

Reservoir Energy Trail

Trace how a pumped-storage system transfers and transforms energy.

PS.5 "The student will investigate and understand that energy is conserved. Key ideas include energy can be stored in different ways; energy is transferred and transformed; and energy can be transformed to meet societal needs."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each phrase that names a form of energy. Number each sentence that describes energy being transferred or transformed so you can trace where the energy goes.

Saving Energy for Evening Use

- ① On a windy afternoon, a power company may use extra electricity to pump water from a lower reservoir to a higher one. The moving electric charges in the wires transfer energy to motors. The motors transform electrical energy into kinetic energy as the pumps move. The water gains gravitational potential energy because it is stored high above the lower reservoir. Energy has not been created inside the pumps. Some energy also spreads to the surroundings as thermal energy and sound.
- ② Later, when homes need more electricity, operators open a gate. Gravity pulls the stored water downhill through a turbine. The water's gravitational potential energy transforms into kinetic energy. The spinning turbine transfers energy to a generator, which transforms kinetic energy into electrical energy that travels through power lines. Friction in the water, turbine, and wires transforms part of the energy into thermal energy. The useful electrical output is smaller than the energy released by the falling water, but the total energy is conserved.
- ③ This system helps meet a societal need, reliable electricity during busy evening hours. It does not make energy from nothing. Instead, it stores energy when demand is low and transforms stored gravitational potential energy into electrical energy when demand is high. Engineers try to reduce unwanted thermal and sound transfers by choosing efficient pumps, turbines, and generators. Even in an efficient system, every energy transfer has effects beyond the intended electrical output, while the total amount of energy remains constant.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What form of energy does the water gain when it is pumped into the higher reservoir?

2 Trace the main energy changes from stored water moving downhill until electricity travels through power lines.

3 Why is the useful electrical output smaller than the energy released by the falling water, even though energy is conserved?

4 What societal need does the pumped-storage system help meet, and when does it provide energy?

3 YOUR TURN _____ Your own words

Write 3 sentences, 45 to 65 words, about a technology that meets a societal need. Trace at least three energy forms or transfers in the technology, include one unwanted energy transfer, and explain how energy is conserved.

PART 1 • READ AND MARK

Underline each phrase that names a form of energy. Number each sentence that describes energy being transferred or transformed so you can trace where the energy goes. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What form of energy does the water gain when it is pumped into the higher reservoir?	The water gains gravitational potential energy.
2	Trace the main energy changes from stored water moving downhill until electricity travels through power lines.	Gravitational potential energy transforms into kinetic energy as water falls. The turbine transfers energy to the generator, which transforms kinetic energy into electrical energy.
3	Why is the useful electrical output smaller than the energy released by the falling water, even though energy is conserved?	Some energy is transformed into thermal energy because of friction in the water, turbine, and wires. Energy is also transferred as sound, so less is available as useful electrical output.
4	What societal need does the pumped-storage system help meet, and when does it provide energy?	It helps provide reliable electricity for homes during busy evening hours, when demand is high.

PART 3 • YOUR TURN (SAMPLE ANSWER)

An electric bus uses chemical energy stored in its battery, which is transformed into electrical energy and then kinetic energy that moves the bus. Some energy transfers to the surroundings as thermal energy and sound. The bus meets a transportation need, and the total energy is conserved even though less energy remains available for motion.

Accept equivalent descriptions of the passage's energy transfers and transformations. For the open response, accept any accurate technology example that traces energy, identifies an unwanted transfer, and states that total energy is conserved.