

Transferring Energy

Now you know about the different energy stores, it's time to find out how energy is transferred between them.

Conservation of Energy Means Energy is Never Created or Destroyed

Energy can be stored, transferred between stores, and dissipated — but it can never be created or destroyed. The total energy of a closed system has no net change.

See the next page for more on dissipation.

A closed system is just a system (a collection of objects) that can be treated completely on its own, without any energy being exchanged to or from the surroundings. If you get a question where the energy of a system increases or decreases, then it's not closed. But you can make it into a closed system by increasing the number of things you treat as part of it. E.g. a pan of water heating on a hob isn't a closed system, but the pan, the gas and the oxygen that burn to heat it, and their surroundings are a closed system.

Energy Transfers Show... well... the Transfer of Energy

Energy can be transferred between stores in four main ways:

- 1) Mechanically — a force acting on an object (and doing work, p.180), e.g. pushing, stretching, squashing.
- 2) Electrically — a charge doing work, e.g. charges moving round a circuit.
- 3) By heating — energy transferred from a hotter object to a colder object, e.g. heating a pan on a hob.
- 4) By radiation — energy transferred by waves, e.g. energy from the Sun reaching Earth by light.

Make sure you understand what's going on in these examples of energy transfers:

A BALL ROLLING UP A SLOPE:

The ball does work against the gravitational force, so energy is transferred mechanically from the kinetic energy store of the ball to its gravitational potential energy store.

A BAT HITTING A BALL:

The bat has energy in its kinetic energy store. Some of this is transferred mechanically to the ball's kinetic energy store. Some energy is also transferred mechanically to the thermal energy stores of the bat and the ball (and to the surroundings by heating). The rest is carried away by sound.

A ROCK DROPPED FROM A CLIFF:

Assuming there's no air resistance, gravity does work on the rock, so the rock constantly accelerates towards the ground. Energy is transferred mechanically from the rock's gravitational potential energy store to its kinetic energy store.

A CAR SLOWING DOWN (without braking):

Energy in the kinetic energy store of the car is transferred mechanically (due to friction between the tyres and road), and then by heating, to the thermal energy stores of the car and road.

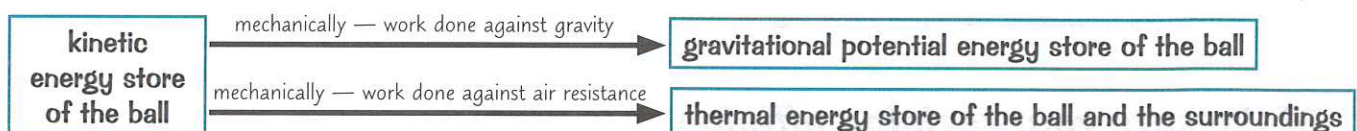
A KETTLE BOILING WATER:

Energy is transferred electrically from the mains to the heating element of the kettle, and then by heating to the thermal energy store of the water.

You can Draw Diagrams to Show Energy Transfers

Diagrams can make it easier to see what's going on when energy is transferred. The diagram below shows the energy transferred when a ball is thrown upwards, taking air resistance into account. The boxes represent stores and the arrows show transfers:

You may have to use or draw a diagram like this in the exam, so make sure you understand what it's showing.



Energy can't be created or destroyed — only talked about a lot...

This is important, so remember it. Energy can only be transferred to a different store, never destroyed.

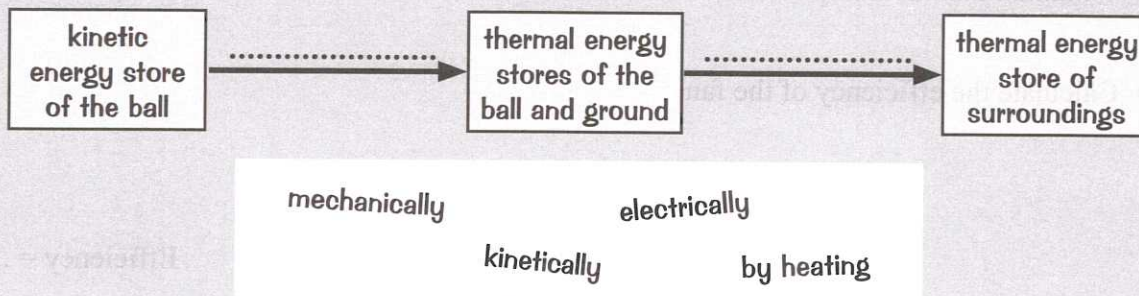
Q1 Describe the energy transfers that occur when a piece of wood is burning.

[2 marks]

Transferring Energy

Warm-Up

A ball is rolling along the ground. It slows down and eventually stops. Fill in the blanks in the energy transfer diagram using the words given below.



1 Energy can be transferred between different energy stores.



a) State the principle of conservation of energy.

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[1]

b) A kettle of cold water is plugged into the mains and brought to the boil. Describe how is energy transferred from the mains to the kettle.

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[1]

c) Describe the main energy transfer for a bike freewheeling down a hill. You should refer to the energy stores that the energy is transferred between in your answer.

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[3]

d) Describe the energy transfers for a golf club hitting a ball. You should refer to the energy stores that the energy is transferred between in your answer.

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[4]

[Total 9 marks]

