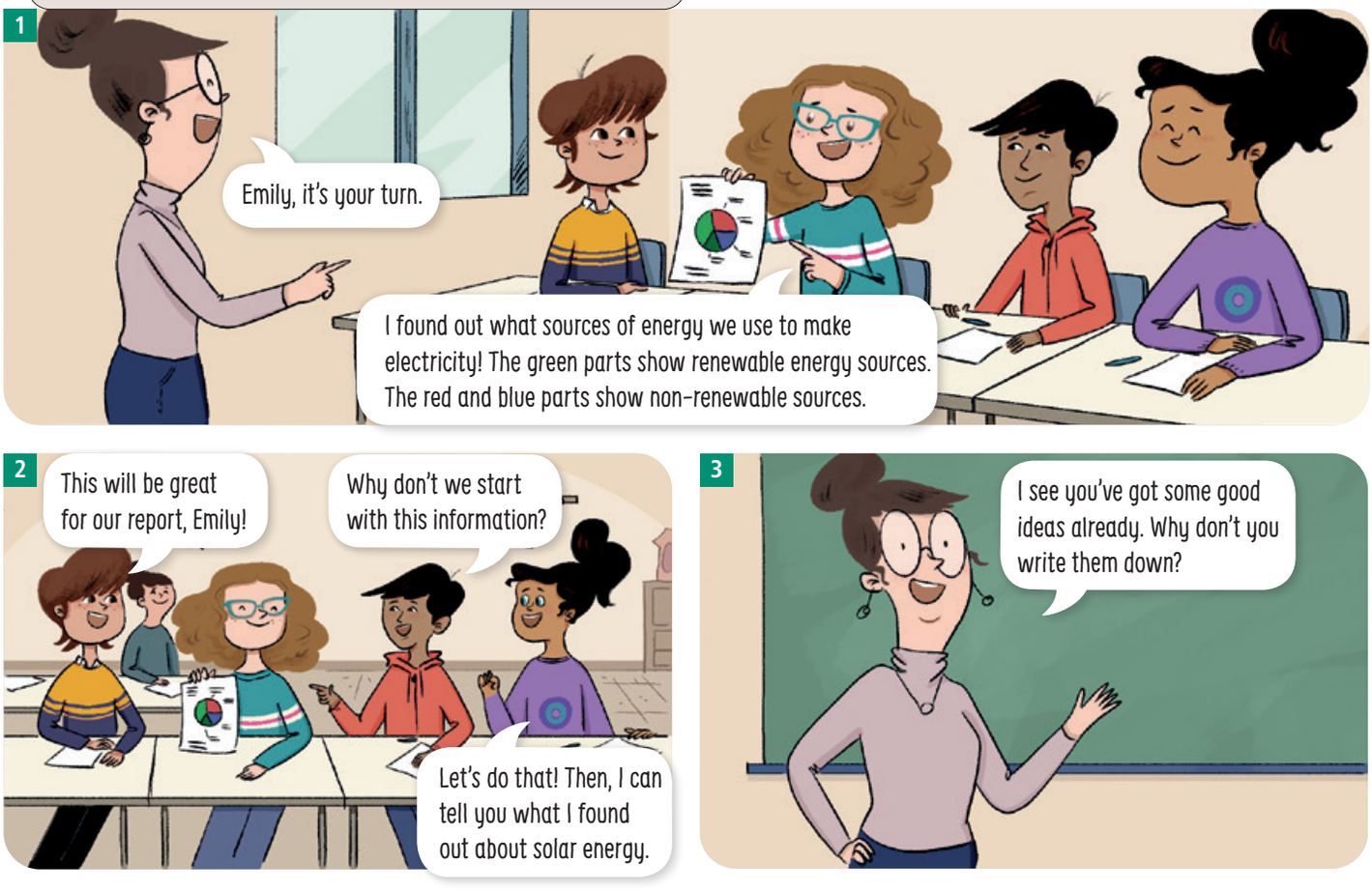
ELECTRICITY

STORY TIME

Read and listen to part 3 of the story *Full of energy.*

The children are in Science class sharing what they found out at home.



ABOUT THE STORY

Read and discuss.

1. What does Emily's electricity bill show?
2. Do the children show that they care about each other's ideas? Why or why not?
3. Do you think they are working well together? Share with your partner ideas to work well in a group.

READ THE WORLD

Read the poster for a talk about light pollution.

THE NIGHT SKY IS DISAPPEARING

Why do the stars seem brighter in the countryside than in the cities? That's because **light pollution** makes it seem like there are fewer stars in the sky.

Light pollution is too much artificial lighting in a place at night.

Why is light pollution a problem?

- It changes the sleep patterns of mammals, birds, fish and insects.
- It affects bats' night vision.
- A brighter night makes it easier for some creatures to become prey.
- It affects humans' vision.
- We can't see the night sky.

What can you do to reduce light pollution?

- Only use garden lights when it is necessary.
- Use warmer (yellow) light bulbs, not blue or white.
- Point lights downwards, not upwards.
- Do not use outdoor lights in birds' migratory periods.
- Turn off lights when leaving a room.

Come to our talk about the disappearing night sky to learn more!

Where: City Hall **When:** Tuesday, 21st March **Time:** 7:30 p.m.

1 Read and answer the following questions.

a What is light pollution?
b How does light pollution affect humans?
c How does light pollution affect other living things?
d What things can be done to reduce light pollution?

2 With your partner, discuss how the poster makes you feel. Have you ever thought of this problem before? Would you be interested in doing something to reduce light pollution? What could you do?

DISCUSS WHAT WE KNOW

Use the *I used to think, Now I think* thinking routine to answer these questions about the unit.

What is electricity?

What are the sources of electrical energy?

How does electricity reach our homes?

What is a robot?

What is electricity?

Electricity is a form of energy that we use to power electrical devices and machines.

Electricity is found in nature, for example in lighting, but it also can be produced from renewable and non-renewable energy sources.

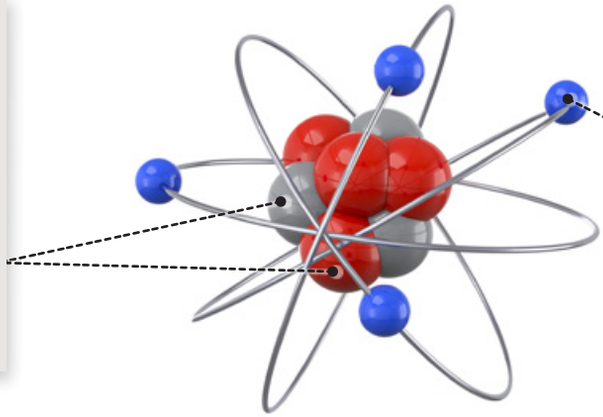
1 In pairs, take turns to define the words below without saying them. Your partner should guess the word. *atom*; *electron*; *proton*; *neutron*; *negative charge*; *positive charge*; *attract*; *repel*.

Electrical charges

All matter is made up of tiny particles called atoms. Atoms are composed of three smaller particles: **protons**, **neutrons** and **electrons**.

Protons and **neutrons** form the **nucleus** of an atom.

- Protons have a **positive electrical charge**.
- Neutrons have **no charge**.



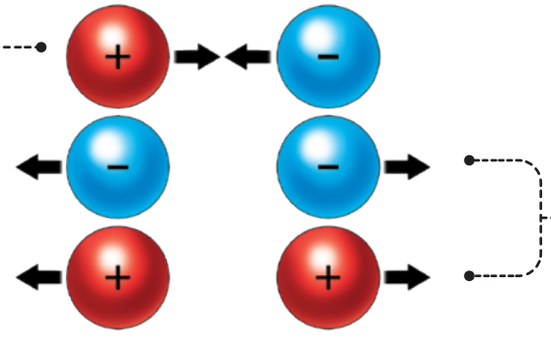
Electrons move around the nucleus and have a **negative electrical charge**.

Atoms usually have the same number of protons and electrons. This means that they are **electrically neutral**. If an atom gains or loses electrons, it becomes electrically charged.

- If an atom gains electrons, it will have more negative charges than positive ones. The atom will have a **negative charge**.
- If an atom loses electrons, it will have fewer negative charges than positive ones. The atom will have a **positive charge**.

Electrically charged objects can move towards one another (**attract**) or move away from each other (**repel**).

Objects with **opposite electrical charges** attract each other.

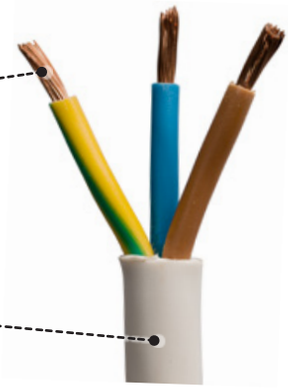


Objects with the **same electrical charge** repel each other.

Electrical conductors and insulators

Some materials, such as copper, silver or aluminium, allow electricity to travel through them. They are **electrical conductors**.

Other materials, such as plastic, paper and wood, do not allow electricity to travel through them. They are **electrical insulators**.



^ Electrical wires are made of copper and are usually covered in plastic to make them safe.

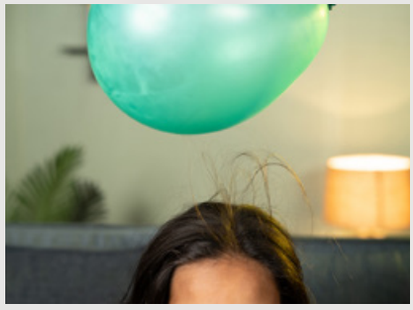
Types of electricity

There are two types of electricity: **static electricity** and **dynamic** or **current electricity**.

Static electricity

It is a form of electricity that does not flow.

^ **Lightning** is a giant spark of electricity in the atmosphere. This is a natural discharge of the static electricity accumulated in clouds during thunderstorms.



^ **Rubbing a balloon** on your hair creates static electricity. This happens because the electrons move from your hair to the balloon, which causes the balloon to become attracted to your hair.

Dynamic or current electricity

There is a flow of electrons through electrical conductors.

< Electricity can flow from a socket though the wires in a cable to a device, such as a mobile phone, and charge it.

2 In pairs, think about times when you have experienced static electricity, for example, when brushing your hair. Tell your partner what happened.

3 Listen to the conversation. Put the topics in the correct order: *electrical charges*; *composition of an atom*; *energy sources.*

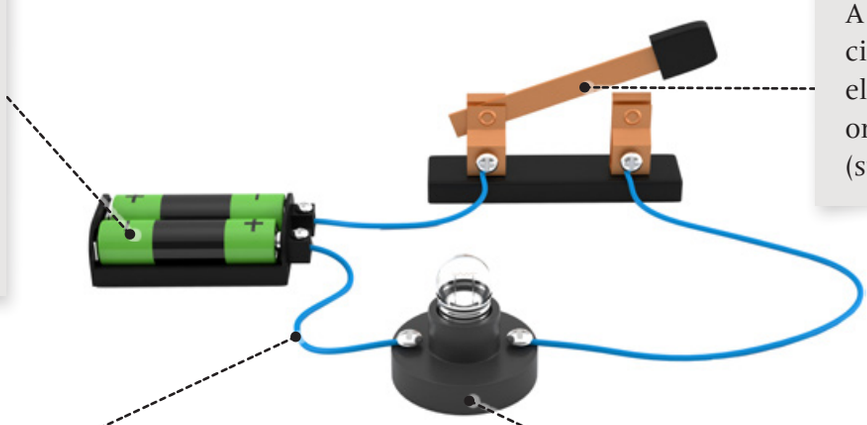
Electrical circuits

Current electricity flows through **electrical circuits**. These are closed paths with no gaps.

A simple electric circuit is made up of four components: an **energy source**, a **load**, a **conductor** and a **switch**.

An **energy source**, such as batteries, provides the energy.

Batteries have a positive and negative terminal.



A **switch** opens the circuit (allowing electricity to flow) or closes the circuit (stopping the flow).

A **conductor**, such as a copper wire, allows electricity to pass through it.

A **load**, such as a light bulb, converts electricity into a different form of energy.

The uses of electricity

Electricity is used to power a variety of devices and appliances, such as lights, TVs, computers, fridges and ovens. We also use electricity to power cars and buses and manufacture the products we need in our daily lives.

We use electricity:

- at home
- in the places where we work and study
- in transportation
- in industry.

4 In pairs, discuss what you think are the most important uses of electricity in your homes.

5 Listen to the conversation. What does the teacher want the class to do? What can the pupils do to troubleshoot problems with a circuit?

What are the sources of electrical energy?

Electricity that arrives in our homes can be generated from non-renewable or renewable energy sources.

Non-renewable energy sources

Burning **fossil fuels** in **thermal power plants** or splitting the atoms of **uranium** in **nuclear power plants** generates steam.

The steam moves a turbine connected to a generator which converts the kinetic energy into electricity.

^ thermal power plant

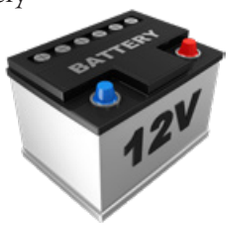
Renewable energy sources

Solar panels, **wind turbines** and **hydroelectric plants** collect the energy of the Sun, wind and water and pass it to a turbine which spins a generator. This converts the energy from the different energy sources into electricity.

^ solar panels and wind turbines

Other sources of electrical energy

- Rubbing two objects against each other, for example a plastic pen on a jumper, can create **static electricity** by **friction**. The electrons from one of the objects will pass on to the other object and it will become positively charged. The other object will be negatively charged.
- A **battery**, such as those found in a car, a mobile phone or a laptop, stores chemical energy. A chemical reaction can convert this energy into electrical energy.



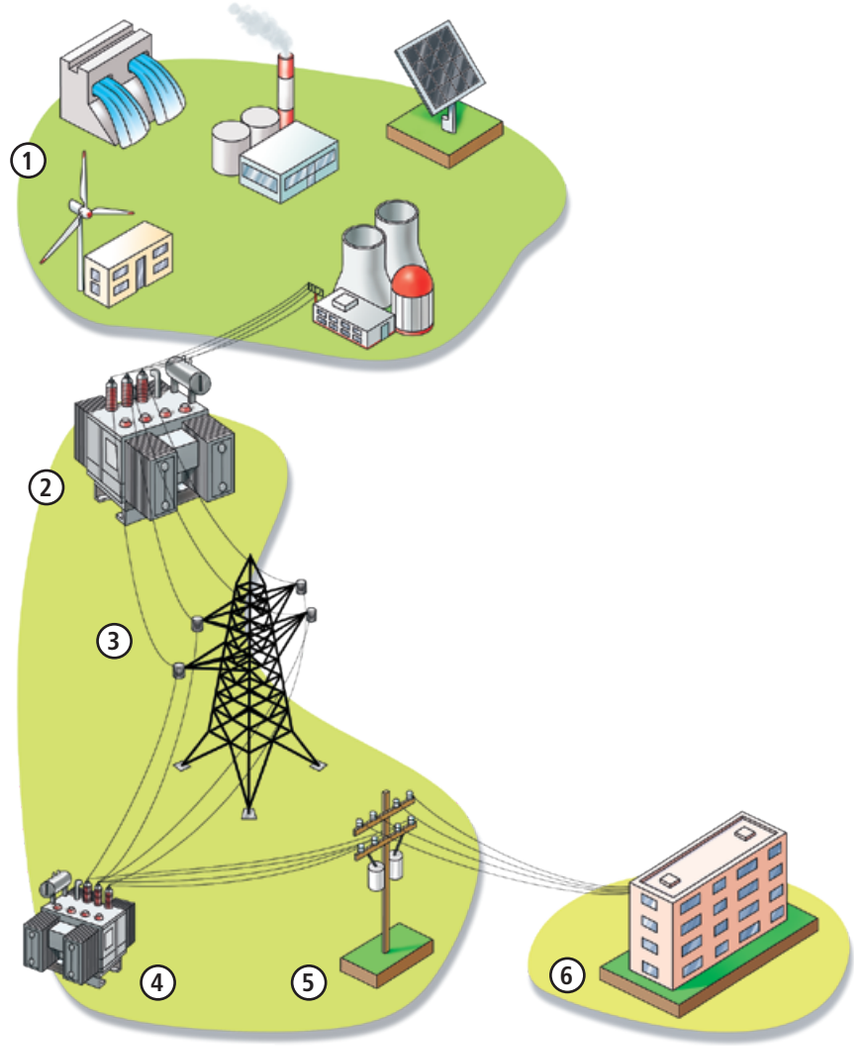
Electromagnetism is the magnetism created when electricity flows through magnetic metals. The magnetism only lasts while the electric current is switched on.

1 In pairs, think about the other sources of electrical energy. Would they be good for generating electricity in our daily lives? Why or why not?

How does electricity reach our homes?

The **transmission** of electrical energy is the process of moving it from one place to another place until it enters our homes.

1. Electricity is generated from non-renewable or renewable sources in nuclear power plants, thermal power plants, hydroelectric plants, etc.



2. The electricity goes to a **substation** where a **transformer** increases the voltage (the pressure which pushes electricity).

3. High-voltage power lines carry electricity over long distances.

4. From the high-voltage power lines, the electricity goes to a **substation** to reduce the voltage to a safe level.

5. The electricity leaves the substation and goes to **electricity providers**.

6. The electricity enters our homes.

In Spain, the power plug sockets are **type F**. There are many types of plugs in the world. This means that when we travel abroad we might need an adapter.

1 In pairs, think of electrical hazards and safety precautions when using electrical devices at home.

What is a robot?

A **robot** is a machine that can be programmed to do some tasks to make our lives easier. Even though some robots are made to look like humans, humans can control them.

Robots usually need electrical energy to function.

Robotics is the branch of engineering which design and constructs robots.

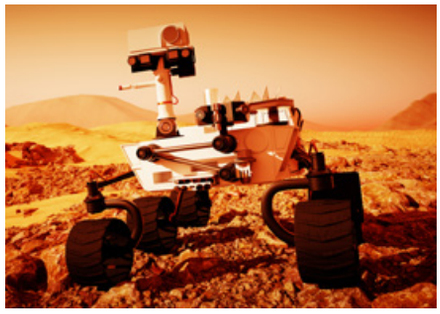
Robots in our lives

Robots have different functions and can be used in different places: at home, in hospitals, in industry, at work, in space, etc. There are even robots that we we can use in our free time.

vacuum cleaner robot

robotic legs

Industrial welding robot



space research robot

1 Some people think that robots will take over human jobs. Discuss this in pairs, then share your opinions with other groups. What do your classmates think?

Advantages of robots

- Robots can save time.
- They can do repetitive tasks quickly.
- They can be used in surgery.
- They can do dangerous jobs.
- They do not need breaks when working.

Disadvantages of robots

- Robots can be expensive.
- They need power.
- They can cause people to lose their jobs.
- They can break down or malfunction.

LANGUAGE CORNER

Time to speak

1 Imagine if you had no home, no electricity and no running water. What would your life be like? How would you feel? Discuss with your partner. Use the pictures to help you.

SPEAKING TIP

If I had no (*home*), I would (*have to*) ...

If I didn't have (*electricity*), I wouldn't ...

My life would be ...

I would feel ...

Time to listen

1 Listen to three people talk about access to clean water. For each question, choose the correct answer.

1 Jemal said his parents ...
- **a** were from Eritrea.
- **b** moved to Eritrea.
- **c** travelled to Eritrea often.

2 Jemal said that his cousin ...
- **a** wanted to swim in the river.
- **b** couldn't go to school because he was ill.
- **c** contaminated the water in the stream.

3 Catherine said many people ...
- **a** wanted to visit areas with access to clean water.
- **b** couldn't get access to clean water.
- **c** drank water from rivers.

4 Catherine said that over 800 children died every day ...
- **a** because of overpopulation.
- **b** after getting sick from dirty water.
- **c** from dehydration.

5 Jonathon said governments and organisations ...
- **a** would provide homes, hospitals and schools with clean water.
- **b** would develop new public services buildings.
- **c** would find ways to use more rainwater.

6 To save water, Jonathon said we ...
- **a** could take shorter showers.
- **b** could filter salt water.
- **c** could save rainwater.

LISTENING TIP

It is alright not to know all the answers the first time; you can check your answers again the second time you listen.

SCIENCE WORKSHOP

TESTING STATIC ELECTRICITY

Materials:

- water
- balloon
- string
- woolly jumper
- pen
- paper

Observe

In pairs, look at the photo and answer the questions

a What can you see in the photo?

b What is happening to the water?

Ask a question

Why do you think the balloon moves the water?

Create your hypothesis

Think about what happens when you rub a pencil on a woolly jumper and pick up some pieces of paper.

Test

1. Turn on the tap. Observe how the water is flowing.
2. Rub the balloon with the woolly jumper.
3. Place the balloon near the water. Observe what happens to the water now.
4. Move the balloon closer to the water then move it away. What happens to the water?

Make conclusions

Think about the two types of electricity. Which type of electricity could this be? Why?

Why do you think the water bends?

Present your conclusions.

PUBLIC SPEAKING

Use short pauses to emphasise important ideas and to give the audience time to understand your message.

UNIT ACTIVITIES

What is electricity?

1 In your notebook, write if the sentences are true or false. Correct the false ones.

a Lightning is a form of electricity.
b All protons are made up of atoms.
c Protons have a positive electrical charge.
d Electrons move around the nucleus.
e Neutrons have a negative charge.
f Atoms always have a different number of protons and electrons.
g If an atom has fewer negative charges than positive ones, it will have a positive charge.
h Objects with the same electrical charges attract each other.

2 In your notebook, complete the sentences with the words in the box.

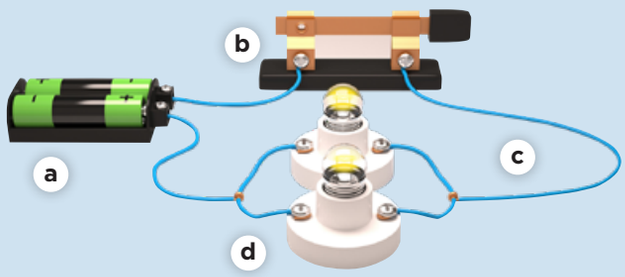
conductors dynamic insulators static

a ..... electricity does not flow.
b ..... do not allow electricity to flow through them.
c ..... allow electricity to flow through them.
d ..... electricity flows.

3 In your notebook, draw a picture of an atom and label its parts. Then answer the questions.

a Why are atoms usually electrically neutral?
b When does an atom have a negative charge?
c When does an atom have a positive charge?

4 In your notebook, label the photo. What does it show?



5 Read the definitions of the parts of a circuit and write down their names in your notebook.

a It converts electricity into a different form of energy.
b It allows electricity to pass through it.
c It opens and closes the circuit, starting and stopping the flow of electricity.
d It provides the energy.

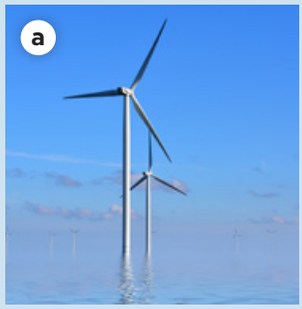
6 Listen to the dialogue and answer the questions.

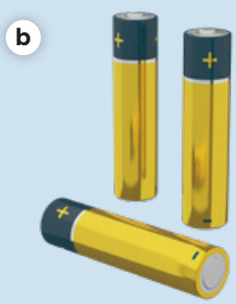
a What does Elena have to do for her project?
b What subjects did she choose for her project?
c What do the button battery, copper tape, light bulb and switch form?
d What do they represent in a circuit?

What are the sources of electrical energy?

7 In your notebook, match the photos to the sources of electrical energy in the box.

chemical energy non-renewable energy sources
renewable energy sources static electricity





8 In your notebook, match the sentence halves.

1. Friction is ...
2. Electromagnetism is ...
3. A battery is ...

a. ... an example of stored chemical energy that can be converted into electricity.

b. ... magnetism that is created when electricity flows through magnetic metals.

c. ... caused by rubbing two objects against one another, for example a plastic pen on a jumper.

9 Describe what you see in the two photos. Which one do you think shows a more environmentally friendly source of electrical energy? What are its advantages and disadvantages? Use the *Think-Pair-Share* thinking routine to answer the questions

How does electricity reach our homes?

10 In your notebook, put in order the steps of the transmission of electrical energy until it enters our homes.

a. The voltage at a substation increases.

b. The voltage at a substation is reduced.

c. Electricity enters our homes.

d. Electricity goes to electricity providers.

e. Electricity travels on high-voltage power lines.

f. Electricity is generated.

11 In your notebook, explain the function of the following:

a. high voltage lines

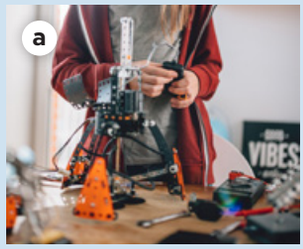
b. substations

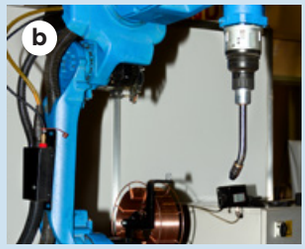
c. electricity providers

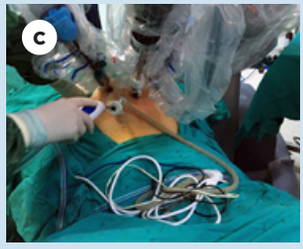
What is a robot?

12 Look at the photos. In your notebook, match the robots to the categories. There are extra categories. What does each robot do?

1. industrial robots
2. robots we use at home
3. space research robots
4. medical robots
5. robots we use in our free time
6. educational robots







13 Listen to the conversation. In your notebook, put the robots they talk about in order. What does each robot do?

a. window cleaner

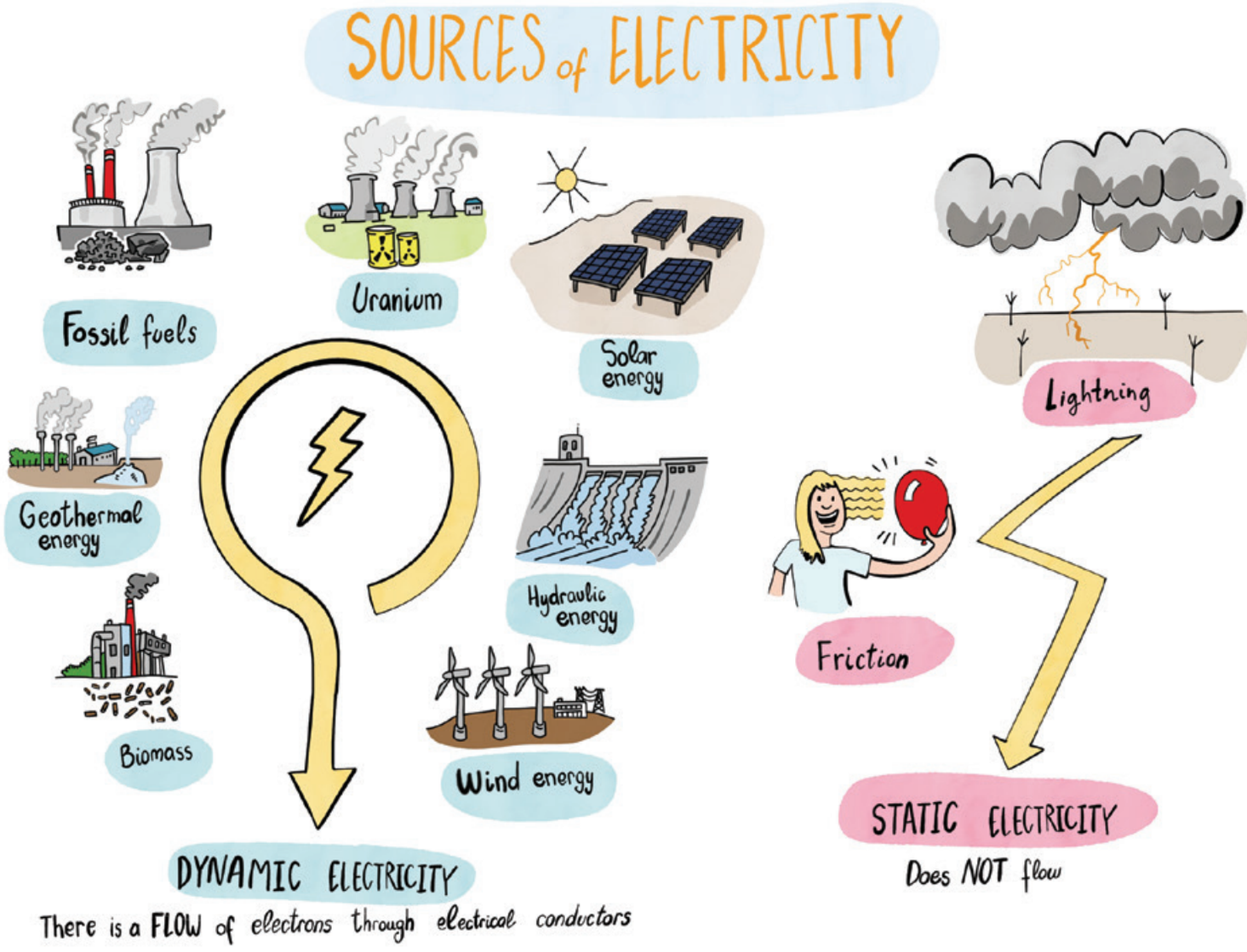
b. drone

c. vacuum cleaner

d. remote controlled car

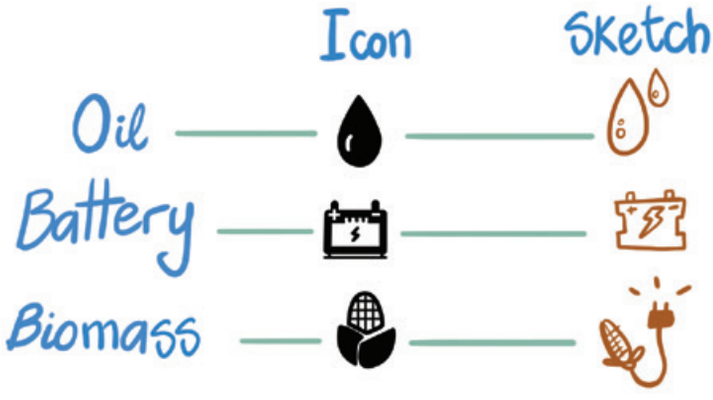
e. lawnmower

VISUAL SUMMARY



TIPS + TRICKS

- Search the internet for ideas on how to represent difficult concepts visually.
- Use the words 'icon' and 'vector' in your search to find a number of ways to simplify your drawings.
- Adapt your icon by adding your personal touch.



UNIT REVIEW

1 In pairs, discuss the following questions giving examples when needed.

- **a** What are the parts of a simple electric circuit?
- **b** What is the difference between static and dynamic electricity?
- **c** What are electrical conductors? Name two examples.
- **d** What type of energy does a battery store?
- **e** How long does electromagnetic energy last?
- **f** What is the difference between robot and robotics?
- **g** Which sources do we use to produce electricity?
- **h** What are the advantages of robots?

2 What is electrical insulation tape used for? What materials is it made of? Discuss with a partner. Then, do some research online to check your answer and write an explanation in your notebook.

3 In your notebook, write down the names of any electricity suppliers in your country that you know. Then, search online to find more names. What sources of energy do those companies use to produce electricity?

4 Look at the photo. Why do you think birds can sit on these wires and not get electrocuted? Write the answer in your notebook.

5 You are going to give a slideshow presentation about how to stay safe around electricity. In your notebook, write a plan including information about the images that you use on each slide. Your presentation will have a maximum of 5 slides. When you have finished, compare your plan with your partner.

6 Role-play the following situation:

Pupil A:

Imagine there is a proposal to establish a thermal power plant near your town. You are a politician, and you support this power plant because it will create good jobs and bring some money to the area. Give reasons to support setting up this thermal power plant.

Pupil B:

You are concerned about the environment and you think your town should consider looking into getting energy from renewable energy sources. Recommend one or two types of energy that would be suitable in your area. Give reasons why these should be chosen.

VISUAL CHALLENGE

In your notebook, sketch your own version of these concepts: **wind energy, solar energy, oil energy.** Look at the following three icons for inspiration.