

Energy stores and changes in systems

Name: _____ Class: _____ Date: _____

Start here

0-5 minutes

Today: Name energy stores and explain how energy moves between them.

You need: Pen and a different-coloured pen. No calculator is needed.

Work from memory. Write on the lines. If you are unsure, make your best attempt.

1. A scooter is moving along a level road. Name the energy store associated with its movement.

2. Name the energy store in a charged battery that can decrease when it powers a device.

3. Hot water cools in a room. Name the energy store of the water that decreases.

Stop for check 1. Wait for your teacher before moving on.

Try again A

Only if your teacher asks. Use the first 2 minutes of reading time, then turn to page 2.

Help: Movement is linked to a kinetic store. Warming an object increases its thermal/internal store.

(a) Name the store associated with a spinning wheel. (b) Name the store that increases when cold water is warmed.

When your teacher says, turn to page 2.

Read the ideas and model

5-15 minutes

An energy store describes energy associated with an object or a system. A transfer pathway describes how energy moves. Name the object as well as its store.

Energy store	Think of...
Kinetic	A moving object
Thermal / internal	An object warming or cooling
Chemical	A battery, fuel or food
Gravitational potential	An object and the Earth: depends on height
Elastic potential	An object stretched or compressed
Magnetic	Interacting magnets
Electrostatic	Interacting electric charges
Nuclear	Atomic nuclei

Four transfer pathways

Mechanically: a force does work. Electrically: charge flows through a potential difference. By heating: energy goes from hotter to cooler objects. By radiation: for example, light or infrared. “Heat”, “light” and “electrical” are not extra energy stores.

Compare the start and the finish

Ask: which object’s store decreases? Which store increases? How is energy transferred? Something can move during a journey and still finish at rest, with zero kinetic energy.

Worked model - battery-powered water heater

A battery-powered heater warms some water. Trace the energy from the battery to the water, including the heating element.

The battery's chemical store decreases. Energy is transferred electrically to the heating element. The hotter element transfers energy by heating to the water, increasing the water's thermal/internal store. For water alone the incoming pathway is heating; for the heater device the supply enters electrically.

For the water alone, energy enters by heating. For the heater device, the supply enters electrically. Your account depends on which objects you include.

Reading adapted from PhysicsUK: Energy Stores and Changes, sections 1 and 3. Optional online reading.

Turn to page 3 for question 4.

Choose and explain

15-20 minutes, then begin practice

4. A book is released from a high shelf. Consider the fall before it reaches the floor and ignore air resistance. Which row describes the changing energy stores? Choose one answer and explain the direction of both changes.

- A. Gravitational potential increases; kinetic decreases.
- B. Chemical decreases; kinetic increases.
- C. Gravitational potential decreases; kinetic increases.
- D. Gravitational potential decreases; a light store increases.

Stop for check 2. Wait for your teacher before moving on.

Try again B

Only if your teacher asks. Complete this instead of questions 8 and 9. Then answer questions 5-7.

Help: After check 2: compare height and speed at two instants. A greater height means a greater gravitational potential store; a greater speed means a greater kinetic store.

A trolley rolls up a smooth ramp and slows down. Ignore friction. Which store decreases and which increases while it climbs?

Practice: name the stores - from 20 minutes

5. A load is raised above its starting position. Name the energy store that increases.

6. A dispenser warms water without boiling it. Name the energy store of the water that increases.

7. A trainee says an accelerating battery-powered trolley stores more “electrical energy”. Correct this by naming the store that increases and the battery store that decreases.

Continue with questions 8-10 on page 4.

Follow the energy changes

20-33 minutes

A hand-cranked hoist

A hand crank raises a load. The load starts and finishes at rest. Its gravitational potential energy increases by 600 J. This value is given: no calculation is needed.

8. Name the transfer pathway by which the turning hand crank raises the load.

9. A trainee says the load's 600 J energy gain is kinetic energy because the load moved. Explain why this is wrong at the end of the lift.

Pause for an independent check - about 30 minutes

10. A compressed spring launches a toy cart along a horizontal track. Describe the energy store that decreases, the store that increases and the transfer pathway while the spring pushes the cart.

Store that decreases:

Store that increases:

Transfer pathway:

Stop for check 3. Wait for your teacher before moving on.

Try again C

Only if your teacher asks. Complete this instead of questions 11 and 12. Then continue with the other questions.

Help: A stretched or compressed object has an elastic potential store. A pushing force transfers energy mechanically.

A stretched rubber band propels a foam glider horizontally. Before it begins to slow, name the store that decreases, the store that increases and the transfer pathway. Ignore height changes.

Continue with the trolley and dispenser on page 5.

Apply the ideas to equipment

33-45 minutes

11. A battery powers the motor of a trolley. Name the pathway by which energy is transferred from the battery to the motor.

12. In a later, separate test, the motor is switched off and the moving trolley is brought to rest by its brakes. Describe the changes in stores and the role of friction. Ignore height changes.

13. A mains-powered dispenser heats water. Before the water boils, describe the two transfer stages from the mains supply to the water. Include the heater.

14. The dispenser is unplugged and its hot water cools in the room. Describe the energy changes in the water and the surroundings.

Check and improve - 45-55 minutes

15. When your teacher gives the answers, check your practice in a different colour. Improve one answer. Write what you first thought, your corrected answer and why the correction is better. If all your answers were correct, explain why electrical is a transfer pathway rather than a store.

At 55 minutes, cover the earlier pages and turn to page 6.

Show what you can do

55-60 minutes

Work independently. Keep the reading and previous answers covered.

16. A rechargeable robot starts at rest, drives up a ramp and stops on a higher platform. (a) Name the battery store that decreases and the store that is greater once the robot is higher. (b) Explain why its final kinetic energy is not greater than at the start. (c) Name the transfer pathway from the battery to the motor.

(a) Battery store that decreases:

Store that is greater on the higher platform:

(b) Explain the final kinetic energy:

(c) Battery-to-motor pathway:

Stop for check 4. Wait for your teacher before moving on.

Write your name on page 1. Hand in this whole booklet, including your corrections.

Try again D - next lesson

Leave this today. Your usual teacher may ask you to do it next lesson.

a battery-powered model crane raises a load and locks it at a higher level. The load starts and finishes at rest. Name the decreasing battery store, the increased store of the load-Earth system, the final kinetic energy and the battery-to-motor pathway.

Hand your booklet to your teacher.