

## Session 1

**Directions:**

Today, you will take Session 1 of the Grade 8 Science Practice Test.

Read each stimulus and question. Then, follow the directions to answer each question. Mark your answers by circling the correct choice. If you need to change an answer, be sure to erase your first answer completely. You may look back at the stimuli when needed.

Some of the questions will ask you to write a response. Write your response in the space provided in your test booklet. Only responses written within the provided space will be scored.

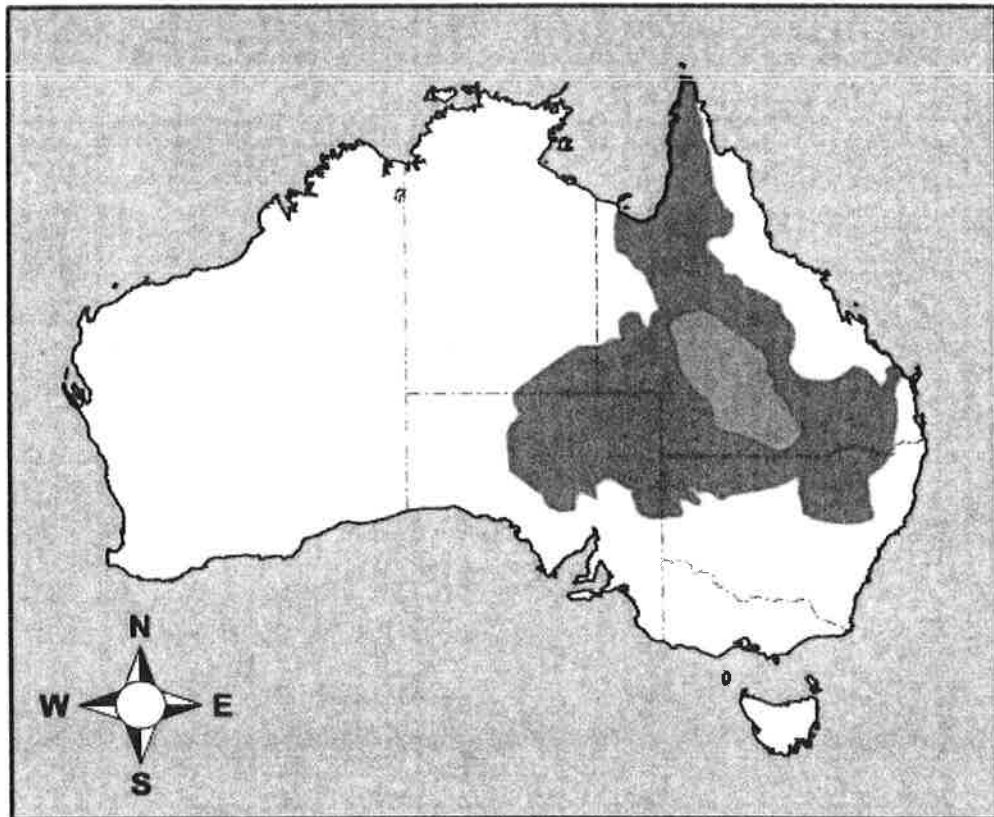
If you do not know the answer to a question, you may go on to the next question. If you finish early, you may review your answers and any questions you did not answer in this session **ONLY**. Do not go past the stop sign.



Use the information about opal and your knowledge of science to answer the questions.

### Opal

Earth processes form many different types of minerals and gems. One example is a mineral-like substance known as opal. Opal can be found in different areas across the Earth, such as Louisiana, Nevada, and Mexico. Australia is estimated to produce as much as 90 percent of the world's opal supply. Map 1 shows some of the major opal deposits in Australia.

**Map 1. Major Opal Deposits in Australia**

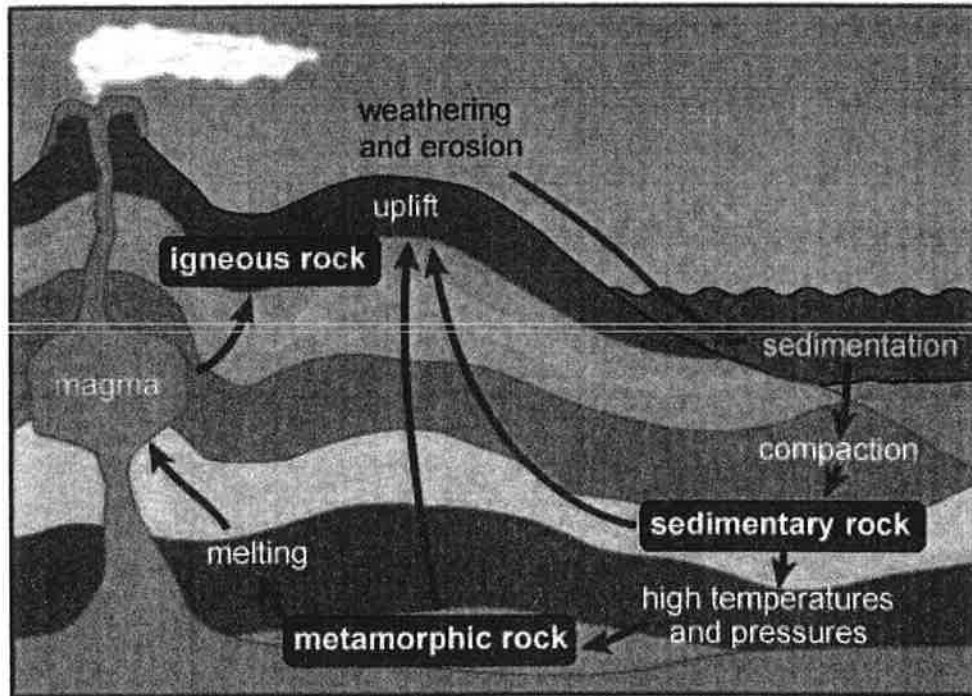


Key	
	Great Artesian Basin
	Queensland opal fields

Source: Tao Hsu.

The process of mineral and gem formation, shown in Figure 1, can help explain how opal is distributed. When sandstone is weathered, it releases grains of sand. Water can then move the sand and other minerals into the cracks formed in other types of rock along the way. When the water evaporates, sand and other materials are left behind. This mixture of sand and other minerals hardens over time, eventually forming opal.

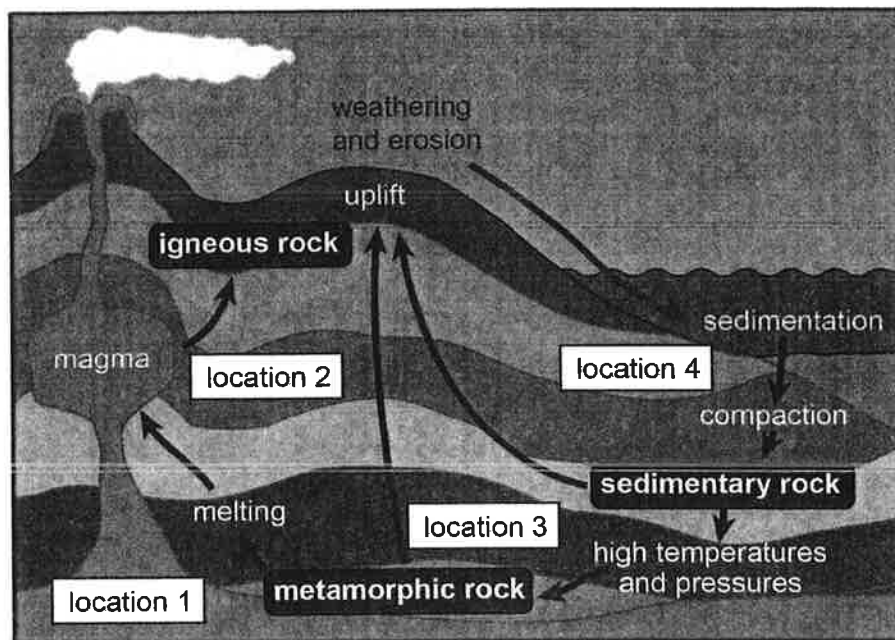
**Figure 1. Conditions for Mineral and Gem Formation**



Source: Allen Institute.

There are several environmental concerns to consider when mining opal. Some opal mines use equipment that releases harmful substances into the soil, air, and water. These machines can also heavily compact the soil in these mining areas, which can affect how the soil absorbs water. In some places, large amounts of material are excavated from an open pit in order to recover minerals available in small concentrations. The small concentration increases the amount of material that must be excavated, damaging the landscape for many years, even after a mine has shut down.

- The locations of mineral and gem formation depend on different Earth processes. Some gems need heat, extreme pressure, or even a certain type of rock layer to form.



Source: Allen Institute.

Which location in the figure shows where opal is **most likely** to form?

- A. location 1
- B. location 2
- C. location 3
- D. location 4

2. Certain steps in the mineral extraction process can often have a lasting impact on Earth.

Write the correct labels in the table to show a **primary** environmental impact and a **secondary** environmental impact of a step in the opal extraction process.

Not all labels will be used.

**Labels:**

Risk of flooding in the area decreases.

Local vegetation is damaged or removed.

Concentration of minerals in the ground is small.

Animals move to new locations in search of food sources.

Step in Mining Process	Primary Environmental Impact	Secondary Environmental Impact
Land is cleared for mining and drilling of minerals.		

3. **Part A**

Based on the information in the stimulus and Map 1, which statements **best** explain why opal is found in places such as Australia?

Circle the **two** correct answers.

- A. Australia has large amounts of sandstone and silica.
- B. Opal can only be formed where an ocean comes in contact with land.
- C. An inland sea once covered central to eastern Australia.
- D. Australia has a very hot, desertlike climate in most areas.
- E. Australia has very few active volcanoes across the continent.

**Part B**

Which statement **best** explains how the conditions identified in Part A affect the availability of opal?

- A. Weathering processes no longer occur in Australia, so no new opal is formed.
- B. Gems do not need an exact combination of elements or minerals to form, so opal forms more easily.
- C. Opal formation occurs over large periods of time, so the number of opal deposits is limited.
- D. Volcanoes in Australia no longer provide high temperatures and pressures, so no new opal is formed.

4. Identify **two** potential improvements to the opal extraction process and explain how these improvements could minimize harm to the environment.

A large rectangular box containing eight horizontal lines for writing the answer.

Use the information about glowing jellyfish and your knowledge of science to answer the questions.

### Glowing Jellyfish

Jellyfish and comb jellies have existed in both cold and warm ocean water for more than 500 million years. These two types of organisms have many similar features even though jellyfish and comb jellies are not closely related. Some jellyfish and comb jellies can even produce and emit light, as shown in Photograph 1.

#### Photograph 1. Jellyfish and Comb Jellies

**Jellyfish**



Source: NOAA.

**Comb Jellies**



Source: Wikimedia Commons.

These organisms glow because of a process known as bioluminescence. During this process, a chemical reaction produces light energy that the organism can then emit. A substance known as a luciferase helps a luciferin molecule release this light energy as it reacts with oxygen. In some comb jellies, this chemical reaction is activated when calcium is present.



The bioluminescence chemical reaction is shown in Figure 1.

**Figure 1. Simplified Bioluminescence  
Chemical Equation**



Bioluminescence can occur in different ways, depending on the organism, but a few factors are common to all bioluminescent organisms. For example, oxygen is a reactant that is always needed. This element is absorbed through the thin cell membranes of the organism. Table 1 summarizes how bioluminescence can be used in different ways.

**Table 1. Uses for Bioluminescence**

Name of Adaptation	Type	Description
flash illumination	defensive	a quick burst of light confuses predators and allows for escape
counterillumination	defensive	camouflages the organism from predators swimming below
slow glow	offensive	lures prey to the organism
pattern flash	reproductive	used to attract a mate

Scientists are studying the genes needed for bioluminescence in comb jellies. In one experiment, a researcher injected the DNA needed for bioluminescence into eight rabbit embryos. The embryos were then placed back inside the mother, where they developed normally. When the eight rabbits were born, it was found that two of them had the ability to bioluminesce. Scientists suggest that similar bioluminescent products will soon be possible for human use.

5. A population of comb jellies has members that show two distinct traits. One part of the population has male comb jellies that use a complex bioluminescence pattern to attract females. Another part of the population has male and female comb jellies that produce light in quick flashes. A new animal that preys on comb jellies enters the area.

Using Table 1, which statement describes the **most probable** change in the comb jelly population over time due to the introduction of the new predator?

- A. Only comb jellies whose genes mutate to no longer glow will survive and pass on this trait.
- B. The comb jellies that have the most complicated patterns will survive to pass on this trait.
- C. The comb jellies that are able to glow in quick flashes will survive and pass on this trait.
- D. The two types of comb jellies will have an equal chance to survive and pass on their traits.

6. A large population of comb jellies was found living in an area with a large food source. After a long period of overfishing, the food source in the area significantly decreased. Scientists want to build a model to describe how the change in the availability of food may affect different types of comb jellies in the population.

Write the statements in the correct order in the boxes to complete the outline for the scientists' model.

Each statement will be used once.

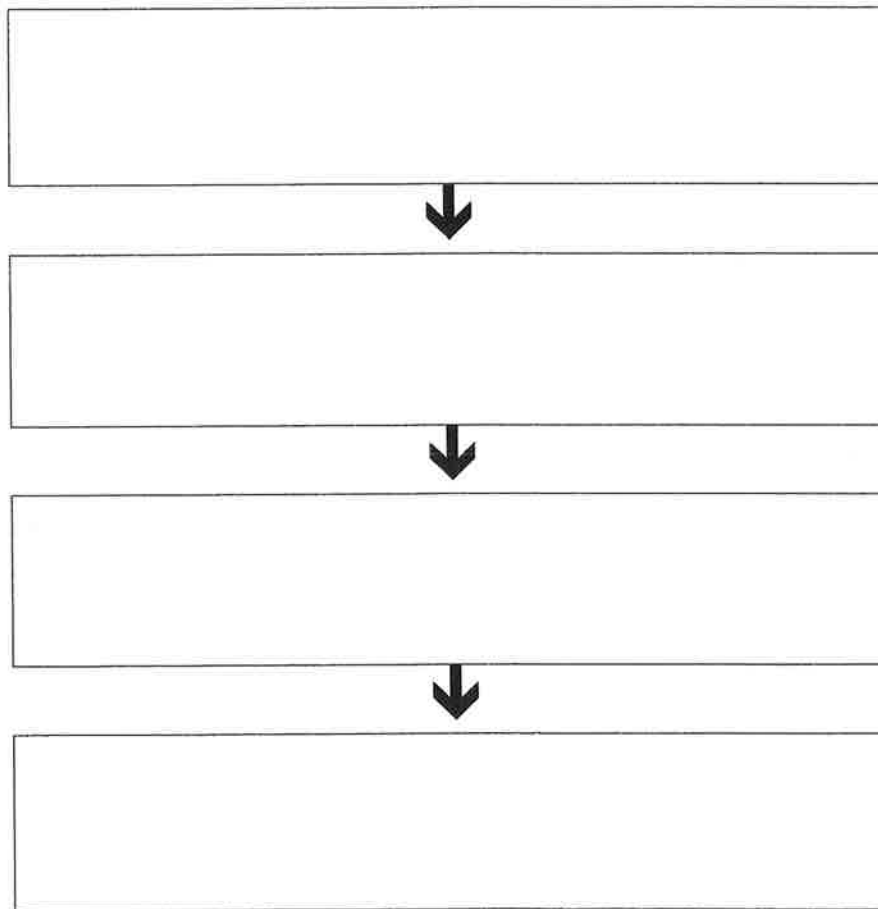
**Statements:**

The slow-glow genes will get passed on to future generations of comb jellies.

Some comb jellies in the population carry genes for producing a slow glow of light.

Slow-glowing comb jellies will be more likely to survive and reproduce.

Comb jellies that slow glow will attract more prey than comb jellies that do not slow glow.

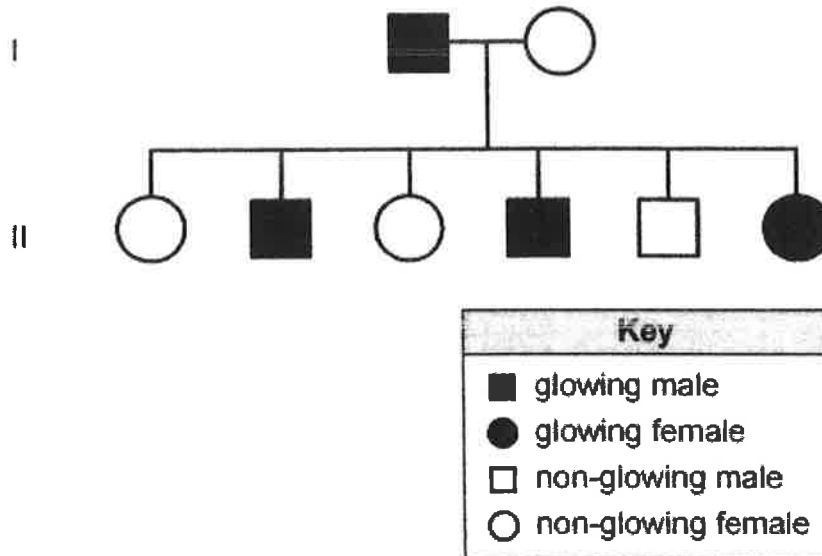


7. Some of the members of a certain population of jellyfish carry genes that allow them to produce quick bursts of light over a short period of time. Which statement describes how this trait will **most likely** affect this population of jellyfish in future generations?
- A. The percentage of jellyfish with the genes for producing quick bursts of light should increase over time because jellyfish with these genes will be more likely to avoid predators.
  - B. The percentages of jellyfish with and without the genes for producing quick bursts of light should not change because all jellyfish in this population will be better able to hunt prey.
  - C. The percentage of jellyfish with the genes for producing quick bursts of light should decrease because these jellyfish will be more easily caught by predators.
  - D. The genes for producing quick bursts of light should not give any advantage or cause any harm to the jellyfish with these genes.

**GO ON TO NEXT PAGE**

8. The slow-glow gene for bioluminescence is inherited as a dominant trait. One of two rabbits that is born with the bioluminescence gene is a male. This male rabbit is mated with a female rabbit that does not have the bioluminescence gene. The offspring resulting from this mating experiment are shown in the pedigree chart.

**Rabbit Pedigree Chart**



Unlike some jellyfish and comb jellies, which are often helped by their ability to glow, rabbits with bioluminescence genes can be more easily spotted by predators.

Use the pedigree chart to describe how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild. Explain how natural selection would affect this probability.

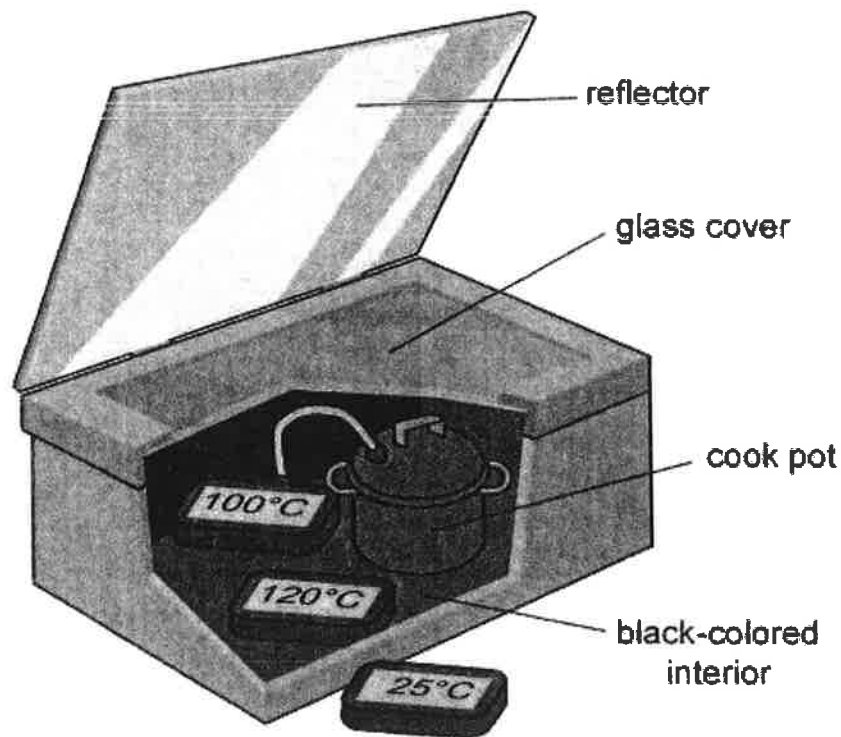
Blank area for writing the answer, containing several horizontal lines.

Use the information about a solar cooker and your knowledge of science to answer the questions.

### Solar Cooker

A group of students has decided to design a solar cooker. These devices use energy from the Sun to help cook food. First, the students plan to measure the efficiency of the solar cooker, and then they will test different improvements to their design. The initial design of their solar cooker is shown in Figure 1.

**Figure 1. Solar Cooker**



The students will first add a measured amount of water to the cook pot. The solar cooker can then be placed in direct sunlight to begin cooking food.



As ultraviolet light from the Sun is transmitted through the glass, the light is absorbed by the black-colored interior of the solar cooker. The black-colored interior then emits thermal infrared radiation as heat waves. Most of this radiation cannot pass back through the glass, causing heat to build up inside the solar cooker and the cook pot. Only the thermal infrared wavelengths of radiation can cook the food. This process of trapping radiation is called the greenhouse effect.

The students note that all of the materials used in the solar cooker are able to conduct at least a small amount of heat. They also observe that more sunlight is transmitted through the glass when it strikes the surface more directly.

9. During the solar cooking process, energy is being transferred in several different ways.

Which statements **best** explain the flow of heat energy in the solar cooker design?

Circle the **two** correct answers.

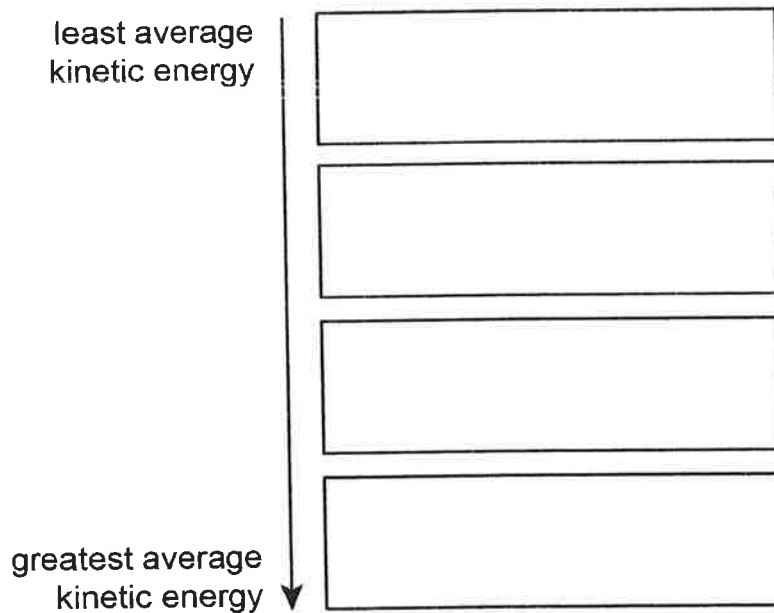
- A. Energy flows from the air outside the solar cooker to the air inside the solar cooker.
  - B. Energy flows from the air inside the solar cooker, through the sides of the cook pot, and to the water.
  - C. Energy flows from the water, through the sides of the cook pot, and to the air inside the solar cooker.
  - D. Energy flows from the air inside the solar cooker, through the sides of the solar cooker, and to the air outside the solar cooker.
  - E. Energy flows from the air outside the solar cooker, through the sides of the solar cooker, and to the air inside the solar cooker.
10. Which change to the design of the solar cooker would make the water in the cook pot boil **faster**?
- A. increasing the volume of water in the cook pot
  - B. changing the interior walls to white instead of black
  - C. using the solar cooker when the outside temperature is cooler
  - D. adjusting the reflector as the Sun moves throughout the day

11. Write the different parts of the solar cooker design in the correct order in the boxes from **least** to **greatest** based on the average kinetic energy of the particles in each part.

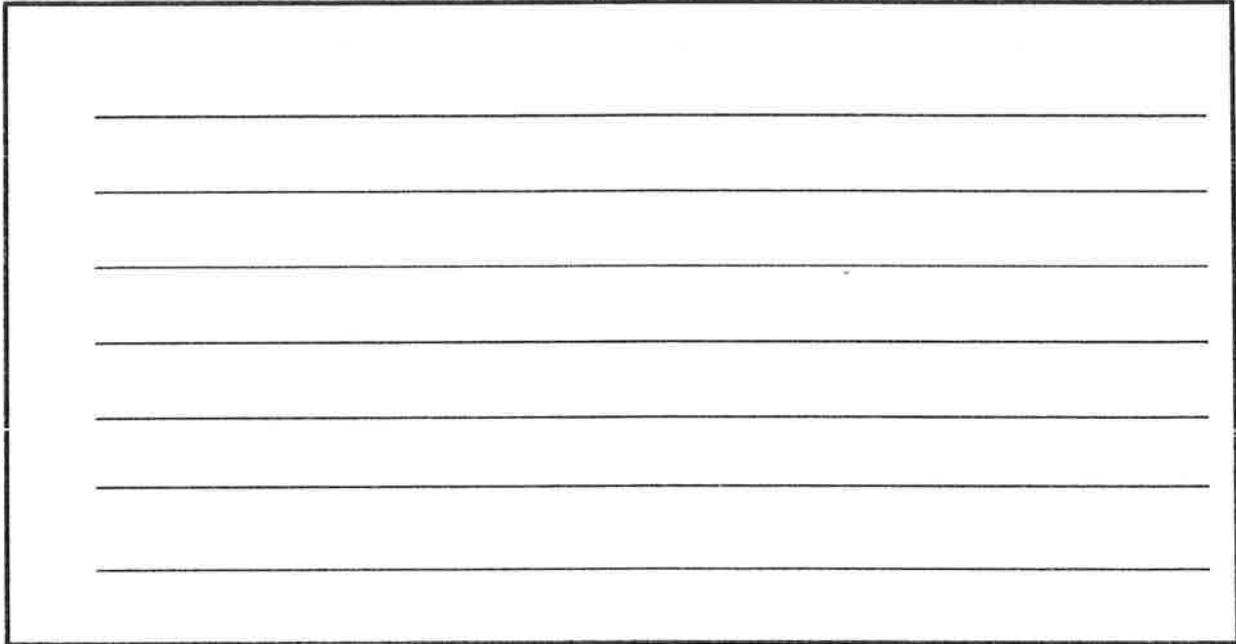
Each part will be used once.

**Parts:**

- the gas particles inside the cook pot
- the gas particles outside the solar cooker
- the solid particles of the solar cooker walls
- the gas particles inside the solar cooker



12. The students have decided to test how removing the reflective lid will affect the efficiency of the solar cooker. Explain how this change will impact the transfer of thermal energy in the solar cooker design and describe **one** possible design improvement the students can make to compensate for this change.



13. Use the information and your knowledge of science to answer the question.

The world map shows the locations where fossils of six different types of organisms have been found.



Key	
✱ fossil 1	▲ fossil 4
● fossil 2	✓ fossil 5
■ fossil 3	⊕ fossil 6

Source: *The Paleobiology Database.*

Based on the information in the map, which fossils provide the **best** evidence for past tectonic plate arrangement?

Circle the **two** correct answers.

- A. fossil 1
- B. fossil 2
- C. fossil 3
- D. fossil 4
- E. fossil 5
- F. fossil 6

14. Use your knowledge of science to answer the questions.

**Part A**

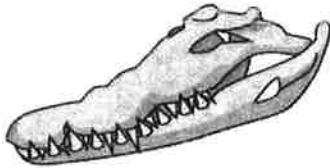
Based on the organism skulls, which organisms share the **most recent** common ancestor?

Circle the **two** correct answers.

A.



B.



C.



D.



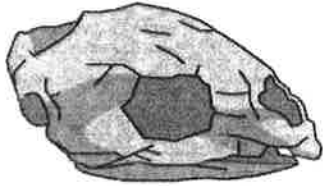
E.



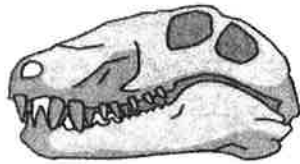
**Part B**

Which fossil shows a skull for an organism that is **most likely** the ancestor for the organisms selected in Part A?

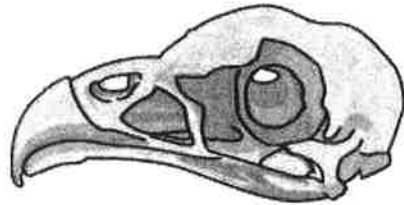
A.



B.



C.

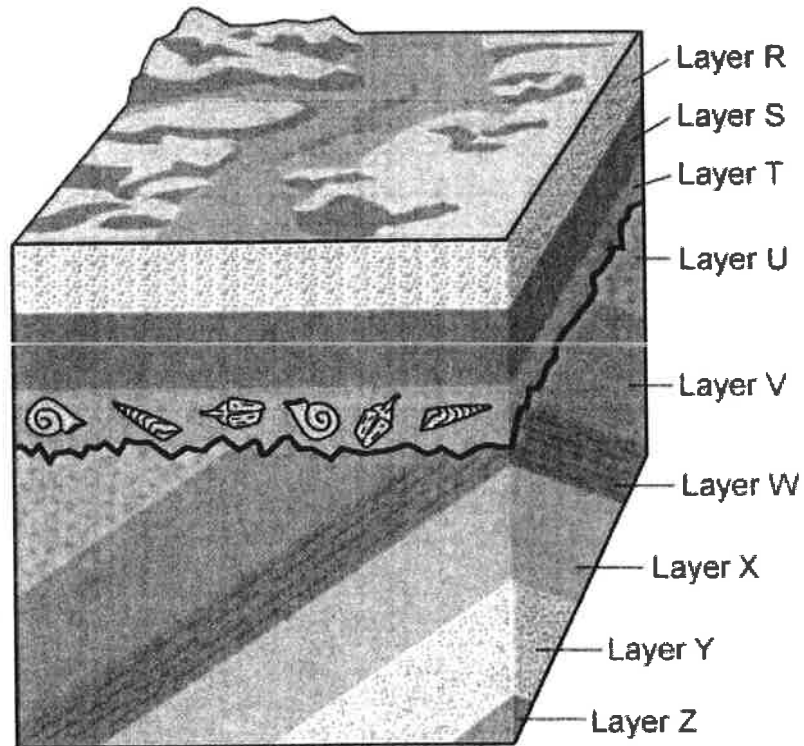


D.



15. Use the information and your knowledge of science to answer the questions.

Rock layers can often help scientists compare and date fossils across a geological timeline. These layers can be affected by different Earth processes. The diagram shows a section of rock layers affected by both erosion and tectonic plate movement.





**Part A**

Which timeline of events **best** explains the formation of the rock layers in the diagram?

- A. Layers R–T formed → Layer T eroded → tectonic pressure pushed layers at an angle → Layers U–Z formed
- B. Layer Z formed → tectonic pressure pushed layer at an angle → Layers Y–U formed → Layers W–U eroded → Layers T–R formed
- C. tectonic pressure pushed layers at an angle → Layers Z–U formed → Layer T formed → Layer T eroded → Layers S–R formed
- D. Layers Z–U formed → Layers Z–U eroded → tectonic pressure pushed layers at an angle → Layers T–R formed

**Part B**

Which statement explaining the age of the rock layers **best** supports the answer to Part A?

- A. Rock layers that contain fossils are always the oldest rock layers and can be used to determine the ages of rock layers above them.
- B. Geologic events like earthquakes can erase rock layers from the geologic timescale and make it difficult to know the ages of different rock layers.
- C. Older rock layers will always be directly below younger rock layers unless they have been disturbed by geologic activity.
- D. Rock layers that are the thickest are the oldest because they represent a longer span of time in which the rock layer was formed.

