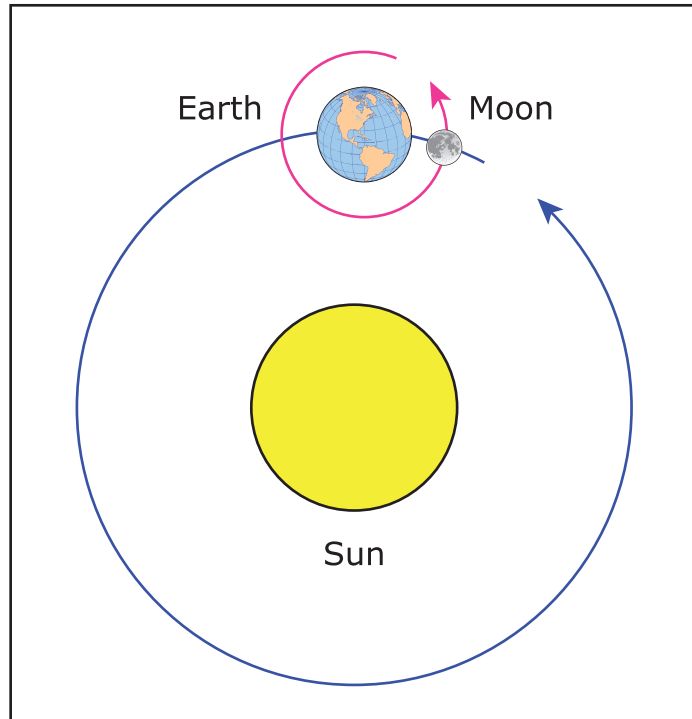
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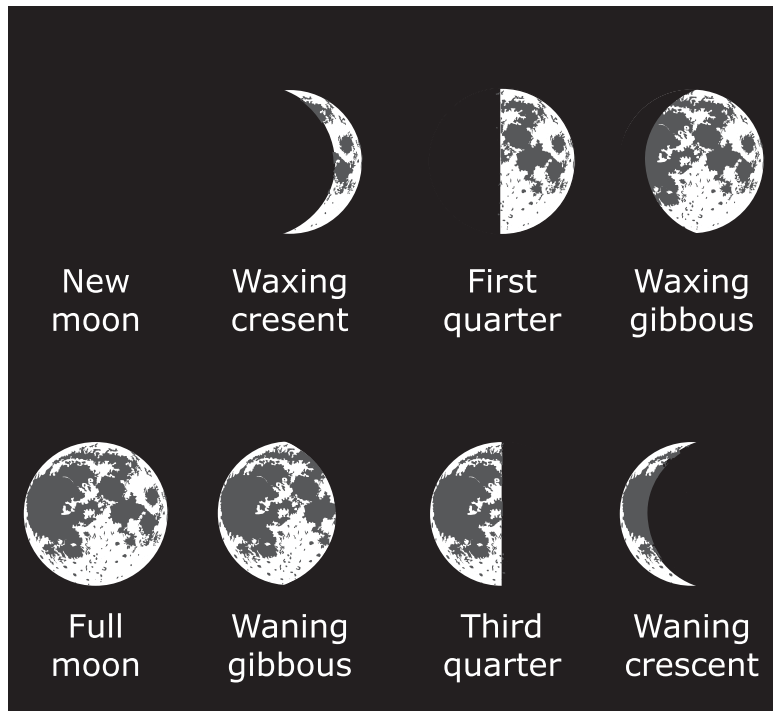
A student noticed that the Moon’s appearance seemed to change from night to night. They decided to check the library for more information about the Moon’s appearance. The student discovered the following information: Figure 1 shows a model of the Sun, Earth and Moon. Figure 2 shows some of the different appearances of the Moon and the name of each of these phases.

**Figure 1.**  
**Movement of Earth and the Moon**



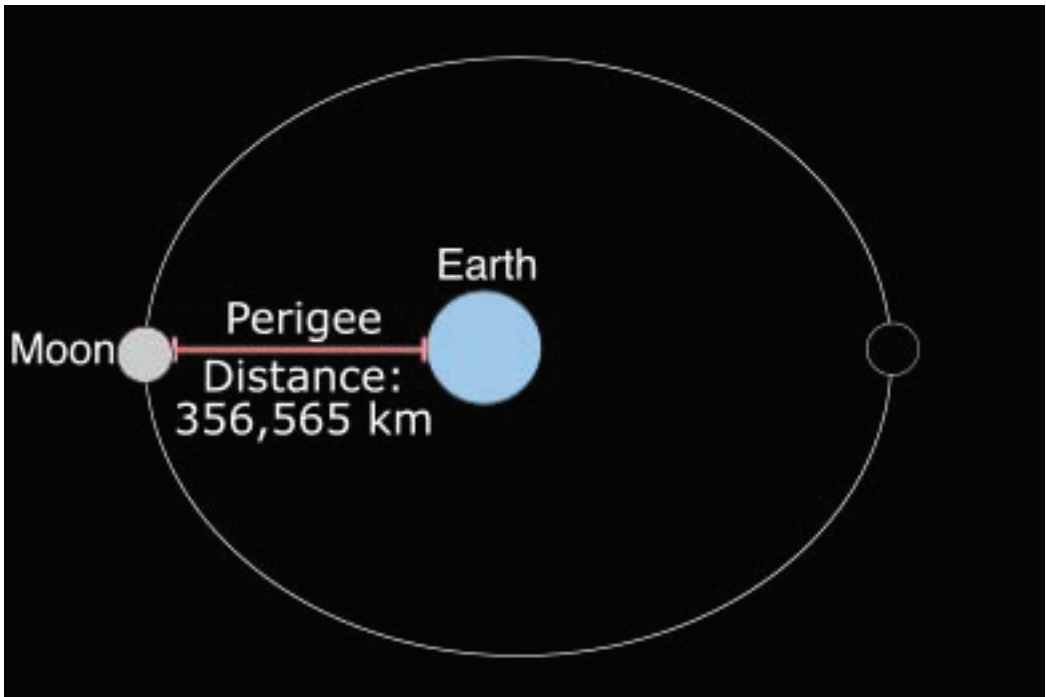
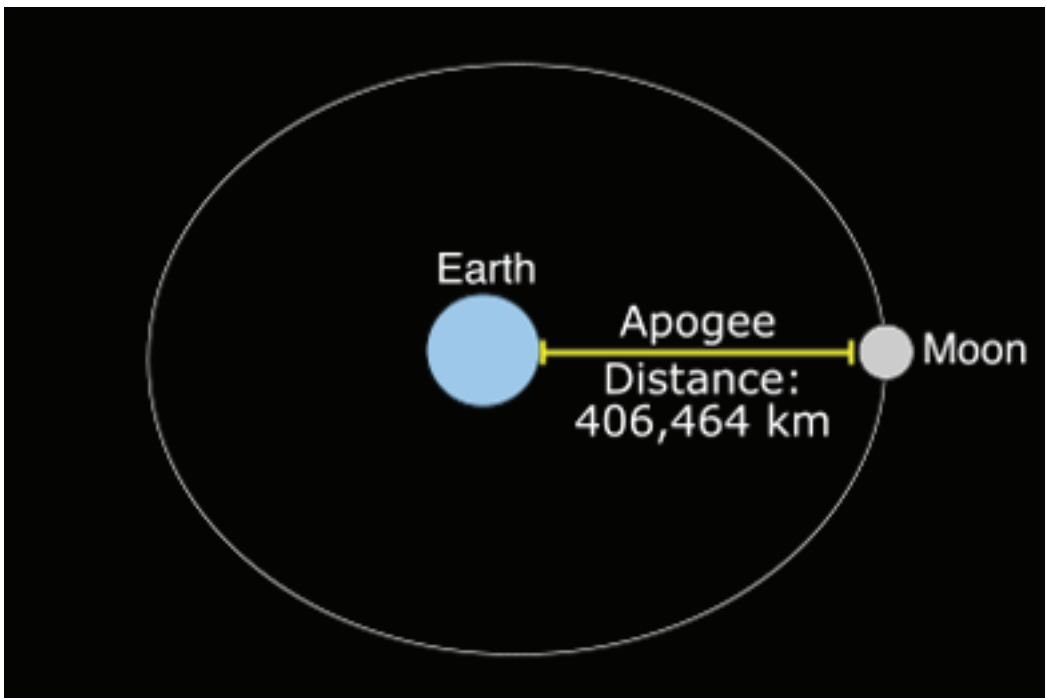
Unit 2

**Figure 2.**  
**Phases of the Moon**



The student also discovered Table 1 and Figure 3, which display data of how the distance between the Moon and Earth changes. Figure 3 was created using data gained through laser-range finding. In this method, lasers on Earth are fired toward reflectors that were left on the Moon by astronauts or probes. The amount of time it takes for each pulse to return to Earth is used to precisely calculate the distance in kilometers (km) between Earth and the Moon.

**Model 1. Orbit of the Moon**

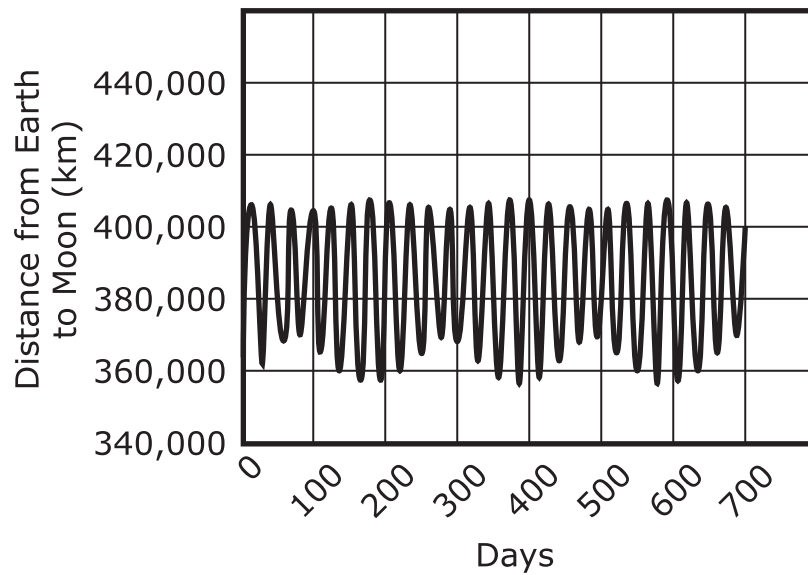




**Table 1. Distance from Earth to Moon**

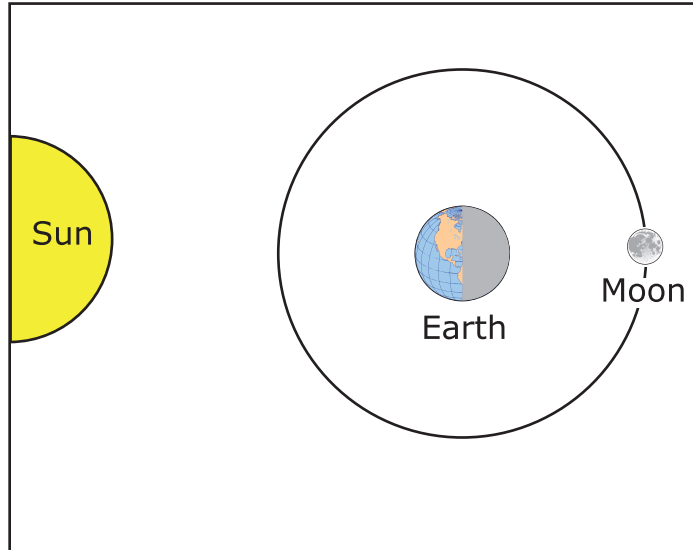
Position	Distance (km)
apogee (point farthest from Earth)	406,464
mean	384,400
perigee (point nearest to Earth)	356,565

**Figure 3.  
Distance from Earth to Moon**

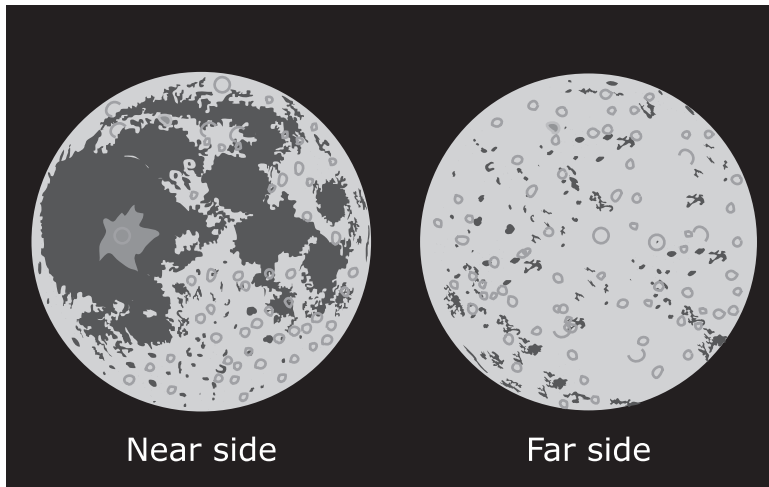


The student modified Figure 1 to make Figure 4 and found Figure 5, which is a representation of images taken by the Lunar Reconnaissance Orbiter probe, launched in 2009.

**Figure 4.**  
**Illumination of the Earth and Moon**



**Figure 5.**  
**The Near and Far Sides of the Moon**



- 31.** Using Figures 1 and 2, determine the best explanation for the Moon's phases.
- Ⓐ The Moon is held in orbit by Earth's gravity.
  - Ⓑ The Earth and Moon both rotate on their axes.
  - Ⓒ The Moon does not generate its own light, but reflects sunlight.
  - Ⓓ The Earth receives different amounts of sunlight reflected from the Moon.
- 32.** The distance between Earth and the Moon changes as the Moon orbits Earth. What can be inferred from the data in Table 1 and Figure 3?
- Ⓐ The Moon is older than the Earth.
  - Ⓑ The Moon is not a perfect sphere.
  - Ⓒ The Moon's mass is smaller than Earth's mass.
  - Ⓓ The Moon is not affected by Earth's gravity alone.

33. The student notices that the model in Figure 1 and the data in Table 1 and Figure 2 do not agree. Complete the sentences to create a valid conclusion.

Write the correct answer in each box. Not all answers will be used.

- |             |             |            |                 |
|-------------|-------------|------------|-----------------|
| A. circular | B. apogee   | C. gravity | D. non-circular |
| E. perigee  | F. rotation | G. the Sun | H. asteroids    |

Although the Moon is held in a stable orbit around the Earth

by , the Moon's orbit is .

The Moon appears to become larger in the sky as it approaches

. The Moon appears to decrease in size as its orbit

approaches .

34. The far side of the Moon shown in Figure 5 was not visible to humans until we had the ability to launch spacecraft that could orbit the Moon. Use Figures 4 and 5 to complete the sentences to explain why this is true.

Write the correct answer in each box. Some answers may be used more than once. Not all answers will be used.

A. rotates

B. revolves

C. Sun

D. Earth

Although the Moon  as it orbits the Earth, only one

side of the Moon is visible from Earth. This occurs because the

Moon  on its axis at the same rate that it

around the Earth so that one side of the Moon always faces the

.

35. The revised model in Figure 4 shows how the Sun illuminates the Earth and Moon. Complete the sentences to describe how Figure 4 can be used to explain different phenomena.

Write the correct answer in each box. Not all answers will be used.

- |         |        |          |          |
|---------|--------|----------|----------|
| A. full | B. new | C. near  | D. far   |
| E. Moon | F. Sun | G. lunar | H. solar |

In the positions shown in Figure 4, the  side of the Moon reflects light from the Sun and a  Moon appears. If aligned correctly in the position shown, the Earth's shadow can cover the  and a  eclipse occurs, which causes a darkening of the moon.

**GO ON TO NEXT PAGE**

**36.** It takes about 8 minutes and 20 seconds for light from the Sun to reach Earth. Light travels from the Moon to the Earth in about 1.3 seconds. The student found the data in Table 2 about the orbit of the Earth around the Sun. The data from the Sun is based on a technique that involves measuring the movement of the Sun as seen from two locations on Earth that are distant from each other. This method is called triangulation. Compare this to the data in Table 1 in order to answer the following tasks.

**Table 2. Distance Between the Earth and the Sun**

Position	Distance( $\times 10^6$ km)
perihelion (point nearest to the Sun)	147.1
mean - average	149.6
aphelion (point farthest from the Sun)	152.1

- Compare the size of the Earth’s orbit around the Sun to the size of the Moon’s orbit around the Earth. Support your comparison with data.
- Using your understanding of the relative size of the orbits, make a statement about the amount of time it takes for sunlight to reach the Earth compared to the time it takes for moonlight to reach the Earth based on each beam’s original source. Support your statement with data.
- Explain which of the two methods for measuring the distance from Earth is likely to be more precise.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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# Unit 3

Welcome! Today you will take unit 3 of the DC Science Assessment Practice Test.

To respond to the tasks on this test, you may be asked to review information in the form of text, images, data tables, and graphs. Analyze all the information and tasks carefully and then respond to each task. You may need to read across multiple pages to see all the information. You will be allowed to use a calculator for all units in this test.

Some tasks require more than one response. You may look back at the information as often as necessary.

For tasks that ask you to explain, describe, or answer in your own words, write your responses in the space provided. You may use scratch paper to organize your thinking before writing your response in the space provided.

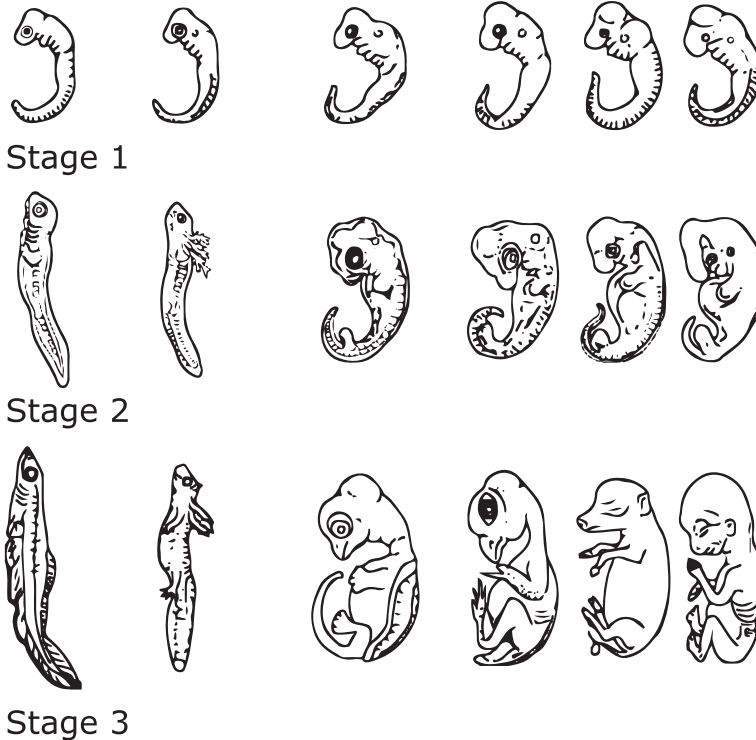
For tasks that ask you to fill in the blank spaces or write answers in the correct box, you may write the letter corresponding to the response or write the entire response in the blank space.

If you are unsure about an answer, select or compose an answer you think is the best response. You can always go back to the items you are unsure of after you've answered all other questions in the unit.

A student read that some scientists think dinosaurs are related to birds. She knows what dinosaurs look like and can't believe they could be related to birds. Her teacher showed her drawings by a scientist who studied how embryos of different species developed and explained that species might look very similar as embryos, but as they develop the traits they need to survive, their bodies change.

**Figure 1.**  
**Embryo Development of Various Species**

Fish Salamander Tortoise Chicken Pig Human



37. What do the Stage 1 embryos in Figure 1 reveal about the relatedness of the included species?
- Ⓐ All of the species are related.
  - Ⓑ Humans are unrelated to the animals.
  - Ⓒ The tortoise and chicken are unrelated.
  - Ⓓ The pig is most closely related to the chicken.

**38.** Figure 1 reveals patterns of embryonic development. What questions can be answered by studying the chart?

Select **two** correct answers.

- Ⓐ Why do tortoises have tails?
- Ⓑ At what stage do differences start to become noticeable?
- Ⓒ What is the biological purpose of a tail in tortoises and mammals?
- Ⓓ Why do fish show significant differences at an earlier stage than the other embryos?
- Ⓔ In what way do mammals, fish, and reptiles become different as they develop?

39. By Stage 3 of embryo development, shown in Figure 1, the embryos show clear differences and look somewhat like juvenile representatives of their species. Complete the sentences below that describe a visible trait.

Write the correct answer in each box. Not all answers will be used.

A. tail	B. beak	C. humans	D. fish	E. survival
F. increase	G. decrease	H. pigs		

The  is a feature that all of the embryos have in common at Stage 1. This trait is eliminated from  but is retained by all of the other species in Figure 1. Adult  and salamanders both live in aquatic environments. They share common structures because these structures  their probability of survival in their similar environments.

40. Even though they are similar at their beginnings, the embryos of different species look more different as they mature. Using Figure 1, match the trait description with the correct developmental stage. Write the correct answer or answers in each box.

A. Eyes begin to form.

B. Limbs begin to form.

C. Some tails are eliminated.

D. Toes begin to form.

Stage 1	Stage 2	Stage 3



41. Chickens begin to develop their beaks in Stage 3 of embryonic development. Having short beaks is a trait that helps chickens survive because they can peck worms and insects from the ground. Sort the additional traits in adult chickens by whether they would increase the probability of survival. Write the correct answer or answers in each box.

- A. White feathers that are easy to see in the habitat
- B. Claws that scratch the ground
- C. Red comb that regulates body temperature
- D. Waste that is used as fertilizer

<p style="text-align: center;"><b>Increases Probability of Survival</b></p>	<p style="text-align: center;"><b>Does Not Increase Probability of Survival</b></p>

42. Use Figure 1 to answer the following questions.

- Why are the drawings of embryos placed side-by-side when they are being studied?
- What is the value in studying how similarities and differences change during the development of embryos?
- If you had to put the species included in Figure 1 into three groups, what would be the groups, and what evidence from Figure 1 justifies your grouping?

Analyze the information carefully. Then write your answers in the space provided. Support your answers with details.

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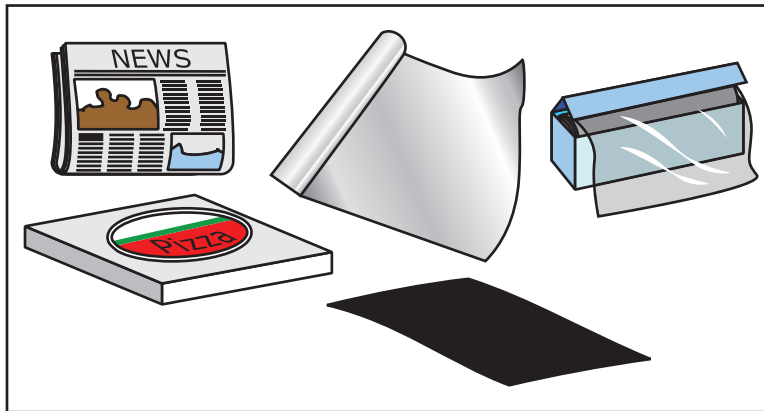
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A group of students want to create a device that will cook foods using energy from the Sun. Their goal is to design a solar cooker that will maximize the rate of cooking.

Figure 1 shows the materials available to the students which include newspaper, plastic wrap, aluminum foil, black construction paper, and a pizza box.

**Figure 1. Available Materials**



**43.** What measurements should students make to determine the dependent variable?

Select **two** correct answers.

- (A) color
- (B) mass
- (C) temperature
- (D) time
- (E) volume

44. When testing how energy is transferred within the solar cooker, the students find that the temperature of the air in the cooker increases more quickly than the temperature of the food in the cooker. What factors of the matter being measured cause this phenomenon?

Select **three** correct answers.

- Ⓐ the state of the matter
- Ⓑ the mass of the matter
- Ⓒ the density of the matter
- Ⓓ the starting temperature of the matter

45. Describe an effective solar cooker.

Write the correct answer in each box. Not all answers will be used.

A. mass

B. kinetic energy

C. potential energy

D. temperature

E. thermometer

F. scale

As the cooker works, the food particles gain .

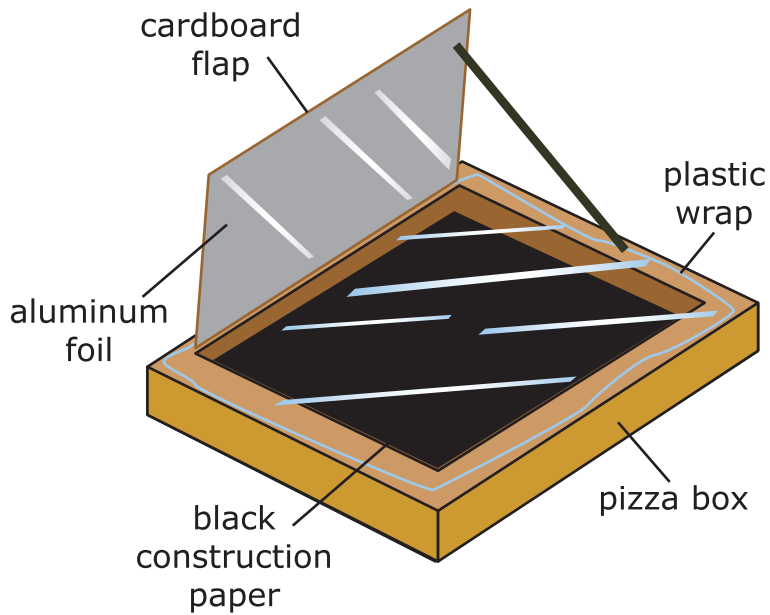
This can be measured by using a  to determine

the rise in .

46. The students learn that as energy travels throughout the solar cooker, each material used can serve a particular purpose by interacting with energy differently. Match the materials to the purpose for which they are best suited.

Write the correct answer in each box.

A. reflect energy	B. absorb energy	C. trap energy
<b>Aluminum Foil</b>	<b>Plastic Wrap</b>	<b>Black Paper</b>



47. In their design, one student stated that the box should be lined around the edges with rolled up newspaper.

Write the correct answer in each box to create a scientific explanation the student could use to justify this design choice.

A. hotter

B. entering

C. conductor

D. insulator

E. colder

F. leaving

The newspaper will act as a(n)  to prevent the

energy from  the solar cooker. The newspaper will

improve the design based on the principle that energy will spontaneously

transfer from a  area to a  one.

48. Why variables change and what measurements are made are important parts of any investigation, including the evaluation of designs. Use your knowledge to explain why the following phenomena occur in solar cookers.
- Explain why the temperature of the air rises faster than the temperature of the food. Explain in terms of kinetic energy.
  - Explain why the temperature of a more dense piece of food takes longer to rise in temperature than a less dense piece of food of the same type and volume. Explain in terms of kinetic energy.
  - Explain why the intensity of the sunlight does not matter when evaluating different solar cooker designs as long as the designs are all tested at the same time and place.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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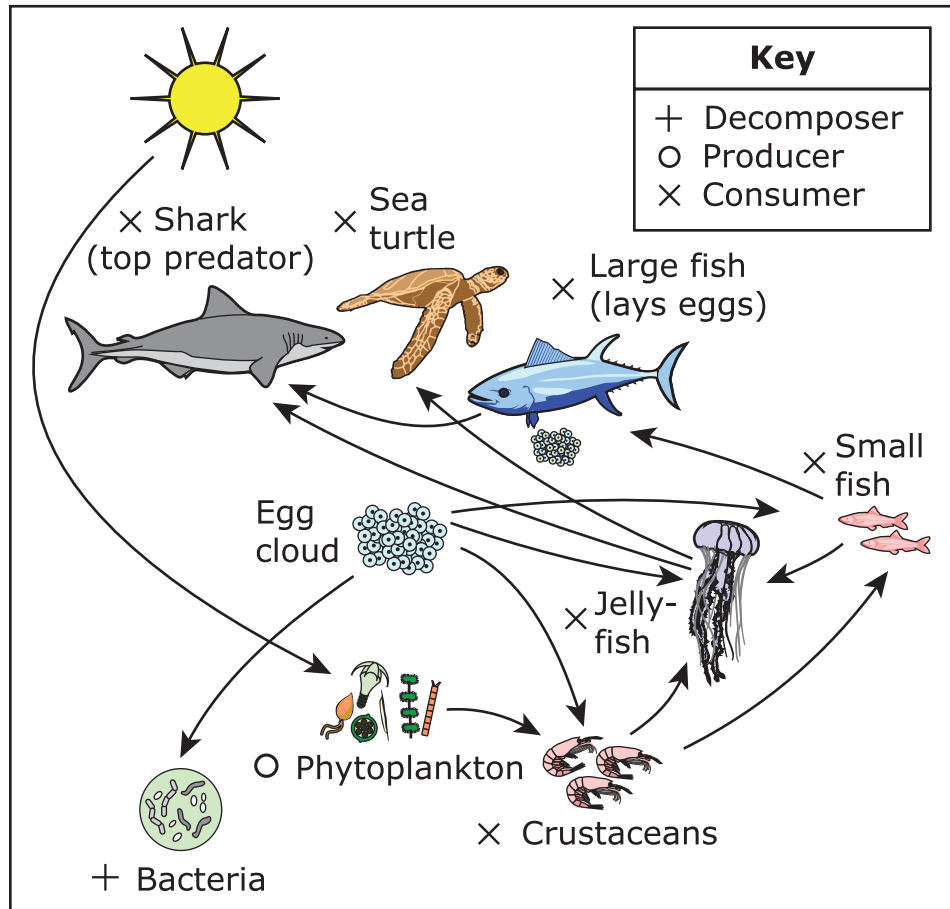
Some students are visiting a coral reef off the coast of Florida. They notice a cloudy area in the water with a group of large fish in the middle. Many smaller fish are gathering there, too. After the cloudy area dissipates, the fish stop grouping up in the area. The students conduct further research and find that the cloudy area is called an “egg cloud.” The egg cloud is an area where fish have gathered to lay eggs to be fertilized. The students learn that the egg cloud provides energy for organisms that are both higher and lower than fish on the food chain. The students create Figure 1 to describe interactions in the reef ecosystem. They also learn that water temperature influences the ecosystem. The change in water temperature for the coral reef is shown in Table 1. They do some research and find Figures 2 and 3.

**Table 1. Average Coral Reef Water Temperature**

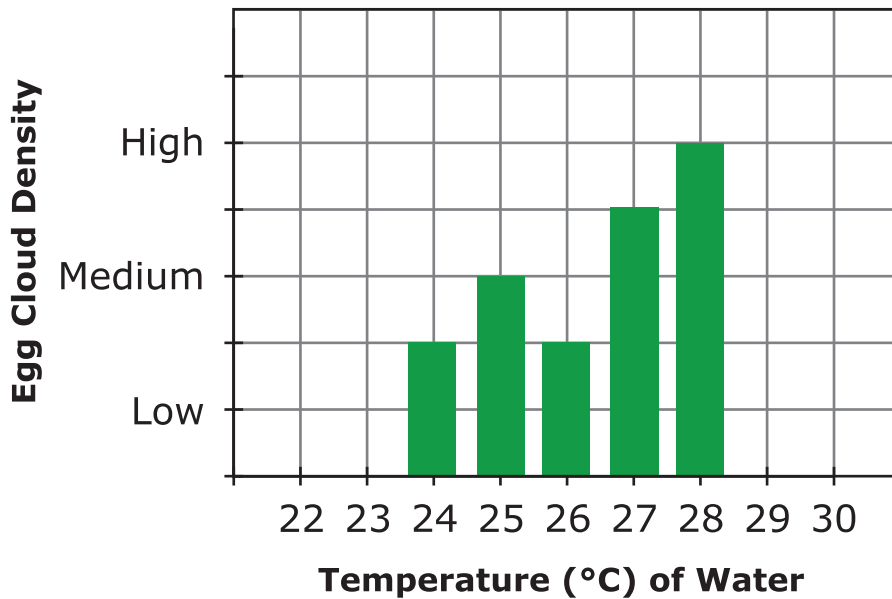
Month	Temperature (°C)
January	21
April	26
July	31
October	28

Source: National Oceanographic Data Center

**Figure 1. Reef Ecosystem Interactions**

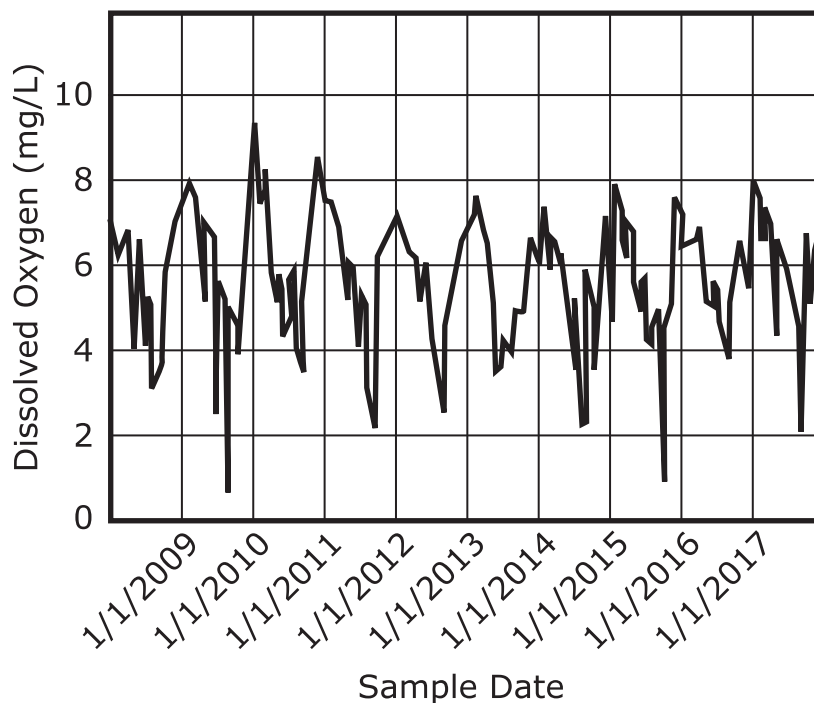


**Figure 2. Observed Egg Clouds in Reef Ecosystem**



Water off the Florida coast is warmer in the summer and cooler in the winter.

**Figure 3. Dissolved Oxygen in Reef Ecosystem**



Source: Sarasota County Environmental Services Department

49. The students observe how energy and matter moves in the reef ecosystem. What are the primary sources of matter and energy in the web?

Select **two** correct answers.

- Ⓐ the Sun
- Ⓑ the eggs
- Ⓒ the bacteria
- Ⓓ the smaller fish
- Ⓔ the phytoplankton

50. Organisms in the same system will compete for limited food. If there is a reduction in egg-cloud availability in the reef ecosystem, which organisms' access to food would be least affected?

- Ⓐ bacteria
- Ⓑ crustaceans
- Ⓒ phytoplankton
- Ⓓ sharks

**51.** The students analyze factors that could affect populations of organisms on the reef. Decide how each change affects the population of small fish.

Write the correct answer or answers in each box.

A. Water temperature decreases

B. Water temperature increases

C. Large fish produce more egg clouds

D. Sharks migrate into the area

**Increases population**

**Decreases population**

52. Models are representations and, therefore, have limitations. Complete the statements analyzing the limits of the reef ecosystem model in Figure 1.

Write the correct answer in each box.

A. shows

B. does not show

The model  all of the organisms in the ecosystem.

The model  how non-living factors can disrupt the ecosystem.

The model  how chemical reactions affect energy in the ecosystem.

The model  the movement of matter through the ecosystem.

The model  the movement of energy through the ecosystem.

53. The amount of oxygen in the water around the reef can affect the ecosystem in dramatic ways. Use the data in Figure 3 to complete the sentences. Scientists measure dissolved oxygen in milligrams of oxygen per liter of water (mg/L).

Write the correct answer in each box. Not all answers will be used.

- |           |                     |                |           |          |           |
|-----------|---------------------|----------------|-----------|----------|-----------|
| A. cycles | B. remains constant | C. temperature | D. volume |          |           |
| E. 2      | F. 4                | G. 6           | H. 8      | I. lower | J. higher |

The amount of oxygen in the reef ecosystem

throughout a year. This happens naturally as the

of the water changes. The normal level of

dissolved oxygen is around  mg/L. In late 2009

and late 2015, scientists noticed large numbers of dead fish

in the reef ecosystem. This indicates that dissolved oxygen

levels  than  mg/L are

harmful to many fish.



**GO ON TO NEXT PAGE**

54. Use Figure 1 and Figure 2 to answer the following tasks.

- Describe how energy flows through the ecosystem to get from the sun to the egg cloud.
- Explain why an increase in water temperature may lead to an increase in the population of bacteria.
- Explain the role of bacteria in cycling of matter in the ecosystem.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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# Unit 4

Welcome! Today you will take unit 4 of the DC Science Assessment Practice Test.

To respond to the tasks on this test, you may be asked to review information in the form of text, images, data tables, and graphs. Analyze all the information and tasks carefully and then respond to each task. You may need to read across multiple pages to see all the information. You will be allowed to use a calculator for all units in this test.

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For tasks that ask you to fill in the blank spaces or write answers in the correct box, you may write the letter corresponding to the response or write the entire response in the blank space.

If you are unsure about an answer, select or compose an answer you think is the best response. You can always go back to the items you are unsure of after you've answered all other questions in the unit.

Dairy farmers try to conserve energy while keeping their milk products safe. They would like to design containers using thermal insulation to maintain the correct temperature and prevent the growth of bacteria. Thermal conductivity measures the ability to allow heat flow.

Material costs and availability of resources used are also factors that the farmers considered in identifying the best design.

Table 1 shows test data for some common thermal insulators. Thermal insulators with lower thermal conductivity values allow less heat flow.

**Table 1. Thermal Insulation Characteristics**

Type of Insulation	Density (kg/m <sup>3</sup> )	Thermal Conductivity (per meter thick)	Notes
Foam	30	0.026	More expensive
Cork	150	0.046	Limited resources
Fiberglass	14	0.044	Absorbs water

- 55.** When milk is being processed, it must be kept warm enough to kill harmful bacteria. When it is taken in trucks to stores, it must be kept cool enough to stop bacteria from growing. For these criteria only, which material would you choose to test and why?
- Ⓐ cork, because of density
  - Ⓑ fiberglass, because of density
  - Ⓒ foam, because of thermal conductivity
  - Ⓓ fiberglass, because of thermal conductivity

56. Of the three materials tested, which one is the least likely to be used by dairy farmers in the final design, and why?

- Ⓐ fiberglass, because of its price
- Ⓑ cork, because of its availability
- Ⓒ fiberglass, because of its density
- Ⓓ cork, because of its lower thermal conductivity

57. Fiberglass is made of particles of glass surrounded by air, while foam contains bubbles of gas that cannot escape. Review Table 1. Write the correct answer in each box.

A. lower

B. higher

The foam has a  density because of the gas. If there were no bubbles in the material, there would be a  density. The thermal conductivity would be .



58. Use the data in Table 1 to answer the question. Write the correct answer in each box.

A. less

B. more

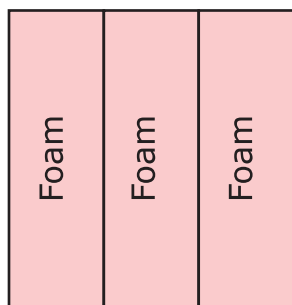
C. the same amount of

If dairy farmers test the same thickness of fiberglass and foam, the mass of fiberglass would be  than foam based on its density. Farmers would need to use  fiberglass to slow the flow of heat to the same extent.

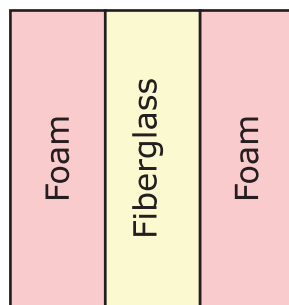
59. Dairy farmers have chosen to test two different insulating box designs. One will be used to take milk to stores. This box must not absorb water when it rains and should be as light as possible. The other box will be used to keep milk hot while it is processed inside a building where weight and water are not a problem.

Each box will be made from layers of foam or a combination of foam and fiberglass, as shown below. Write the correct answer or answers in each box to match each characteristic to the correct type of layering.

**Figure 1. Combinations of Foam and Fiberglass**



Three layers of foam



Fiberglass between two layers of foam

A. Best insulator

B. Lightest

C. Best for inside building

**Three layers of foam**

**Fiberglass between two layers of foam**

Unit 4

**GO ON TO NEXT PAGE**

**60.** When milk is being processed, it must be kept warm after it is heated. When milk is being taken to stores, it must be kept cold. To make sure that the insulation being used is working properly, you have been asked to take temperature measurements. Would you test the temperature inside the milk container or outside of the milk container?

- Explain the flow of energy while milk is being processed and where you would test.
- Explain the flow of energy while milk is being taken to stores, where you would test it and why.
- Both situations, processing milk or taking milk to stores, are affected by the air surrounding the container. Explain which situation is harder to control.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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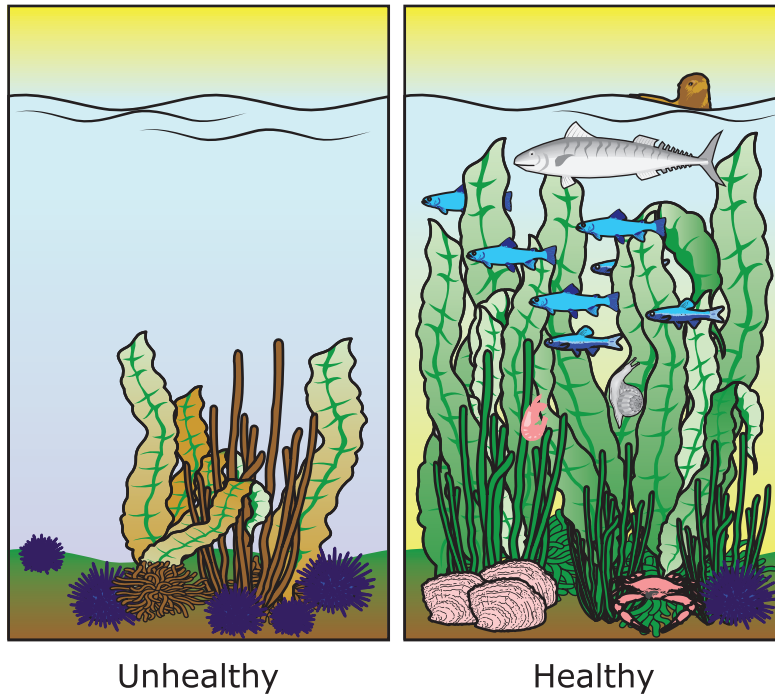
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Some students read a quote by Charles Darwin. It says, "The number of living creatures of all orders whose existence intimately depends on kelp is wonderful." They research kelp forests and find out that biodiversity in these ecosystems is declining. The students find a picture comparing an unhealthy and healthy kelp forest (Figure 1). They examine the kelp forest food web (Figure 2). They also find some data about the effectiveness of two possible solutions to the decline of kelp forests (Figures 3 and 4).

**Figure 1.**  
**Unhealthy and Healthy Kelp Forests**



Unit 4

Figure 2. Kelp Forest Food Web

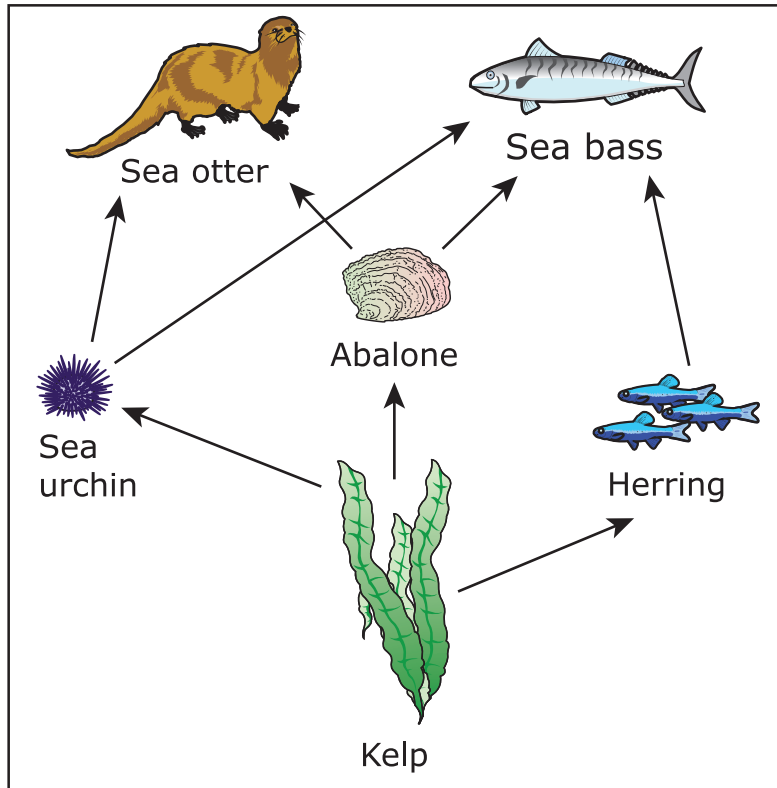
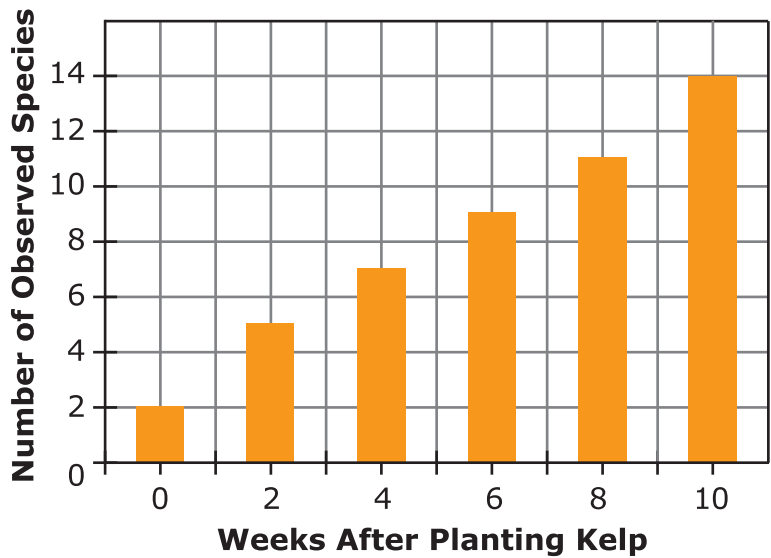


Figure 3 shows data collected after new kelp forests were planted off the coast of Costa Rica.

Figure 4 shows data collected after sea otters were re-introduced to existing kelp forests off the coast of Alaska. Biomass is the total mass of organisms in the ecosystem.

**Figure 3. Number of Species of Fish After Planting Kelp**

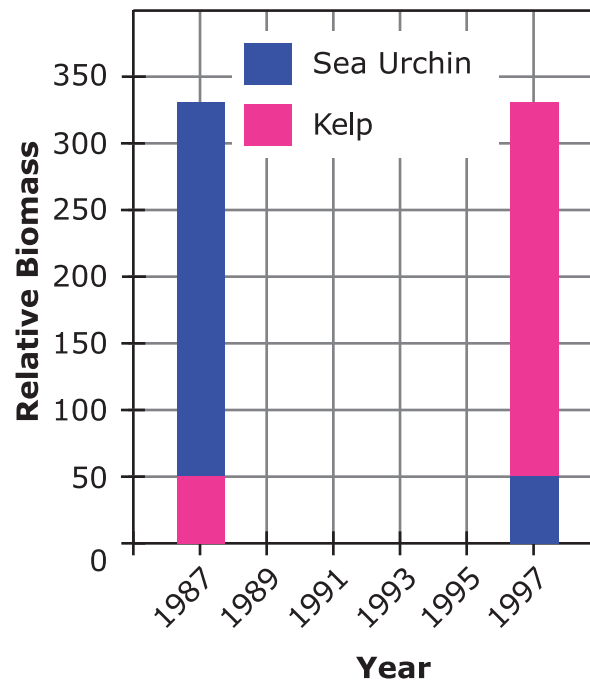


Source: R. Radulovich, et al., *Aquaculture*, 2014

Unit 4



**Figure 4. Sea Urchin and Kelp Biomass**



Source: J. A. Estes, et al., *Science*, 1998

- 61.** Examine Figures 1 and 2. What statement explains the impact that re-introducing sea otters to an unhealthy kelp forest will have on the health of the ecosystem?
- Ⓐ Health will decrease because sea otters will eat the kelp.
  - Ⓑ Health will increase because sea otters will eat sea urchins.
  - Ⓒ Health will decrease because sea otters will eat sea urchins and abalone.
  - Ⓓ Health will increase because sea otters will compete with herring for abalone.

62. Which of the following are possible ways of increasing the health of the unhealthy kelp forest ecosystem depicted in Figure 1?

Select **three** correct answers.

- Ⓐ Encourage people to harvest kelp for food.
- Ⓑ Encourage people to fish for sea bass for food.
- Ⓒ Encourage people to harvest sea urchins for food.
- Ⓓ Encourage people to plant more kelp in kelp forests.
- Ⓔ Encourage people to introduce otters to the kelp forests.

63. Compare the unhealthy and healthy kelp forests in Figure 1. Complete the sentences to describe how biodiversity relates to the health of an ecosystem.

Write the correct answer in each box. Not all answers will be used.

- |           |            |             |            |          |
|-----------|------------|-------------|------------|----------|
| A. larger | B. smaller | C. predator | D. habitat | E. biome |
|-----------|------------|-------------|------------|----------|

A healthy ecosystem contains a  variety of species than an unhealthy ecosystem. Every species has a role in the ecosystem, and if one species is lost, then it can affect all of the ecosystem. Not only must there be enough healthy kelp to maintain the food web, but the kelp also provides a  for many different species.

64. The students want to find a solution that could restore biodiversity and stability of kelp forests but cost very little or no money. Determine if each solution meets these criteria.

Write the **two** answers that best meet these criteria in the box. Not all answers will be used.

A. Farm sea bass to be returned to the oceans

B. Hold contests to see how many sea urchins can be captured by divers

C. Design and build sea otter nurseries near kelp forests

D. Hire fish and wildlife officers to enforce sea bass capture limits

E. Gather signatures for a petition to pass laws that encourage kelp farming

**Solution Meets Criteria**

65. People harvest kelp to use for food, alternative fuel, and for fertilizer for crops. They cut the kelp so it will grow back in a year. Use evidence to complete the argument on the effects of harvesting the kelp.

Write the correct answer in each box. Answers can be used more than once or not at all.

- A. large
- B. small
- C. increase
- D. decrease

Harvesting the kelp will have a  effect on the kelp forest ecosystem. Sea urchin, abalone, and herring populations will . Then, sea bass and sea otter populations will . The biodiversity of the sea kelp forest will .

**GO ON TO NEXT PAGE**

**66.** Use the data shown in Figures 3 and 4 to answer the following tasks.

- Explain whether or not the planting of new kelp forests was successful by using the test results as evidence.
- Explain whether or not the reintroduction of sea otters to existing kelp forests was successful by describing the results of the test of this solution.
- Describe how the data show that there was an increase in biodiversity in both, in one, or in neither case.

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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On a field trip to a lumber mill in Oregon, students learn that poplar trees are used for their wood. The tour guide tells the students that wood production is down this year because many poplar trees are being infected by a fungal disease called leaf spot and because the region has experienced a drought, with much less rain than usual over the last several years. The guide explains that scientists are trying two different solutions to the problem of decreased wood production.

The first solution is to take cuttings from groups of poplar trees that have desirable traits and replant them as seedlings to grow as new trees. The results of one of these experiments is shown in Table 1. In this experiment, a lumber company planted equal numbers of seedlings from three groups of poplars, just east of the Cascade Mountains of Oregon, and then years later, scientists returned to count the number of seedlings of that group that remained and grew into young trees.

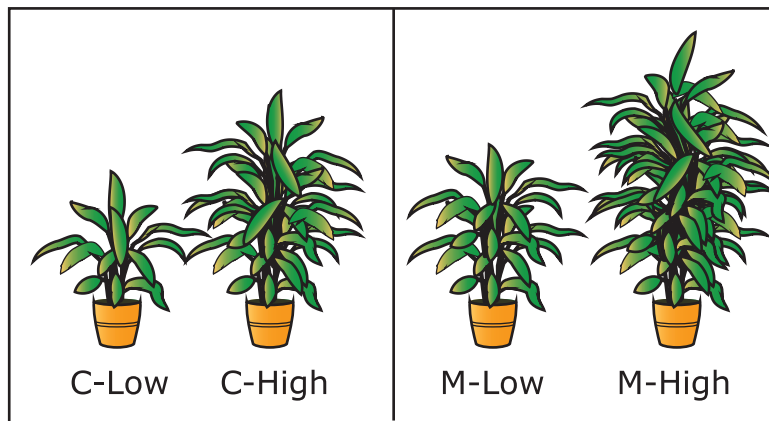


**Table 1. Survival of Poplar Seedlings by Selected Group**

<b>Poplar Tree Group</b>	<b>Number of Surviving Seedlings</b>
<b>A</b>	6,810
<b>B</b>	3,233
<b>C</b>	1,918

The second solution is to develop genetically modified poplars that can better utilize nitrate fertilizer in the soil. An experiment examined the height (in centimeters) and biomass (in grams) of the new genetically modified seedlings by comparing the groups of modified seedlings to groups of unmodified seedlings after 3 months of growth. Each group of trees had been treated with either a low or high concentration of nitrate solution to serve as fertilizer. The results of this experiment are shown in Figure 1 and Table 2. Figure 1 shows representatives of the average seedling of each group listed in Table 2. Note that 'C' refers to 'control' and 'M' refers to 'Modified', and 'High' refers to high nitrate levels and 'Low' refers to low nitrate levels.

**Figure 1. Representatives of Average Poplar Seedlings**



Unit 4

**Table 2. Poplar Tree Height and Biomass after 3 Months**

<b>Poplar Tree Group</b>	<b>Average Height (cm)</b>	<b>Average Biomass (g)</b>
<b>C-Low</b>	32	14
<b>C-High</b>	52	19
<b>M-Low</b>	39	15
<b>M-High</b>	64	33

- 67.** From which of the following groups of poplar trees should breeders take cuttings if they are trying to solve the current wood production problem?

Select **two** correct answers.

- Ⓐ Groups that are closer to the lumber mills.
- Ⓑ Groups of healthy trees that live among trees with leaf spot.
- Ⓒ Groups that are currently of greater than average height when compared to all other groups.
- Ⓓ Groups that have shown sustained growth through the last several years of less rain than usual.
- Ⓔ Groups on the south sides of the mountains, which receive more sunlight and are of greater average biomass than groups on the north sides of mountains.

68. What can scientists conclude based on the results shown in Figure 1 and Table 2?

- Ⓐ High amounts of fertilizer increase the ability of the trees to reproduce.
- Ⓑ Both high amounts of fertilizer and the genetic modification increased growth rates.
- Ⓒ Adult trees will contain more biomass if they are fed high amounts of nitrate and are genetically modified.
- Ⓓ High amounts of fertilizer increase growth rates, but the genetic modification did not increase growth rate.

69. Explain the design and the results of the breeding experiment, given in Table 1, by completing the sentences.

Write the correct answer in each box. Not all answers will be used.

A. artificial

B. natural

C. drought

D. disease

E. survival

F. growth

G. genetic

H. environmental

The scientists performed  selection by only taking cuttings from trees that had desirable traits. All of the trees selected exhibited the trait of good rooting ability,

because these trees would likely be more resistant to

. All of the trees selected also exhibited the trait of not showing the symptoms of leaf spot, because

these trees would likely be more resistant to  .

However, not all 3 groups of trees showed the same

rates. The trees of Group A likely have more

influence over the traits of interest than the

other groups.

70. Describe the influence of technology on the lumber business by completing the sentences.

Write the correct answer in each box. Not all answers will be used.

- A. artificial selection
- B. genetic engineering
- C. genetic
- D. environmental
- E. parent
- F. offspring

The results in Table 1 show that  has been used successfully by lumber companies. But the results in Table 2 show that  could be used as well. Both of these technologies can improve outcomes by selecting for  factors that are passed on through reproduction from  to .

71. Sort the following influences on poplar tree growth as either “genetic” or “environmental”.

Write the correct answers in each box.

A. Resistance to leaf spot fungus

B. Ability to utilize nitrate

C. Nitrate amounts in soil

D. Presence of leaf spot fungus

E. Hours of sunlight

F. Centimeters of rain

G. Rooting ability

**Genetic**

**Environmental**

**72.** Experimental results require explanation. Explain the experimental results shown in Table 1.

- Describe two desirable traits that the lumber company would be interested in when selecting trees for breeding.
- If all of the trees were selected based on the same traits, describe one reason for the differences in the results shown in Table 1.
- If you wanted to make sure that genetic factors were the cause of the success of Group A, how would you design a future experiment to find out?

Analyze the information carefully. Then write your answer in the space provided. Support your answer with details.

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