Energy in the Pool

Trace how matter cycles and energy moves through living things.

FB.3.4 "Analyze the relationship between photosynthesis and cellular respiration and explain that relationship in terms of the need for all living things to acquire energy from their environment."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline substances that connect photosynthesis and cellular respiration, circle where energy enters or leaves the pool, and number the steps that carry energy from sunlight to crab cells.

A Tide Pool After Dark

1. At low tide, a shallow pool holds green algae, grazing snails, and a small crab. Sunlight reaches the algae through the water. In photosynthesis, algae use light energy to turn carbon dioxide and water into sugars and oxygen. The sugars hold chemical energy that came from sunlight. Some sugar becomes material for new algal cells, while some remains available as fuel. A snail scraping algae from a rock takes in that stored chemical energy as food. The crab may eat the snail, gaining energy that first entered this food chain as sunlight.

2. Algae do not stop needing energy when clouds cover the pool. In cellular respiration, their cells break down sugars using oxygen, releasing energy that cells can use for growth and repair. Snail and crab cells also carry out cellular respiration, using sugars from food and oxygen from their surroundings. This process produces carbon dioxide and water. Much of the released energy becomes heat as organisms use it, so energy does not cycle endlessly through the pool. At night, photosynthesis stops without light, but respiration continues in algae, snails, and crabs as long as they have fuel and oxygen.

3. At sunrise, light again lets algae make sugars. Some carbon dioxide produced by respiration can enter the water and be used in photosynthesis. Water can also be used again, and oxygen made by algae can support respiration. These substances move between the two processes, but the energy does not return to sunlight after a cell uses it. New light energy must enter the pool to replace energy lost as heat. A snail cannot collect sunlight to make its own sugars, so it needs food; algae need sunlight to produce sugars and also use those sugars to power their cells.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why can algae still release usable energy at night even though photosynthesis has stopped?

2. Trace the energy the crab uses back to sunlight. Include photosynthesis, feeding, and cellular respiration in your explanation.

3. How can a substance produced during cellular respiration help photosynthesis, and how can a substance produced during photosynthesis help cellular respiration?

4. If substances move between photosynthesis and respiration, why does the pool still need new sunlight?

3 YOUR TURN

Your own words

Choose a setting other than a tide pool and name a plant or alga and an animal that eats it. In about five sentences, explain how energy enters this food relationship, how both organisms use cellular respiration, and why the setting needs a continuing energy source.

ANSWER KEY

Energy in the Pool

HIGH SCHOOL · FB.3.4

PART 1 · READ AND MARK

Underline substances that connect photosynthesis and cellular respiration, circle where energy enters or leaves the pool, and number the steps that carry energy from sunlight to crab cells. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why can algae still release usable energy at night even though photosynthesis has stopped?	**Photosynthesis has made sugars that the algae can use as fuel. At night, their cells can break down those sugars through cellular respiration if oxygen is available.**
2	Trace the energy the crab uses back to sunlight. Include photosynthesis, feeding, and cellular respiration in your explanation.	**Algae capture sunlight through photosynthesis and store its energy in sugars. A snail eats algae, and the crab eats the snail. The crab uses food molecules in cellular respiration to release usable energy.**
3	How can a substance produced during cellular respiration help photosynthesis, and how can a substance produced during photosynthesis help cellular respiration?	**Respiration produces carbon dioxide, which algae can use in photosynthesis. Photosynthesis produces oxygen, which cells can use in respiration.**
4	If substances move between photosynthesis and respiration, why does the pool still need new sunlight?	**Energy does not cycle between the processes the way substances can. Some energy becomes heat as organisms use it, so new sunlight must enter the pool.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In a meadow, grass captures sunlight and stores some of its energy in sugars through photosynthesis. A rabbit gains stored chemical energy when it eats the grass. Grass cells use sugars and oxygen in cellular respiration to release energy for their activities. Rabbit cells also use food molecules and oxygen in cellular respiration to release usable energy. Because some energy becomes heat as the organisms use it, new sunlight must keep reaching the meadow.

Accept other accurate descriptions of energy moving from sunlight through a producer and food to an animal. Responses should distinguish substances that can be used again from energy that leaves as heat.