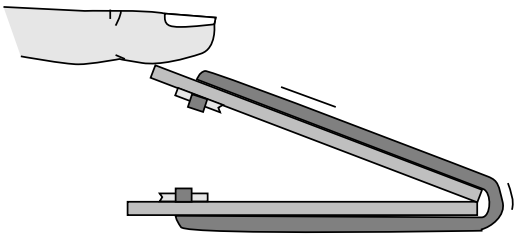
Lesson 2

Jumping with energy

45 mins

Students make a jumping toy called a flic flac and observe what happens when stored energy is released. They then find evidence of energy around them.



At a glance

Student book pages 5–7

- Introduce the word 'energy'.
- Students carry out the team investigation.
- Discuss questions in the student book.
- Discuss and list examples of energy being involved when a change occurs.

Engage

Lesson outcomes

1 **Students understand that when a change occurs it is evidence of the transfer of energy.**
They show their understanding by explaining that when the flic flac moved, energy that was in the elastic band was used to power the motion.

2 **Students can use evidence of changes to discover that energy is all around them.**
They show this by giving everyday examples of energy being used to bring about changes.

Equipment and preparation

Team investigation

For each team

6 pieces of stiff cardboard (about 6 x 6 centimetres)
scissors (or a hole punch)
masking tape
3 elastic bands (about 8 centimetres long)
3 matchsticks (or strong toothpicks) *Use matches with the heads removed.*
writing paper
job badges for director, manager and speaker

Preparation

Cut cardboard to size for each team.

Teaching strategies

1 Introduce the word 'energy' by asking:

How many ways can you use the word energy in a sentence?

Suggestions could include:

- *At the end of a race I ran out of energy.*
- *Food gives me energy.*
- *We get energy from electricity and gas.*
- *The world is facing an energy crisis.*

Explain that in the following lessons students will find out about the different meanings of energy.

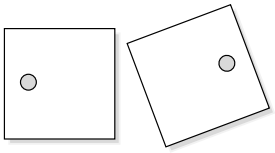
2 Outline the team investigation: *Can we find evidence of energy stored in a flic flac?*

Form teams and allocate jobs.

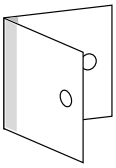
Ask managers to collect team equipment.

3 Ask students to carry out steps 1 to 5 in the student book.

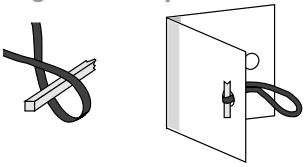
Step 1 **Make holes in two cardboard squares with scissors (or a hole punch). Make the holes about 1 centimetre from the edge.**



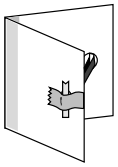
Step 2 **Tape the two pieces of card together to form a hinge. The hinge is opposite the holes.**



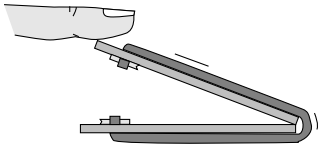
Step 3 **Thread one end of the elastic band through one of the holes in the card. Break a matchstick in half and put one piece through the loop as shown.**



Step 4 **Do the same for the other end of the elastic band and tape down the two matchsticks.**



Step 5 **'Set' the flic flac by bending it inside out. Place it on a desk and hold it down with your finger. When you move your finger away, the flic flac should jump into the air.**



Caution! **Do not put your face close to the flic flac when it is set. It could hit you in the eye.**

4 When all students have completed their flic flacs, they can release them at the same time to compare performance.

5 Discuss the questions in the student book:

1 **Do you think the set flic flac had energy? Why do you think so?**
2 **Whose flic flac had the most energy? How do you know?**
3 **Where did the energy come from that made the flic flac move?**

Evidence that the flic flac has stored energy includes its 'jumping' action, the noise it makes, and the fact that you have to set it (give it energy in the first place). Students may need help to realise that the energy that made the flic flac jump was stored in the elastic band. (Some students might also realise that the energy stored in the band came from their muscles, when they set the flic flac.)

6 Use discussion to elicit the idea that if a change occurs, energy transfer is involved. Ask questions such as:

Is energy involved in changing a raw sausage to a cooked one?
Where does the energy come from?

Is energy involved in changing a wrinkled shirt to a smooth one (ie, in ironing it)?
Where does the energy come from?

Is energy involved in making a school bus move along the road?
Where does the energy come from?

7 Ask teams to make a list of three changes that show evidence of energy transfer. Explain that team members should take it in turns to write down the evidence of the change and where the energy came from.

Encourage students to think about using all their senses as ways of detecting change. In this way they will find diverse examples and evidence other than movement.

8 Ask teams to give examples from their lists, or display the lists around the room.

Students will probably list a wide range of examples: plants growing, a car moving, the sound of a band, the smell of cooking.

Background information

Energy is associated with change, and there is nearly always energy involved when something changes. We can define energy as the capacity to do work or bring about changes. This definition is not very helpful, however, and a few examples make the idea clearer.

If we push a car to set it moving, then we have done work on it and increased its energy. If the moving car then runs into a fence and breaks it, the car has expended its energy on doing something to the fence.

The energy of motion of the car in this example is just one kind of energy. Another common form of energy is heat energy. We can convert energy of motion into heat energy. When this is happening, we call it friction. This is how brakes stop a car, and you can easily feel that they get hot in the process.

Energy can be stored in many ways. The simplest is energy of position (a form of potential energy). It takes work to lift a heavy object onto a table, but the object can then fall off. If it does so, this converts its energy of position into energy of motion and then into mechanical work as it smashes whatever it falls on.

Another form of stored energy is elastic energy. We do mechanical work with our hands when we stretch elastic or wind up a clock spring; the energy can then be released either slowly, to run a clock, or quickly as in a flic flac, and converted to energy of motion.

Energy can also be stored as chemical energy. An example of stored chemical energy is petrol. If we set it alight, we convert its chemical energy, as it combines with oxygen in the air, into heat energy. But if, instead of this uncontrolled burning, we burn it inside the engine of a car, then we can convert some of its stored chemical energy into useful energy of motion as well as heat.

Torch batteries and car batteries also have stored chemical energy which can be converted to electrical energy when they are connected into a circuit. The electrical energy can then be converted into energy of motion by an electric motor or into heat and light by a light bulb. Food is another example of stored chemical energy, which can be converted into other forms of energy in our bodies.

One of the important properties of energy is that it can't be created or destroyed, but only converted from one form to another. These processes of energy conversion always tend to make the energy less easily available and less useful. All of our useful sources of energy (eg, oil, coal, spinning wheels, wound springs), convert their energy to heat. Most of this heat is dissipated in air or water and we can't make any further use of it.

Fossil fuels such as oil and coal, with their huge store of chemical energy, are immensely valuable. But they will not last forever. Even the sun on which we depend for life, is slowly burning up its internal hydrogen fuel and will eventually die and cool down.

This is the global picture of energy, one of the most important concepts in science. Our present understanding took centuries to develop, so do not try to take it all in at once!

Extensions

Students experiment with making flic flacs to see what happens when they change some of the components (eg, stiffness of cardboard, size and shape of cardboard, size of elastic band).

Students use two elastic bands in a controlled setting to see who can shoot a ping pong ball the furthest. Discuss the energy involved.

Students find pictures in newspapers and magazines that include examples of energy that is stored or being used. They glue the pictures onto a chart, with the evidence of the energy involved written beside each picture.