

Where Energy Waits

Model energy as particle motion or energy stored in fields.

HS-PS3-2 "Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each phrase that tells where energy is stored or how it changes, and circle each feature a model should show. These marks will help you connect energy accounting to a particle or field model.

Three Ways to Track Energy

- ① At the Riverside Science Center, a cart rolls down a track and reaches a brake pad at the bottom. Before contact, the cart's visible motion is evidence of kinetic energy. During braking, rubbing at the wheel and pad makes both materials warmer. A particle model can show this change: draw many particles in each solid, then add longer, mixed-direction arrows after braking. The arrows do not show the cart traveling. They show faster, less organized particle motion inside the warmed materials. The cart slows while thermal energy increases, so the total energy account includes both changes.
- ② Energy can also be stored in the gravitational field of the Earth and cart system. At the top of the track, the cart is higher above Earth than it is at the bottom. A system diagram can represent Earth and cart as two objects, with a field region between them and a label for stored energy. As the cart descends, the amount stored in that field decreases while the cart's kinetic energy increases. The diagram does not need to show invisible particles moving through empty space. It must show the chosen system and make clear that position in the gravitational field matters.
- ③ Electric fields provide another way to track stored energy. Imagine two metal plates connected to a battery for a short time, then disconnected. One plate has a positive charge and the other has an equal negative charge. A model may draw the plates, plus signs, minus signs, and field arrows from the positive plate toward the negative plate. The space between the plates is part of the system because energy is stored in the electric field there. When the plates are connected through a small lamp, charges move, stored field energy decreases, and the lamp transfers energy to light and warmer materials. A complete model labels these energy changes.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What do the longer, mixed-direction arrows in the brake-pad particle model represent, and what do they not represent?

2 Write an energy-account statement for the cart as it brakes, using the passage evidence.

3 What two objects and what region should a system diagram show to model energy stored when the cart is high on the track?

4 Name two features a model of the charged plates should include, then state what the space between the plates represents.

3 YOUR TURN _____ Your own words

Create a two-panel model for a steel ball held above a clay pad, then released onto the pad. In each panel, label the system and energy locations, use arrows or notes to show changes, and include a one-sentence energy account.

PART 1 • READ AND MARK

Underline each phrase that tells where energy is stored or how it changes, and circle each feature a model should show. These marks will help you connect energy accounting to a particle or field model. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What do the longer, mixed-direction arrows in the brake-pad particle model represent, and what do they not represent?	They represent faster, less organized particle motion in the warmed solids. They do not represent the cart traveling.
2	Write an energy-account statement for the cart as it brakes, using the passage evidence.	The cart's kinetic energy decreases as thermal energy, shown by increased particle motion in the wheel and brake pad, increases.
3	What two objects and what region should a system diagram show to model energy stored when the cart is high on the track?	It should show the Earth, the cart, and the gravitational field region between them.
4	Name two features a model of the charged plates should include, then state what the space between the plates represents.	The model can include plus and minus signs on the plates and field arrows from the positive plate to the negative plate. The space between the plates contains the electric field where energy is stored.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Panel 1: System, steel ball, Earth, and clay pad. The ball is above Earth, so energy is stored in the gravitational field between Earth and the ball. Panel 2: The ball is stopped in the clay, and longer, mixed-direction particle arrows in the ball and clay show increased particle motion after impact. Energy account: Energy changes from gravitational field energy to kinetic energy and then to increased particle motion in the ball and clay.

Accept equivalent diagrams or descriptions that identify a system, show energy stored in a gravitational or electric field, or use particle-motion arrows to represent thermal energy. For Part 3, the model should show energy changing form or location while accounting for the ball's motion and impact.