Buried Sunlight

Model how fossil fuels form and what burning them releases

HS-ENV2-5 "Use a model or simulation to analyze how layers of energy-rich organic material have been gradually turned into great coal beds and oil pools by the pressure of the overlying earth. Observe that by burning these fossil fuels..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each condition that helps buried organic matter become a fossil fuel, then number the steps in each formation path. Circle the words that name what burning releases into the environment.

From Buried Remains to Released Heat

1. Picture a layered model of an ancient coastal swamp. At the surface, plants capture sunlight through photosynthesis and store some of that energy in carbon-rich tissue. When plants die in oxygen-poor water, decomposers cannot break down all their remains. More plants pile up, forming peat. Rivers spread sediment over the peat, adding weight and pressure as new layers accumulate. Over millions of years, burial also raises temperature. Water and other substances leave the compressed peat, and its carbon becomes more concentrated. The result can be a thick coal bed, not a layer made by pressure alone.

2. Now move the model offshore. Microscopic algae and other organisms use sunlight or eat organisms that do, then sink after death. Some remains settle into mud where little oxygen is available. As more sediment piles on top, pressure and heat gradually transform buried organic matter into oil and natural gas. Oil may move through porous rock until an impermeable layer traps it in a pool. Unlike a coal bed, an oil pool may be located away from the rock where its organic material first accumulated. In either path, burial preserves some energy originally captured from sunlight rather than creating energy.

3. Imagine extending both model paths to a power plant. Burning coal or oil transfers stored chemical energy into heat, which can generate electricity but also warms the surroundings. Combustion does not make the carbon disappear: fuel carbon combines with oxygen from the air to form carbon dioxide, CO_2, which enters the atmosphere. Sulfur-containing fuels can also release sulfur dioxide, and incomplete burning can produce soot. These materials are matter released into the environment, not forms of energy. The layered model leaves out many details, including differences in burial rates, so it shows likely processes rather than guaranteeing a deposit at every site.

2 ANSWER WITH EVIDENCE

Use the passage

1. In the swamp model, what would likely happen to coal formation if oxygen-rich water reached the dead plants before burial? Explain why.

2. Why might an oil pool be found away from the place where its organic matter first settled?

3. Trace the energy in a coal bed from its original source to the surroundings when the coal burns.

4. Trace carbon from a fossil fuel into the air during combustion. How is this movement of matter different from the energy transfer?

3 YOUR TURN

Your own words

A river delta covers one oxygen-poor marsh with new sediment each year, but another marsh drains and its dead plants are exposed to air. Write a four-step text model comparing their paths, predicting which marsh is more likely to produce coal, and tracing the energy and carbon if that coal is burned.

ANSWER KEY

Buried Sunlight

PART 1 · READ AND MARK

Underline each condition that helps buried organic matter become a fossil fuel, then number the steps in each formation path. Circle the words that name what burning releases into the environment. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In the swamp model, what would likely happen to coal formation if oxygen-rich water reached the dead plants before burial? Explain why.	**Decomposers would break down more of the plants, leaving less peat to become coal.**
2	Why might an oil pool be found away from the place where its organic matter first settled?	**After forming, oil can move through porous rock until an impermeable layer traps it.**
3	Trace the energy in a coal bed from its original source to the surroundings when the coal burns.	**Plants captured sunlight and stored some of its energy in organic matter. Burning the coal transfers that stored chemical energy to the surroundings as heat.**
4	Trace carbon from a fossil fuel into the air during combustion. How is this movement of matter different from the energy transfer?	**Carbon in the fuel combines with oxygen and enters the air as carbon dioxide. The carbon is matter, while stored chemical energy is transferred as heat.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

1. Plants in both marshes capture sunlight and store energy in their tissue. 2. Dead plants in the drained marsh are exposed to oxygen, so decomposers break down more of them; remains in the wet marsh can accumulate as peat. 3. Sediment buries the peat, and pressure and heat over millions of years make the covered marsh more likely to produce coal. 4. If that coal burns, its stored energy becomes heat, while its carbon combines with oxygen and enters the air as CO_2.

Accept models that show reduced preservation in the drained marsh and connect burial, pressure, heat, and time to the greater likelihood of coal formation in the covered marsh. Energy must be traced to heat, and carbon must be traced to carbon dioxide.