



Robots and humans working together
Photo by Robert Markowitz and Bill Stafford, NASA

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1 Look at the photo and the caption. How do you think they are going to 'work together'? In what ways do robots already work with humans?

2 2.7 Listen to someone talking about the importance of technology in our lives. Answer the questions.

- 1 What everyday jobs does technology do for humans?
- 2 Under what circumstances does technology ever make mistakes?
- 3 Where does the robot in the photo work? What does it do?

3 Which of these comments are true for a robot, a human or both?

has new ideas	finds solutions and solves problems
never gets hungry or tired	can make a mistake
doesn't get bored	always follows instructions
makes decisions	invents things

4 Work in groups. Compare humans and technology. Think of two more advantages or disadvantages for each.

Technology

Lead-in

Personal response

Ask students what they think about science fiction, particularly that relating to space travel and robots.

Ask: Have you read any good science fiction books or seen any science fiction films or TV series? Which ones have you enjoyed? Do you think they have a realistic view of the future? What do you think the future will really be like? Students could discuss their ideas in pairs or small groups.

1 Ask students to look at the photo and say what they can see. Then ask them to discuss the two questions as a class.

2 2.7 Ask students to read the three questions carefully to focus their listening. Play the recording through – twice, if necessary. Elicit the answers from the class, having one student read the question and another answer.

ANSWERS

- 1 It solves maths problems (pocket calculator), it sends messages (email / mobile phone) and it cooks dinner (microwave).
- 2 when the instructions given by humans are incorrect
- 3 It works on the International Space Station. It does simple repetitive jobs.

3 Ask students to read through the comments in the box, then decide if they relate to humans, to robots or to both, then discuss their ideas as a class.

SAMPLE ANSWERS

Human: has new ideas, makes decisions, invents things

Robot: never gets tired or hungry, doesn't get bored, always follows instructions

Both: finds solutions and solves problems, can make a mistake

4 Ask students to continue their discussion about humans and technology in small groups, and find further advantages and disadvantages for each like those in Exercise 3.

SAMPLE ANSWERS

Technology is often faster than humans.

Technology can break down.

Humans require payment for work.

Humans disagree and argue.

Humans are more mobile than technology.

Humans can be creative and innovative.

Extra activity

Ask students to talk about robots they have seen in the real world and those in films (e.g. C-3PO and R2D2 in *Star Wars* or HAL in *2001: A Space Odyssey*) and whether they think these robots are similar to those in real life.

Invention for the eyes

Lead-in

Personal response

Ask students to think about different sorts of glasses and contact lenses that people wear. Discuss what their purpose is and who needs them. If you have any students who wear glasses in the class, ask them to explain what sort of problems they have with their sight and what sort of glasses they wear. Ask: *Do you wear glasses all the time, or do you just need them for certain things?* (e.g. reading, driving). *Do you have more than one pair of glasses?* *What sort of problems do you have because of wearing glasses?* (e.g. difficulties doing sport, etc.)

Speaking

1 Ask students to discuss the inventions in pairs, then elicit ideas from the whole class. Ask students to think about how important each invention was and what impact it has had on our lives.

ANSWERS

See page 153 of the Student's Book

2 Ask all the students to think of another important invention. Brainstorm ideas and write them on the board. Ask each student to say why the invention they think of is important, before deciding which of their inventions is the most important in human history.

Listening

3 [2.8] Ask students to look at the picture and then read the three questions to focus their listening. Then play the recording – twice, if necessary. They can check their answers with a partner, then discuss the answers as a whole class.

ANSWERS

- 1 There are no opticians **where they live** so they can't get glasses if they need them.
- 2 They **don't need an optician** because the **person wearing them** can change the shape of the lens until they can see properly.
- 3 Africa, Asia and Eastern Europe

4 [2.9] Ask students to look at the diagram and read the instructions to focus their listening. Then play the first two paragraphs of the programme on track 2.9. Elicit the answers in the correct order. (See audioscript 2.8, first and second paragraph.)

ANSWERS

- 1 The wearer turns the wheels on each side.
- 2 The pump pushes the silicone oil through the pipe.
- 3 The silicone oil moves into the lens.
- 4 The lens changes shape.

8a Invention for the eyes

Speaking

1 Work in pairs. What problems did these famous inventions solve? Check your answers on page 153.

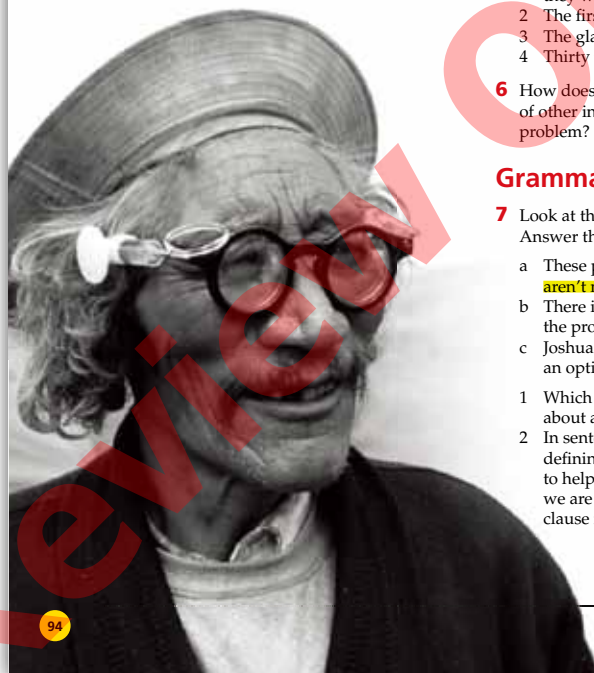
Braille electric light bulb
microwave oven post-it note telescope

2 Think of one more invention that solved a problem and tell the class. Compare everyone's inventions and decide which was the most important in human history.

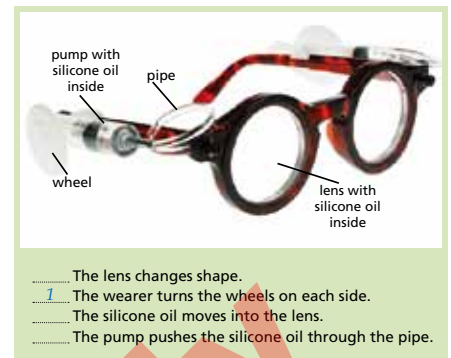
Listening

3 [2.8] This Tibetan man is wearing a new type of glasses. Listen to a science programme about the glasses. Answer the questions.

- 1 What is a problem for many people in the world?
- 2 How can the glasses solve this problem?
- 3 In which parts of the world do people now wear the glasses?



4 [2.9] Listen to the first half of the programme again. Number the instructions on the diagram in the correct order (1–4).



5 [2.10] Listen to the second half of the programme again. Are the sentences true (T) or false (F)?

- 1 Joshua had to do experiments with the glasses before they worked properly.
 - 2 The first man who used the glasses made clothes.
 - 3 The glasses are expensive to produce.
 - 4 Thirty thousand people will have the glasses by 2020.
- 6 How does Joshua's invention compare with your list of other inventions in Exercise 2? Does it solve a bigger problem?

Grammar defining relative clauses

7 Look at the sentences (a–c) from the science programme. Answer the questions.

- a These people live in parts of the world **where there aren't many opticians**.
 - b There is a scientist who has found a solution to the problem.
 - c Joshua Silver has invented glasses which don't need an optician.
- 1 Which word (*where*, *who* or *which*) do we use to talk about a) a person, b) a place and c) a thing?
 - 2 In sentence a, the highlighted part is called the defining relative clause. It gives essential information to help people identify which person, place or thing we are talking about. Underline the defining relative clause in sentences b and c.

5 [2.10] Ask students to read through the sentences to focus their listening. Then play the second part of the programme for them to decide if the statements are true or false. Check the answers as a class and ask students to correct the false statements. (See audioscript 2.8, third and fourth paragraph.)

ANSWERS

- 1 T
- 2 T
- 3 F (*The glasses are cheap to produce*)
- 4 F (*Joshua hopes a billion people across the whole world will have them by 2020*)

6 Ask students to discuss the invention as a class, and compare it with other inventions they have thought about. Ask students to think about issues such as the impact this could have on people's ability to earn a living (e.g. the example of the man who made clothes) or to carry out everyday activities safely, such as cooking or using tools.

Extra activity

Ask students who wear glasses (or contact lenses) to explain what it is like and how it affects their everyday life. Ask: *What would your life be like if you couldn't have glasses or contact lenses? Have you ever broken or lost your glasses? What was it like?*

▶ DEFINING RELATIVE CLAUSES

The first person **who** used the new glasses was a man in Ghana.

Silver started an organisation **which** is called the 'Centre for Vision in the Developing World'.

The organisation has worked in many places **where** over thirty thousand people now wear the glasses.

You can use *that* instead of *who* or *which* (but not *where*). It's less formal.

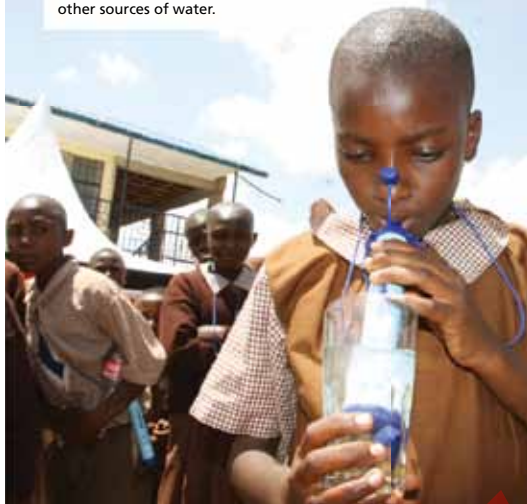
Tim Berners Lee is the man **that** invented the World Wide Web.

It's the invention **that** changed the world. This is the room **that** where he invented it.

For further information and practice, see page 163.

Lifestraw

There are still over one billion people in the world ¹ **who need clean water**. They live in regions ² _____ water supply. Now, some inventors ³ _____ have developed *Lifestraw*. It's an invention ⁴ _____ while you drink. It doesn't have any moving parts ⁵ _____ so it lasts a long time and it's cheap to produce (\$2 each). It's also small and easy to carry to places ⁶ _____ or other sources of water.



- 8 Look at the grammar box. Then complete the sentences with *who*, *which* or *where*. Underline the defining relative clause.

- Einstein was a scientist _____ changed the way we think.
- The Hubble Telescope in space can see places _____ no one has ever been.
- Concorde was the first commercial aeroplane _____ flew at supersonic speed.
- Silicon Valley is a place _____ many successful technology companies like Apple and Microsoft are based.
- In 1800 Alessandro Volta built a machine _____ was the first battery.
- Hedy Lamarr was a woman _____ was famous as an actress in the 1940s. She was also the co-inventor of a secret communication system.

- 9 In which sentences in Exercise 8 can you use *that* at the beginning of the relative clause?

- 10 Complete the text on the right about another invention, *Lifestraw*. Use these phrases and a relative pronoun (*who*, *which* or *where*).

cleans the water **need clean water**
there is a lake, river can break
there is no safe
specialise in solving problems like this

- 11 Think of a famous person, a famous invention and a famous place or city. Write a sentence to define each one. Then swap sentences with your partner. Can he/she guess what they are?

Example:

*It's a thing which you put in your computer.
It's small but it has a large memory. (a USB memory stick)*

Speaking

- 12 Work in groups. Invent a new kind of robot which helps people. Discuss these questions and draw a simple design of the robot with any important information on a large sheet of paper.

- What is the robot for (e.g. cleaning the house)?
- Who will use it (e.g. busy working people)?
- Where can you use it (e.g. around the office)?

- 13 Prepare and give a short presentation for the class about your new invention.

Our new invention is a robot which ...

It's for people who ...

You can use it in places where ...

Ask students to complete the sentences and underline the relative clauses individually, and then check their answers with a partner. Elicit the answers from the whole class.

ANSWERS

- | | |
|---------|---------|
| 1 who | 4 where |
| 2 where | 5 which |
| 3 which | 6 who |

Defining relative clauses:

- who changed the way we think.
- where no one has ever been.
- which flew at supersonic speed.
- where many successful technology companies like Apple and Microsoft are based.
- which was the first battery.
- who was famous as an actress in the 1940s.

- 9 Ask students to look back at the sentences and the information in the grammar box, and decide which pronouns can be replaced with *that*.

ANSWERS

- 1, 3, 5, 6

- 10 Ask students to complete the text individually, then check with a partner. Elicit the answers as complete sentences.

ANSWERS

- where there is no safe
- who specialise in solving problems like this
- which cleans the water
- which can break
- where there is a lake, river

- 11 Read the example to students, and ask them to write their own three sentences. They should then swap sentences with a partner and decide what their partner's famous things are. They can change partners and do it again.

Speaking

- 12 Ask students to work in groups of four to design their robot and work out what it is for, who will use it and where.

- 13 Ask the groups to present their robot to the class. Each group member should present a part of the information, so they need to plan who will do what.

Homework

Ask students to describe a piece of domestic electrical equipment, say what it looks like, what it does, who uses it, and where it is used in the house.

Grammar defining relative clauses

- 7 Ask students to read the three sentences and answer the questions individually, then check with a partner. Elicit the answers from the class.

ANSWERS

- a) who b) where c) which
- b) who has found a solution to the problem
c) which don't need an optician

Grammar note

A common mistake in relative clauses is for students to repeat a pronoun with the relative pronoun, e.g. *The first person who used the new glasses he was a man in Ghana*. Check that students do not start making this mistake when they write their own sentences with relative clauses. In a defining relative clause you can miss out the relative pronoun *who*, *which* or *that* when it is the object of the relative clause (i.e. followed by a noun or a pronoun), e.g.

*Those are the cakes **which** she made this morning.*

Those are the cakes she made this morning.

- 8 Read the information about defining relative clauses in the grammar box with students and make sure they understand how defining relative clauses work. If you need more explanations, examples or practice, refer to page 163 of the Student's Book.

Technology for explorers

Lead-in

Personal response

Ask the class to look at the title of this section and to suggest what technology could be useful to explorers in different places (e.g. the Amazon, the Antarctic, the Sahara Desert).

Vocabulary the Internet

1 Ask students to complete the comments individually, then check their answers with a partner. Elicit answers as complete sentences. Check students are familiar with all the computer-related words here, both those in the box and other words in the gapped sentences (see Vocabulary note below).

ANSWERS

- | | |
|------------|-------------|
| 2 download | 6 subscribe |
| 3 write | 7 upload |
| 4 do | 8 log on |
| 5 search | |

Vocabulary note

social networking site = sites like Facebook, where you can share photos or clips and keep in touch with friends

to download = to copy things from the Internet onto your computer

to upload = to copy things onto the Internet

a blog = a sort of online diary

online gaming = playing games with other people on the Internet

a podcast = a news broadcast online

a password = a sequence of numbers and letters that allow you to enter a website

2 Ask students to work in pairs and discuss their computing habits by changing the sentences in Exercise 1 as appropriate. They should add a further sentence to each item, giving more details about how they use that aspect of the Internet. Elicit ideas from round the class and have a brief discussion about students' habits.

Read the information about verb prefixes in the *Wordbuilding* box. Elicit further verbs from the class with these prefixes, e.g. *undo*, *overdo*, *redo*, *underdone*, *underuse*, *overuse*, *reuse*, *upgrade*, *downgrade*, etc. Refer to Workbook page 67 for further information and practice.

8b Technology for explorers

Vocabulary the Internet

1 Complete the comments from different people about how they use the Internet with these verbs.

do download log on search set-up
subscribe upload write

- I set up an account with a social networking site because it's a good way to keep in touch with old friends.
- Does anyone buy CDs anymore? I don't. It's much easier to _____ music.
- I _____ a weekly blog with all my family's news.
- A lot of my friends _____ online gaming but I find it all a bit boring.
- When I need to find information quickly, the first thing I do is to _____ the web.
- I _____ to a daily podcast which gives me all the latest news.
- My friends and family _____ and share their photos all the time.
- Online banking is so easy. You just _____ with a password and your account details.

2 Which of the sentences in Exercise 1 are true for you? Change any sentences which are untrue or give more details.

I write a blog but I don't write about my family. I describe what my friends and I like doing.

WORDBUILDING verb prefixes

Many prefixes can change or add new meaning to a verb. For example, the verb *load* can be *download*, *upload*, *unload*, *overload*, *reload*.

For further information and practice, see Workbook page 67.

Reading

3 Read the blog on the right. Answer the questions.

- How does Jay Gifford use the internet?
 - Why does he think modern technology is important for explorers?
- 4 Read the blog again. Which of these things does Jay write about on his social networking sites?
- where he is
 - what he is doing at the moment
 - his plans for later
 - his recent news
 - his opinions

http://blogs.ngm.com/blog_central/wild/

NATIONAL GEOGRAPHIC

NGM BLOGWILD

Kamchatka Project

Posted by Jay Gifford | July 15, 2:55 PM

After travelling round the world for almost half a week and moving through three international airports and nineteen time zones, we finally step off the helicopter. We are at the beginning of the Karimskaya River in the region of Kamchatka. It's a bright sunny day and in the far distance I can see the Karimskiy volcano. This is probably the wildest place in Russia but if the weather is this good for the next few days, the expedition will go well.



In the past, when explorers arrived in a strange place, they put up their tents or cooked a meal. But nowadays, when explorers arrive in a new place, they log on to their social networking site using a satellite phone. I write, 'Just landed. Need to relax for a few hours.' Explorers in the past wrote about their adventures in books which were published months or years later. Nowadays, I post a message in seconds.



Sites like Facebook and Twitter also help if we have a problem. Someone in our group touched a strange plant and suddenly his skin was red and painful. I asked for advice on Twitter: 'Hand touched a strange plant. It's red and hot. Any advice?' Minutes later, someone who knew the region replied, 'Probably a Pushki plant. If it is, it'll hurt but it won't kill you!' In the age of the modern explorer, communication like this really helps to make decisions and sometimes it even saves lives.

Continue reading this entry »
Posted by Jay Gifford | Comments (21)
Filed Under: Kamchatka, Karimskaya, Wild, River

Reading

3 Ask students to read the two questions to focus their reading then read the blog to find the information. Elicit answers from the whole class.

ANSWERS

- He posts messages on social networking sites.
- You can find the answer to problems quickly and easily, which can help you to make decisions and can save lives.

4 Ask students to read the blog again and decide what things from the list Jay writes about.

ANSWER

what he's doing at the moment; his plans for later; his recent news

Grammar zero and first conditional

5 Ask students to read the sentences from the blog and answer the questions, then compare their answers with a partner. Elicit answers from the whole class and read the information and examples in the grammar box. Ask students to say which of the sentences a–c in Exercise 5 use the zero conditional (b and c), and which use the first conditional (a). Refer to page 163 of the Student's Book for further information or practice.

ANSWERS

- 1 b, c 2 a

Grammar zero and first conditional

- 5 Look at the sentences (a–c) from the blog in Exercise 3. Answer the questions (1–2).
- If the weather is this good for the next few days, the expedition will go well.
 - Sites like Facebook and Twitter also help if we have a problem.
 - When explorers arrive in a new place, they log on to their social networking site.
- Which sentence talks about things that are generally true?
 - Which sentence talks about a possible future situation?

► ZERO and FIRST CONDITIONAL

zero conditional

if/when + present simple, present simple
When we have news, we text all our friends.
We text all our friends if we have news.

first conditional

if + present simple, *will* (won't)
If I hear any news, I'll text you.
I'll text you if I hear any news.

For further information and practice, see page 163.



- 6 2.11 Look at the grammar box. Complete the conversation between two explorers planning a canoeing expedition with the correct form of the verbs. Then listen and check your answers.

A: So, what are we going to take with us?
B: Well, I don't know what the weather's going to be like. If it rains, we ¹ _____ (need) all this waterproof clothing.
A: Yes, but if we take all that, there ² _____ (not / be) space for anything else. Anyway, when I go canoeing, I ³ _____ (always / get) wet. Why are you packing that?
B: If we don't have a map, we ⁴ _____ (probably / get) lost.
A: Don't worry. If I ⁵ _____ (bring) my GPS, we'll know exactly where we are at all times. What about food?
B: I normally take tins and packets of food when I ⁶ _____ (go) on a trip like this.
A: Good idea. If you carry the food in your canoe, I ⁷ _____ (pack) both the tents in mine.
B: Maybe that's not such a good idea. If something ⁸ _____ (happen) to one of us, then the other person either won't have any food or won't have a tent.
A: Well, hopefully that ⁹ _____ (not / happen) if we're careful.

7 Pronunciation intonation in conditional sentences

- a 2.12 In conditional sentences, when the *if/when* clause is first, the intonation rises and then falls. Listen and repeat.

If it rains, we'll need this.

- b Work in pairs. Practise reading the conversation in Exercise 6. Pay attention to the rising and falling intonation where necessary.

Vocabulary and speaking

- 8 Work in groups. You are going to the mountains for two days. The weather forecast is for sun on the first day and rain on the second. Because you are walking and camping, you don't want to take too many items. You have tents, rucksacks and food. Discuss these other items and choose five others to take. Explain your reasons for taking them.

camera	gas cooker	GPS	hairdryer	hat	laptop
matches	mobile phone	sun cream	sunglasses	torch	
towel	umbrella	video game player			

If we take ..., we won't need ...

We'll need ... if it rains ...

Pronunciation intonation in conditional sentences

- 7a 2.12 Play the extract for students to listen to first. Then play the recording again and pause it for them to repeat chorally and individually

- 7b Ask students to practise the dialogue in pairs, paying particular attention to the intonation of the conditional sentences.

Vocabulary and speaking

- 8 Read the information first with the class, and explain any language they don't understand. Ask students to work in groups of four to discuss their expedition and choose five items. When they have agreed on what to take, ask each group for their list and discuss any differences with the whole class.

Homework

Ask students to write a sequence of six first conditional sentences about what they will and won't do over the coming weekend (e.g. *If the weather is good, I will have a barbecue and invite some friends. If it rains, I will go to the cinema.*)

Extra activity

Ask students to look back at the blog and find another conditional sentence. They should say what type of conditional sentence it is, and whether it matches explanation 1 or 2 in Exercise 5 (i.e. generally true or possible future situation).
Answer: *If it is, it'll hurt but it won't kill you.*
(Explanation 2, future possible situation)

Grammar note

Note that in many contexts there is little difference between *if* and *when* when you use the zero conditional to talk about general truths:
If / When I go by car, it takes me 10 minutes.
But there is a difference between *if* and *when* when you use the first conditional to talk about future events:
If I see Jane, I will tell her.
(but I don't know if I will see her)
When I see Jane, I will tell her.
(and I know that I will see her)

- 6 2.11 Ask students to complete the conversation individually, then check with a partner. Elicit the answers as complete sentences.

ANSWERS

- | | |
|---------------------|----------------|
| 1 we'll need | 6 go |
| 2 won't be | 7 I'll pack |
| 3 always get | 8 happens |
| 4 will probably get | 9 won't happen |
| 5 bring | |

Designs from nature

Lead-in

Personal response

Ask students to talk about the patterns and colours that exist in certain living things in nature (e.g. animals, plants, birds, insects). Ask them to describe any interesting patterns they can think of, and discuss what the purpose of them might be (e.g. camouflage in tigers and many fish, moths and toads; courtship in the colourful breeding plumage of many birds).

Reading

- 1 Ask students to look at the photos and discuss the question as a class.

ANSWER

The robot is shaped like the gecko, and it looks as if it can walk up a vertical wall like a gecko. It uses some sort of special material on its feet.

- 2 Ask students to read the questions to focus their reading, then read the article and answer the questions. They can check their answers with a partner before you elicit them from the class.

ANSWERS

- Because they can move quickly up and down walls and across ceilings.
- the gecko's feet, and how the gecko can run up smooth vertical surfaces
- The robot cannot walk upside down.
- in order to copy their designs

- 3 Ask students to try to match the animals and plants 1–4 at the bottom of page 98 with the inventions A–D at the bottom of page 99. They should look for similar characteristics to help them match. They then read the rest of the article to check their predictions.

ANSWERS

- 1 D 2 A 3 B 4 C

Critical thinking supporting the main argument

- 4 Check that students understand the main argument as explained in the rubric (i.e. that we can use characteristics that have evolved in animals and reproduce these in man-made objects). Ask students to decide which sentences support the main argument. They should work individually. Elicit answers from the class, having them read out the correct sentences.

ANSWERS

- 1, 2, 5

8c Designs from nature

Reading

- Look at the photos at the top of page 99. How is the robot similar to the gecko?
- Read the first two paragraphs of the article. Answer these questions.
 - Why are geckos amazing?
 - What are the scientists interested in?
 - What is the problem with the robot?
 - Why do people study plants and animals?
- Look at the photos (1–4). Inventors and designers studied these plants and animals for the inventions (A–D) at the bottom of the article on page 99. Try to match the animal or plant to the invention. Then check your answers by reading the rest of the article.

Critical thinking supporting the main argument

- 4 The main argument of this article is that the design of animals can improve the design of our own world. Which of these sentences support or restate the argument?
- Scientists want to use the design of a gecko on their own robot.
 - Animals and plants can teach humans a lot about design and engineering.
 - Most humans have never seen a whale.
 - Mercedes Benz is producing a new kind of car.
 - Engineers in Canada are studying whales' flippers because they move so effectively through water.

Word focus have

- 5 Look at two uses of *have* (a–b) when it is the main verb (i.e. not an auxiliary verb). Then match *have* in the sentences from the article (1–5) with the two uses.

have /hæv/

- a** possessing or owning something (including physical appearance, ideas, illnesses, etc.)
b actions or experiences

- It has four feet. **a**
- It still has a more difficult time when it tries to walk upside down.
- When they have a problem, nature often has the answer.
- Most people have some Velcro on an item of clothing.
- He had a closer look.
- We can also use *have got* instead of *have* when talking about possessing or owning something (e.g. *It's got four feet*). Look at these nouns. We can use *have* with all of them, but which ones can't use *have got*?

a bad cold a chat a new car a rest blonde hair
 fun a good time

Speaking

- 7 Work in groups. Read the three pieces of information about different animals. Discuss how these animals could help humans. Which products in our life could they improve?

- Spiders have got silk which is very light and very strong. It's stronger than many human-made materials, including steel.
- The Abalone is a type of shellfish. It's got a shell that is much stronger than many types of stone.
- Glow worms have a cold light which is more efficient than a light bulb.



boxfish



lotus leaf



humpback whale



bur

Word focus have

- 5 Read through the instructions and uses of *have* with the class. Ask students to match the sentences to the uses individually, then check with a partner.

ANSWERS

- 2 b 3 a 4 a 5 b

- 6 Ask students to call out the answers to this quickly. Make sure that students understand *have got* can only be used to talk about possession (i.e. use a in Exercise 5), not actions or experiences (use b).

ANSWER

You can't use *have got* with *a chat*, *a rest*, *fun*, *a good time*.

Extra activity

If students need further practice, ask them to find one more sentence in the article with *have*, and decide which use in Exercise 5 it matches.

Wilhelm Bartlott was another inventor who had a great idea (use a) ...

DESIGNS FROM Nature

*When we have a problem,
nature often has the answer*

In a room at Stanford University, scientists are studying a small animal called a gecko. It's an amazing animal because it can move very quickly up and down a tree and it can even walk upside down on ceilings. The scientists are particularly interested in the gecko's feet. They want to use the same design on their own robot. The metal robot looks very similar to the gecko. It has four feet which can also walk up walls made of glass or plastic. However, it still has a more difficult time when it tries to walk upside down.

Animals and plants can teach humans a lot about design and engineering. As a result, many engineers, scientists and designers spend time studying them. When they have a problem, nature often has the answer. This science is called biomimetics. *Bio-* means 'studying living things' and *mimetics* means 'copying the movement of things'. In other words, scientists – or biomimeticists – study animals and plants in order to copy the design.

Take, for example, a whale. Engineers in Canada are studying their flippers because they move so effectively through water. The engineers believe the shape can also improve the movement of wind turbines. Similarly, the boxfish is another animal from the sea which is helping car manufacturers in Germany. Mercedes Benz is using the shape of the fish for one of its new cars. The shape makes it faster and more fuel efficient.

Velcro is probably the most famous example of biomimetics. Most people have some Velcro on an item of clothing. It was invented by the Swiss engineer George de Mestral in 1948. He was walking in the countryside when he pulled a plant's bur from his trousers. He noticed how the bur stuck so well to his clothes. He worked on his idea and the result was Velcro, which became an affordable alternative to the traditional zip.

In 1982, Wilhelm Bartlott was another inventor who had a great idea when he was studying the leaves of a lotus plant. Bartlett noticed that water always ran off the leaf. When he had a closer look, he also noticed how the leaf cleaned itself. Bartlott copied the leaf's special surface and now you can find it in specialised paint products where water and dirt never stay on the paint.

In conclusion, biomimetics has helped to design our world and there are many more future possibilities. Unfortunately, it might take a long time to discover all the possibilities. This isn't really surprising because it's taken nature thousands of years to design its animals and plants.

flipper (n) /'flɪpə(r)/ the flat arm or leg of a sea animal, used for swimming

bur (n) /bɜː/ a seed from a plant

zip (n) /zɪp/ two rows of metal teeth-like parts which come together (e.g. on a coat)



TALK ABOUT ► A NEW INVENTION ► PLANNING AN EXPEDITION ► IMPROVING DESIGN ► HOW SOMETHING WORKS
WRITE ► AN ARGUMENT FOR TECHNOLOGY

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Speaking

7 Ask students to work in groups of four to discuss how these different animals could help people and which products they might help to improve. Then have the groups report their ideas back to the class, and discuss them as a class.

SAMPLE ANSWERS

Spiders: could help us to develop new, stronger fibres, e.g. for cables and wires to use in construction of bridges and buildings, or for textiles to use in clothing.

Abalone shell: could help us to develop stronger building materials, e.g. concrete for building.

Glow worms: could help us to develop new forms of lighting, e.g. street lighting, torches and household lamps, light bulbs, etc.

Homework

Ask students to write about an animal feature that could be used to help with the design of some material or object. It can be one of the animals dealt with in Exercise 7 or something completely new.

Gadgets

Lead-in

Personal response

Having made sure that students understand what a gadget is, ask them what their favourite gadget is at home – get them to describe it and say what they use it for.

Vocabulary technology verbs

1 Ask students to look at the photos and answer the questions in pairs, then discuss this as a class.

SAMPLE ANSWER

It is a headlamp that fits on your head, and it can be used when you work in a dark place (e.g. a cellar, a loft, or outside at night) and you need to have your hands free in order to carry things, climb or do anything else.

2 Ensure students know the meanings of the words in the box and in the text. They should complete the instructions individually, then check with a partner. Elicit the answers as complete sentences.

ANSWERS

- | | |
|-------------|------------|
| 2 Switch on | 5 Plug |
| 3 Press | 6 recharge |
| 4 send | |

Pronunciation linking

3a [2.13] Read through the description of how linking works with the class. Ask students to look at the list of phrases, and imagine how they sound. Play the recording and let them listen. Then play it again and pause after each phrase so that they can repeat it chorally and individually.

3b Ask students to do think of items and make sentences in pairs. Circulate and monitor their grammar and pronunciation.

Real life asking how something works

4 [2.14] Ask students to look at the instructions for the headlamp in Exercise 2 again and tick the features they hear discussed. They can then check their answers with a partner.

ANSWERS

2, 3/4, 5/6

8d Gadgets



Head Torch

- You can 'push' the light forward and backwards.
- and choose three types of lighting (normal / long distance / emergency red).
- the button on the side to
- an emergency 'whistle' signal.
- it into a laptop and
- its batteries for up to 160 hours.

Features

Vocabulary technology verbs

- 1 Look at the photo of the head torch in the advert above. What is it used for? Would it be useful for you? Would you buy one?
- 2 Complete the list of features (1–6) for the head torch with these verbs.

plug press push recharge send switch on

3 Pronunciation linking

a [2.13] A word ending with a consonant sound links to the next word if it starts with a vowel sound. Listen and practise saying these instructions.

- 1 Switch_it_on.
- 2 Plug_it_into a laptop.
- 3 Recharge_it_overnight.
- 4 Send_an_email.
- 5 Click_on the link.

b Work in pairs. Think of more items you often use at home or at work and make sentences using the verbs in Exercises 2 and 3a. Pay attention to linking where necessary.

I switch_on my mobile_in the morning and recharge_it_overnight.

Real life asking how something works

- 4 [2.14] Listen to two people who are going on a camping trip. They talk about the head torch. Tick the features in Exercise 2 that they discuss.
- 5 [2.14] Listen to the conversation again. Tick the questions in the box you hear.

ASKING HOW SOMETHING WORKS

Where do I switch it on?
How did you do that?
What happens if I press this button?
What is this for?
How long does the battery last?
Why do you need to do that?
How do you make it switch on / record?

6 Work in pairs. Take turns to ask and explain how something works. Use these objects or gadgets in your bag or in the school.

a mobile phone a CD player
an MP3 player a computer
an interactive whiteboard a DVD player
a vending machine

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TALK ABOUT ► A NEW INVENTION ► PLANNING AN EXPEDITION ► IMPROVING DESIGN ► HOW SOMETHING WORKS
WRITE ► AN ARGUMENT FOR TECHNOLOGY

5 [2.14] Read through the questions first to focus students' listening. Then play the recording while they tick. Elicit which questions they heard.

ANSWERS

- Where do I switch it on?
- How did you do that?
- What is this for?
- Why do you need to do that?

6 Ask students to choose items from the box, or other gadgets around them, and explain how they work to their partner.

Homework

Ask students to write a description of a gadget they have at home.

8e

An argument for technology

Lead-in

Personal response

Ask students to tell the class what they find positive and what they find negative about technology, and give reasons for their ideas.

8e An argument for technology

Writing a paragraph

1 Read the paragraph. Where do you think it comes from? Choose the correct option (1–3).

- 1 an instruction manual
- 2 a report on energy in the workplace
- 3 a message to a colleague at work about the lighting



LED lighting is a more effective form of modern lighting technology. **Firstly**, LED lights last longer than normal lights. **For example**, a normal light bulb lasts for around 5,000 hours. LED light bulbs last 100,000 hours. **Furthermore**, LED light bulbs change 80% of electricity into light. Normal bulbs only change 20%. **In other words**, LED lights need less electricity to produce more light. **On the other hand**, one disadvantage is that LED lights are more expensive than normal lights. **However**, they don't have to be changed every year and they use less energy. **As a result**, they are cheaper.

2 Writing skill connecting words

Look back at the highlighted connecting words in the paragraph in Exercise 1. Match the words with their uses (1–6).

- 1 to sequence ideas and sentences: firstly
- 2 to introduce an example: for example
- 3 to add supporting information: furthermore
- 4 to say the same thing in a different way: in other words
- 5 to introduce contrasting information: on the other hand
- 6 to introduce a result: as a result

3 Writing skill supporting sentences

The first sentence in the paragraph about LED lighting is the topic sentence. It gives a general introduction to the main idea of the paragraph. Afterwards, all the other sentences support this main idea. Which of these sentences (1–8) are topic sentences (T) and which are supporting sentences (S)?

- 1 The Internet has completely changed our access to information.
- 2 Take, for example, how many books and articles you can read online.
- 3 For example, closed circuit television (CCTV) is on our streets and in public places.
- 4 There are many different ways to use technology in security.
- 5 In other words, all your personal information can be put onto one identity card.
- 6 Firstly, Russia put the first satellite in space in 1957. Now there are thousands in space.
- 7 Over the last fifty years, there have been many great achievements in space travel and technology.
- 8 Furthermore, robots have now landed and travelled on Mars.

4 Read these notes for a paragraph about GPS technology. Write the paragraph using the notes and connecting words from Exercise 2.

- Main argument: GPS is a good idea for anyone who travels a lot
- Supporting ideas:
 - 1 GPS maps are always up-to-date and accurate
 - 2 more expensive than a normal map but safer to use when driving
 - 3 saves time (and money on petrol)

5 Choose one of these types of technology and prepare to write a paragraph about why it is useful. Write your paragraph with three supporting ideas.

mobile phones email wireless technology
music downloads your own idea

6 Use these questions to check your paragraph.

- Have you used a topic sentence?
- Have you used three supporting sentences?
- Have you used connecting words?

Writing skills supporting sentences

3 Read the information with the class and make sure students understand what a 'topic sentence' is – they can look back to the opening sentence of the paragraph in Exercise 1 as an example. Ask them to categorise the sentences individually, then check with a partner.

ANSWERS

- | | | | |
|-----|-----|-----|-----|
| 1 T | 3 S | 5 S | 7 T |
| 2 S | 4 T | 6 S | 8 S |

4 Ask students to write the paragraph individually, then exchange it with a partner so both students can check each other's writing.

SAMPLE ANSWER

GPS is a good idea for anyone who travels a lot. Firstly GPS maps are always up-to-date and accurate. Furthermore, they are safer to use when driving. On the other hand, one disadvantage is that GPS is more expensive than a normal map. However, it saves time. For example, you will drive directly to your destination without spending time getting lost and trying to find your way. As a result, you will also spend less money on petrol.

Background note

GPS stands for the Global Positioning System, which is a space-based navigation system which provides place and time information in all weather, anywhere on earth where there is an unobstructed line of sight to four or more satellites. It was developed in the 1960s for military purposes, and then strengthened by the launch of 24 satellites between 1989 and 1994. In 1996, civilian use was sanctioned by the US President. In 2005 the first of a series of modernised satellites was launched. The system is owned and operated by the US government.

5 Explain to students that they should first make a plan of their paragraph, like the one in Exercise 4, with one main idea expressed in a topic sentence and three supporting ideas. They may need research time, so it could be set as a homework activity.

6 Ask students to use the checklist to go through the first draft of their paragraph and make any necessary changes.

Extra activity

Ask students to work in pairs and exchange their paragraphs to examine the structure, as well as language and ideas, and then provide feedback to their partner.

Writing a paragraph

1 Ask students to read the three options, then read the paragraph and decide where it is from. Elicit ideas and discuss the answer.

ANSWER

2 (it does not give any instructions so it is not option 1; it gives a lot of statistics and talks mainly about energy use, so it is likely to be a report about energy; it uses formal language so it is not option 3)

Background note

LED stands for 'light-emitting diode', and LEDs are a semi-conductor light source. Based on a discovery first made in 1907, LEDs were not practically developed until 1962. They are used on cars, on planes, in street lights and as the backlighting for TV and computer screens. They are cheap to produce and very long-lasting.

Writing skills connecting words

2 Ask students to match the words to their uses individually, then check with a partner. Elicit the answers with the phrases given by asking students to read the use, then the words from the passage.

ANSWERS

- | | |
|------------------|------------------------------|
| 2 For example | 5 On the other hand; However |
| 3 Furthermore | 6 As a result |
| 4 In other words | |

Wind power

Videoscript

00.00–00.28 Around the town of Spirit Lake, Iowa, the land is very flat, and the wind blows across it a lot of the time. It's not easy to live with, but one school district here is using this wind in order to get an advantage. In Spirit Lake, they've built two wind turbines right next to their schools. These turbines are helping the schools to save energy – and money.

00.28–00.36 Jim Tirevold The little turbine, since it's been paid off, has saved the district \$81,530.

00.36–01.00 The Spirit Lake school district built its first wind turbine in 1993. This was the first turbine used to power a school in this part of the US. Since then, the school has constructed a second turbine. Together, the two turbines could save the district \$140,000 a year in energy costs. This amount of money is very impressive, but it's even more impressive if it's explained in a different way.

01.00–01.07 Tim Grieves Well, it will mean anywhere from two to three teachers, which is very important at a time right now.

01.07–01.11 From the inside, it's clear just how big the turbines really are.

01.11–01.14 Jim Tirevold This turbine stands 180 feet to the hub height.

01.14–01.20 The turbine is held in place by steel rods that go 25 feet down into a solid foundation.

01.20–01.27 Interviewer What type of a wind could this withstand?

Jim Tirevold It's rated to stand up to 130 mile an hour winds.

01.27–02.44 The strength of the turbines is especially important in a place where tornadoes can – and do – occur. In extremely strong winds, the huge blades of the wind turbines simply shut down, or stop working. The turbines are also very efficient at using the wind. They'll produce energy in winds of just eight miles an hour.

The smaller turbine sends its power directly to the school itself. The larger turbine sends its power to the local electricity grid. There it can be used by the power company.

This little school district is able to sell the extra energy that the turbines produce.

The schools aren't the only ones who are making money in the energy business. In the countryside south of the Spirit

Lake schools, more turbines stand near the big silos on the local farms. In this area, 65 farmers have recently allowed energy companies to build wind turbines right next to their fields. Now, farmers can make money from the wind, just as they do from selling their crops. Farmer Charles Goodman thinks he'll make an extra \$6,000 a year from the three turbines on his farm.

02.32–02.41 Interviewer So when you see the wind kicking pretty good like it is, that's money in your pocket, right?

Charles Goodman I smile all the time when the wind's blowing like this.

02.41–02.57 This piece of the Iowa countryside is just 27 miles long, but it now has 257 wind turbines. These turbines provide enough energy to power

a city like Des Moines. That's 71,000 homes!

02.57–03.08 The turbines are also providing more than just power. In Spirit Lake, wind power is used for teaching as well.

03.08–03.17 Physics teacher Jan Bolluyt can't imagine why schools wouldn't use wind power.

03.17–03.23 Jan Bolluyt When I talk about force, and energy and electricity, they see that we're producing it right here.

03.23–03.33 The teachers here encourage students to keep detailed records. They write down the amounts of fossil fuels, such as coal, that are no longer needed for energy for the school.

8f Wind power



The people of Spirit Lake are using the power of the wind to ensure a better future for everyone.

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Before you watch

- 1 Work in groups. Look at the photo and discuss the questions.
 - 1 Where are the children in the picture?
 - 2 What technology can you see? What is it for?
 - 3 How will the children benefit from this technology?

While you watch

- 2 Watch the video and check your answers from Exercise 1.
- 3 Watch the video again and answer the questions.
 - 1 How much money could the wind turbines save the school district in energy costs?
 - 2 How would the district spend the money?
 - 3 Why is it very important that the turbines in Spirit Lake can withstand strong winds?
 - 4 What does the school district do with the energy from the larger turbine?
 - 5 Why are farmers happy when the wind blows?
 - 6 What do teachers encourage students to do?
- 4 Watch the video again. Complete the phrases with the correct number.

6,000 71,000 81,530 130 257 180 2

- 1 The number of wind turbines in Spirit Lake: _____
- 2 The amount of money the smaller turbine has saved the district: \$ _____
- 3 The height of a wind turbine: _____ feet
- 4 The strength of winds the wind turbines can withstand: _____ mph
- 5 The amount of money Charles Goodman will make in a year from his wind turbines: \$ _____
- 6 The number of wind turbines in this piece of the Iowa countryside: _____
- 7 The number of homes in the town of Des Moines: _____

After you watch

5 Roleplay a conversation between a salesperson and a head teacher

Work in pairs.

Student A: You are a wind turbine salesperson. You are going to visit a school to explain the benefits of wind turbines. Write notes about three or four benefits.

Student B: You are the head teacher of a school. Read the notes below and prepare questions to ask the salesperson.

- You are interested in wind turbines but are not sure whether to build one for your school. Some parents have complained that wind turbines are very ugly.
- Think of three or four disadvantages of wind turbines.
- Ask the salesperson about the benefits of wind turbines.

Act out the conversation. Then change roles and repeat the conversation.

- 6 Jan Bolluyt says: 'So, you know, it's not just a small thing.' What is he referring to? Do you agree with him?
- 7 Work in pairs. Discuss these questions.

- 1 What types of alternative energy are used in your country?
- 2 What are the advantages and disadvantages of alternative energy compared to fossil fuels?
- 3 Where do you think we will get our energy in the future?

blade (n) /bleɪd/ the long, narrow part that makes a propeller turn when the wind hits it
blow (v) /bləʊ/ the wind does this when it moves
crop (n) /krɒp/ plants that farmers grow and harvest
encourage (v) /ɪn'kʌrɪdʒ/ get someone to do something
ensure (v) /ɪn'ʃʊə/ guarantee
flat (adj) /flæt/ without hills or mountains
fossil fuel (n) /'fɒsɪl 'fjuːəl/ gas, oil or coal
foundation (n) /faʊn'deɪʃən/ a solid base under the ground that a structure sits on
grid (n) /grɪd/ a system of cables for distributing electricity
impressive (adj) /ɪm'presɪv/ causing a feeling of admiration
pay off (v) /peɪ 'ɒf/ finish paying for something
power (n) /'paʊə/ electricity, energy
power (v) /'paʊə/ send electricity to
rod (n) /rɒd/ a long, thin piece of metal or wood
save (v) /seɪv/ use less money
silos (n) /'saɪləʊ/ a place where farmers put their crops after they harvest them
steel (n) /stiːl/ a type of metal
turbine (n) /'tɜːbaɪn/ a type of machine that produces energy from a moving propeller
withstand (v) /wɪð'stænd/ resist

- 3 Give students time to read the questions, then play the video again for them to write the answers.

ANSWERS

- 1 \$140,000 a year
- 2 on teachers
- 3 Because they need to be able to withstand tornados.
- 4 It sends the power to the local electricity grid.
- 5 Because they have turbines on their land and they can make money from the wind.
- 6 keep records of how much fossil fuel they are not using

- 4 Give students time to read the sentences, then play the video again for them to write in the numbers.

ANSWERS

- 1 2 3 180 5 6,000 7 71,000
- 2 81,530 4 130 6 257

After you watch

- 5 Students work in pairs to roleplay a conversation between a salesperson and a head teacher, according to the instructions.
- 6 Elicit ideas from the class about what the quote means, and whether they agree with it.
- 7 Students work in pairs to discuss the questions.

03.33–03.45 Jan Bolluyt We're talking tons of carbon dioxide. We're talking tons of sulphur dioxide. We're talking hundreds of trees. So, you know, it's not just a small thing.

03.45–end In this part of Iowa, people are using wind power to earn money and to learn about saving the environment. The people of Spirit Lake are using the power of the wind to ensure a better future for everyone!

Before you watch

- 1 Students work in groups. Ask them to look at the photo and discuss the questions. Take feedback from the class.

While you watch

- 2 Play the whole of the video for students to check their ideas from Exercise 1.

ANSWERS

- 1 in a playground
- 2 a wind turbine; to get energy from the wind
- 3 They will get free energy for their school.

UNIT 8 REVIEW

Grammar

1 Ask students to use the prompts to write sentences with a relative clause.

ANSWERS

- 2 Camping is an activity which (that) I enjoy doing.
- 3 GPS is a gadget which (that) tells you where you are.
- 4 My parents are the people who (that) are always happy to see me!
- 5 The thing which (that) I hate about TV is the adverts.
- 6 The Space Shuttle was the first spacecraft which (that) travelled from and to Earth.

2 Ask students to think about how they would complete these two sentences individually, then work in pairs to discuss their answers.

3 Ask students to complete the sentences using the verbs in the box, with a form of *will* if necessary.

ANSWERS

- 1 press
- 2 will work
- 3 love
- 4 doesn't call
- 5 won't go

Vocabulary

4 Ask students to look at the list and pair the verbs and nouns that are the best match. Point out that some verbs match with more than one noun, but others will only pair with one. They should therefore look through the whole list first and decide on the pairs before they write them down. Note also that *make* appears twice and matches with two items.

ANSWERS

- 1 b / e
- 2 d
- 3 a
- 4 b / e
- 5 c

5 Ask students to complete the questions with words from Exercise 4. Then work with a partner to discuss their answers.

ANSWERS

- 1 idea
- 2 make
- 3 make
- 4 problem, find

6 Ask students to complete the sentences with two words, one from each box. They should be words that go together to form a phrasal verb.

ANSWERS

- 1 log on
- 2 set up
- 3 Plug ... into
- 4 turn ... round / up
- 5 push ... forward
- 6 Click on

UNIT 8 REVIEW

Grammar

1 Make sentences with a relative clause using the words.

- 1 the invention / has changed the modern world / the internet
The invention which has changed the modern world is the internet.
- 2 camping / an activity / I enjoy doing
- 3 GPS / a gadget / tells you where you are
- 4 my parents / the people / always happy to see me!
- 5 the thing / I hate about TV / the adverts
- 6 the Space Shuttle / the first spacecraft / travel from and to Earth



2 Complete these sentences for you. Then tell your partner why.

- 1 Someone who changed my life was ...
- 2 Something which improved my life was ...

3 Complete the sentences with these verbs. Use *will* ('ll) or *won't* where necessary.

not call not go love press work

- 1 When you _____ this button, the TV comes on.
- 2 If you put new batteries in, it _____ again.
- 3 When it's sunny, we _____ to go to the beach.
- 4 If he _____, then he doesn't want to come with us.
- 5 I _____ hiking if you don't go.

I CAN

describe people, places and things with extra information

talk about situations that are generally true and possible in the future

Vocabulary

4 Match the verbs (1-5) with the nouns (a-e).

- 1 make
- 2 find
- 3 solve
- 4 make
- 5 have
- a a problem
- b a decision
- c an idea
- d a solution
- e mistakes

5 Complete the questions with words from Exercise 4. Then discuss the questions with your partner.

- 1 What's the best _____ you've ever had in your life?
- 2 What decisions do you _____ in your daily life or at work? How important are they?
- 3 What's the most common mistake you _____ in English?
- 4 Do you like to solve a _____ on your own or _____ a solution with others? Why?

6 Match two words (one from each box) and complete the sentences.

click log plug forward
push set turn on (x2) round up

- 1 I want to _____, but I've forgotten my password.
- 2 How do you _____ an online account?
- 3 _____ it _____ the wall socket and it'll recharge.
- 4 For maximum volume, _____ the dial _____ to number 10.
- 5 You can pull it backwards for reverse or _____ it _____ to go faster.
- 6 _____ the icon in the top corner to open the program.

Real life

7 Put these words in the correct order to make questions for asking how something works.

- 1 switch / it / where / do / I / on?
- 2 you / did / that? / do / how
- 3 if / I / happens / button? / press / this / what
- 4 the / battery / long / how / does / last?
- 5 that? / why / do / do / you / to / need
- 6 record? / how / it / do / you / make

8 Match these responses (a-e) with the questions in Exercise 7. One response answers two questions.

- a So you don't lose any data.
- b Eight hours.
- c There.
- d By pressing this.
- e You turn it off.

I CAN

talk about using technology

explain and ask how something works

Speaking

9 Work in pairs. Explain to your partner how to use the DVD in the back of this book.

Real life

7

ANSWERS

- 1 Where do I switch it on?
- 2 How did you do that?
- 3 What happens if I press this button?
- 4 How long does the battery last?
- 5 Why do you need to do that?
- 6 How do you make it record?

8

ANSWERS

- 1 c
- 2 d
- 3 e
- 4 b
- 5 a
- 6 d

Speaking

9 Ask students to get into pairs. One of them should explain how to use the DVD and the other should ask questions for clarification. They can then swap roles so the other student gives the explanation.