After Dark Energy

Model the energy paths in a solar garden light.

8.16 "Develop and use a model to construct an explanation of how electrical energy is transferred and transformed."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline places where energy changes form, circle parts that carry electrical energy, and write 1 beside daytime charging and 2 beside nighttime lighting to plan your models.

The Light Beside the Path

1. At the edge of a school garden, a small solar light gathers energy while the sun is up. Sunlight strikes its solar cell, which changes part of that incoming light energy into electrical energy. Wires connect the cell to a rechargeable battery inside the post. During the day, electricity passes through the wires and charges the battery, storing energy in a chemical form. Not all sunlight becomes stored energy. Some light bounces off the cell, and some energy spreads to the surroundings as thermal energy.

2. After sunset, a sensor closes a switch in the light's circuit. The charged battery then supplies electrical energy through wires to an LED. Inside the LED, some electrical energy changes into visible light. The LED also warms slightly, so thermal energy leaves it and reaches the nearby air. If a wire breaks or the switch stays open, the circuit has no complete path. Energy cannot be transferred through that broken path to the LED, even if the battery still holds stored energy.

3. An energy model can show parts of this system as labeled boxes, with arrows for energy moving between them. Arrow labels name the form of energy being transferred, while notes inside boxes can name changes in form. A model for this light needs different paths for daytime charging and nighttime lighting because the direction of electrical transfer changes. It should also include energy reaching the surroundings rather than suggesting that all energy becomes useful light. Models leave out many details, but they help explain what happens when a part changes.

2 ANSWER WITH EVIDENCE

Use the passage

1. Make a daytime arrow chain from the sun to the battery. Label the energy form before the solar cell, through the wires, and in the charged battery.

2. Make a nighttime arrow chain from the battery to the nearby air. Include the LED and label the energy forms.

3. A model shows only battery -> LED -> visible light and claims all stored energy becomes light. What two changes would make this model more accurate?

4. Suppose the switch stays open after sunset. Explain which arrow in a nighttime energy model would no longer show energy transfer and what would happen to the LED.

3 YOUR TURN

Your own words

Choose an electrical device other than a garden light. Write an arrow model that shows its energy source, the path electrical energy takes, and at least two forms of energy it produces, then explain your model in two sentences.

ANSWER KEY

After Dark Energy

GRADE 8 · 8.16

PART 1 · READ AND MARK

Underline places where energy changes form, circle parts that carry electrical energy, and write 1 beside daytime charging and 2 beside nighttime lighting to plan your models. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Make a daytime arrow chain from the sun to the battery. Label the energy form before the solar cell, through the wires, and in the charged battery.	**Sun (light energy) -> solar cell (electrical energy) -> wires (electrical energy) -> battery (stored chemical energy).**
2	Make a nighttime arrow chain from the battery to the nearby air. Include the LED and label the energy forms.	**Battery (stored chemical energy) -> wires (electrical energy) -> LED (thermal energy) -> nearby air (thermal energy).**
3	A model shows only battery -> LED -> visible light and claims all stored energy becomes light. What two changes would make this model more accurate?	**Add the electrical transfer through wires between the battery and LED. Add an arrow showing thermal energy moving from the LED to the nearby air.**
4	Suppose the switch stays open after sunset. Explain which arrow in a nighttime energy model would no longer show energy transfer and what would happen to the LED.	**The arrow showing electrical energy moving through the circuit to the LED would no longer apply. The LED would not light.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Wall outlet (electrical energy) -> cord (electrical energy) -> fan motor (motion and thermal energy) -> blades (motion) -> air (motion).
Electrical energy travels from the outlet through the cord to the fan motor, where some becomes motion that turns the blades. The blades transfer energy to the air, and some electrical energy also becomes thermal energy in the motor.

Accept equivalent arrow models that distinguish energy transferred between parts from energy transformed within a part. For the open task, accept any accurate device model with a source, an electrical path, two output energy forms, and a two-sentence explanation.