

5.1

Energy around you

Forms of energy

Moving energy

- **Kinetic energy** is the energy of movement. Anything that moves has kinetic energy. The faster an object moves, the more kinetic energy it has. In a collision, kinetic energy is quickly changed into other forms.
- **Heat energy** can come from the Sun, flames, chemical reactions, electrical devices or even from a person or animal. Heat warms, burns, dries, melts, and makes hot-air balloons rise.
- **Light energy** comes from the Sun, light globes, fires and animals such as glow-worms. Without light energy, the world would be a very dark place.
- **Sound energy** is the energy that air has when it is vibrating. Your ears and brain interpret the vibrating of air as sounds. Sound comes from your voice, musical instruments, cars and power tools.
- **Electrical energy** comes from power stations, solar cells, batteries, and sparks such as lightning. Electrical energy powers your TV, computer, microwave and toaster.

Figure 5.1.1

Here are five different and common forms of energy. All these forms of energy make things happen.



Measuring energy

Energy is measured using a unit called the joule (symbol J). You use one joule of energy when you lift a 1 kg bag of potatoes 10 cm off the floor. Lifting 1 kg of potatoes isn't too hard, which shows that a joule is a small amount of energy. In fact, a joule is so small that energy is often measured in batches of 1000 joules. A batch of 1000 joules is known as a kilojoule (kJ). If you lifted 1 kg of potatoes 10 cm with 1 J of energy, then you could lift them 100 metres with 1 kJ of energy!

Food energy is commonly measured in kilojoules (kJ). Even larger amounts of energy, such as electrical energy, are measured in megajoules (MJ).

$$1 \text{ kJ} = 1000 \text{ J}$$

$$1 \text{ MJ} = 1\,000\,000 \text{ J}$$

Stored energy

Not all forms of energy are as obvious as those discussed so far. Many of the objects around you have stored energy or **potential energy**. Petrol in a car's fuel tank and books on a shelf both have potential energy. They are not releasing energy at the moment but have stored energy. Stored energy gives objects the potential to make things happen: the books can fall off the shelf and the petrol can burn.

Counting calories

You may have heard of a unit of energy called the calorie. This unit is used in some countries of the world, particularly to measure food energy. One calorie (cal) is the amount of energy needed to raise the temperature of 1 gram of water by 1°C. This is about 4.2 joules.

- **Gravitational potential energy** is energy stored in an object when it is above the ground, and has the potential to fall due to gravity. The greater the height, the more gravitational potential energy an object has. For example, the higher a water slide, the more gravitational potential energy you have at the top and the more kinetic energy you will have on the way down!
- **Chemical energy** is energy stored in substances. An example is energy stored in food and petrol. This energy is only released when we digest the food or burn the petrol. Wood, paper, apples, petrol and batteries all contain chemical energy.
- **Elastic potential energy** is energy stored in a stretched or squashed elastic object such as a rubber band or a spring.
- **Nuclear energy** is energy stored inside atoms. Nuclear energy is released in a nuclear power plant, in a nuclear bomb explosion, and inside the Sun. Nuclear reactions produce heat and light.



5.1

Unit review

Remembering

- Name** the unit used to measure energy.
- List** five different forms of energy.
- Recall** what you know about energy by matching the following types with their descriptions.
 - kinetic energy
 - sound energy
 - elastic potential energy
 - gravitational potential energy
 - light energy
 - in vibrating air particles
 - in a stretched or squashed spring
 - in objects positioned above the ground
 - released from glow-worms
 - in a moving object

Understanding

- Explain** why the energy in food is usually stated in kilojoules rather than joules.
- Explain** why sound energy could be considered a type of kinetic energy.
- Petrol, kerosene and oil are all types of fuel. **Clarify** which type of energy these fuels possess.

Applying

- Calculate** how many joules of energy are in:
 - 3 MJ
 - 7500 kJ
- Calculate** how many megajoules would be in these quantities: **a** 2500 000 J **b** 5000 kJ
- Identify** the key type of energy possessed by a:
 - seatbelt buckle that has been in the sun all day
 - shopping trolley rolling across the floor
 - marshmallow
 - golf ball hit along the ground
 - lawnmower filled up with petrol
 - bird resting in its nest on a tree branch.
- a** Ben burns about 30 kJ per minute while he's dancing. Calculate the number of kilojoules he would use if he danced for an hour.
 - If a single serving (40g) of nutragrain provides 155 calories of energy, can you calculate how many servings of the breakfast Ben would need to replace this energy?

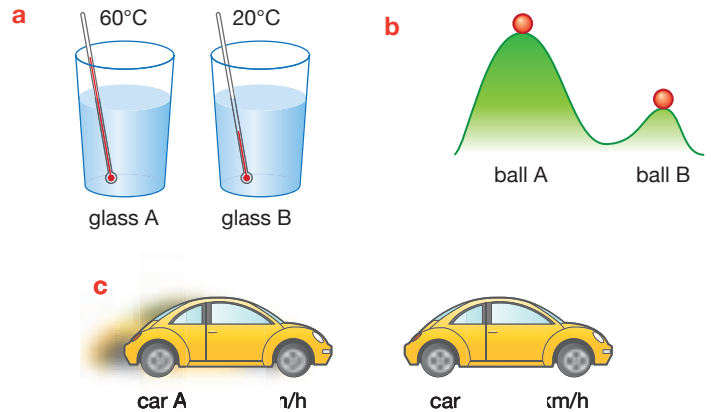
Analysing

- The following objects have potential energy. **Classify** each one as an example of gravitational potential energy, chemical potential energy or elastic potential energy.

a A piece of chocolate cake	e A cardboard box
b A stretched spring	f A 9-volt battery
c A glass of cola	g A banana
d A teaspoon of sugar	h A squashed tennis ball

Evaluating

- Aisha lifts a 10 kg bag of onions 10 cm off the ground. **Propose** a different task in which she would do the same amount of work.
- For each pair of objects shown in Figure 5.1.6:
 - identify** which (A or B) has more energy
 - justify** your response.



Applying - Complete the following table

Situation	Type of energy that caused the change	Changes you observed
A sparkler burns.		
A torch is turned on.		
A tennis ball falls.		
A slinky spring is compressed and released.		
Warm air is blown over a damp cloth.		