

Flexi-Course Book

Technical English

1B

Students' Book
and Workbook



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With Workbook CD

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1 Dimensions




Start here 1 What do you know about this bridge?

- 1 What's it called?
- 2 Where is it?
- 3 How high is it?

Listening 2  **39** Listen to part of a TV programme about the bridge. Check your answers to 1.

3 Work in pairs. Which of the following can you see in the photo?

cable deck pier pylon span

4  **40** Listen to the next part of the TV programme and complete the specifications of the bridge.

BrE: *metre, millimetre, centimetre.*
AmE: *meter, millimeter, centimeter.*

Don't add -s to abbreviations of units.
say: *one hundred metres / kilometres*, write: *100 m / 100 km*

Millau Bridge: specifications				
Structure	(1) <i>cable-stayed</i>	Length of outer spans	(7)	m
Completion date	(2) <i>December 2004</i>	Number of piers	(8)	
Material: cables and deck	(3)	Height of pylons above deck	(9)	m
Material: piers	(4)	Height of deck above water	(10)	m
Total number of spans	(5)	Length of deck	(11)	km
Length of inner spans	(6)	m	Width of deck	(12) m

Vocabulary 5 Complete the table.

Adjective	high	long	_____	wide
Noun	_____	_____	depth	_____

6 Complete the sentences with the correct word in brackets.

- The _____ of the road is 6 m. (wide/width)
- The river is 230 km _____. (long/length)
- The sea has a _____ of 330 m. (deep/depth)
- These pylons are over 80 m _____. (high/height)
- These oil wells are more than 700 m _____. (deep/depth)
- The total _____ of the road is about 120 km. (long/length)
- The tunnel is 15 m _____. (wide/width)
- The _____ of the bridge is 130 m. (high/height)

Language

How	high	is it?	It's	2	millimetres	high.
	wide	are they?	They're	10	centimetres	wide.
	long			100	metres	long.
	deep			1000	kilometres	deep.

Speaking 7 Make questions about the Millau Bridge. Use the specification chart in 4.

8 Work in pairs. Ask and answer your questions in 7.

Example:

TV presenter: How long are the inner spans?

Engineer: They're 342 metres long.

Task 9 Work in pairs. Find out the specifications of your partner's bridge.

Student B. Turn to page 114.

Student A:

- Ask Student B questions about the Akashi-Kaikyo Bridge. Complete your specifications chart.
- Then change roles. Turn to page 112 and answer Student B's questions about the Rion-Antrion Bridge.

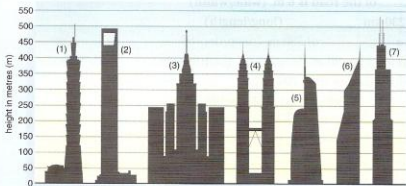
Akashi-Kaikyo Bridge: specifications	
Type of structure	<i>Suspension</i>
Country	
Piers (number)	
Span (length)	
Deck (above water)	
Deck (length)	
Water (max depth)	
Water at main pier (depth)	

The Akashi-Kaikyo Bridge




2 Quantities

- Start here** 1 Try the quiz. Match the names of the buildings to the pictures. Write the number and the approximate height of each building.



- A Dubai Towers Doha, Qatar**
(Picture # ____; height ____ m)
- B Federation Tower, Russia**
(Picture # ____; height ____ m)
- C Abraj Al Bait Towers, Saudi Arabia**
(Picture # ____; height ____ m)
- D Sears Tower, USA**
(Picture # ____; height ____ m)
- E Petronas Towers, Malaysia**
(Picture # ____; height ____ m)
- F Taipei 101, Taiwan**
(Picture # ____; height ____ m)
- G Shanghai World Financial Centre, China**
(Picture # ____; height ____ m)

- 2  41 Listen and check your answers to 1.

- Reading** 3 Read the FAQs from the website and match them to the answers.

BR lift = AmE elevator

write: 8000 m²; say: eight thousand square metres.
write: 250,000 m³; say: two hundred and fifty thousand cubic metres.
write: 5 kg; say: five kilograms or five kilos.

This is Taipei 101. It is currently the highest in the world. Here are some frequently asked questions (FAQs) about the building.

- 1 How high is Taipei 101?
- 2 What's the footprint of the building?
- 3 How many storeys does it have?
- 4 How do you get to the top?
- 5 What's the building made of?
- 6 How much steel and concrete is in the building exactly?

- A About 700,000 tonnes.
- B By super-fast elevator. The building has two high-speed elevators. Each elevator travels at 17 m/s.
- C 101.
- D It towers above Taipei at the amazing height of over 508 metres.
- E Reinforced concrete, steel, aluminium and glass.
- F The base of the building has an area of about 450 m².

Language

Countable nouns can be both singular and plural. Examples: *screw, nail, bottle*.
Uncountable nouns are always singular. Examples: *concrete, cement, sand, oil*.

screws are countable		cement is uncountable	
a	screw	some	cement
one			
some			
two	screw	-s	a bag of
a bag of			
two bags of			two bags of

Do you need	some/any	screws? cement?	How	many much	(screws) (cement)	do you need?
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4 Complete the dialogue with the words in the box.

any how many much some What colour What size

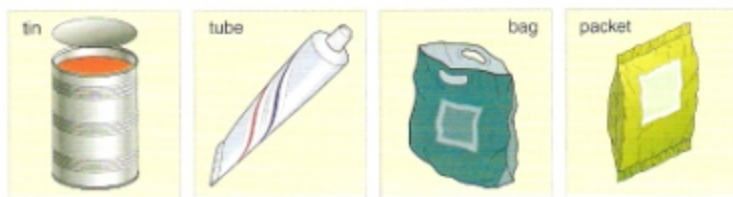
- *Good morning. Can I help you?*
- Hello. Do you have (1) _____ screws?
- *Certainly. (2) _____ do you need?*
- Ten mil.
- *OK. And (3) _____ do you need?*
- Fifty, please.
- *Right. So that's fifty 10 mil screws. Anything else?*
- Yes. I need to buy (4) _____ paint, please.
- (5) _____?
- Black.
- *OK. So (6) _____ black paint do you need?*
- Six large tins, please.
- *Anything else?*
- No, that's all, thanks.

5 Make similar dialogues with your partner. Use the questions in the box and the information from the table.

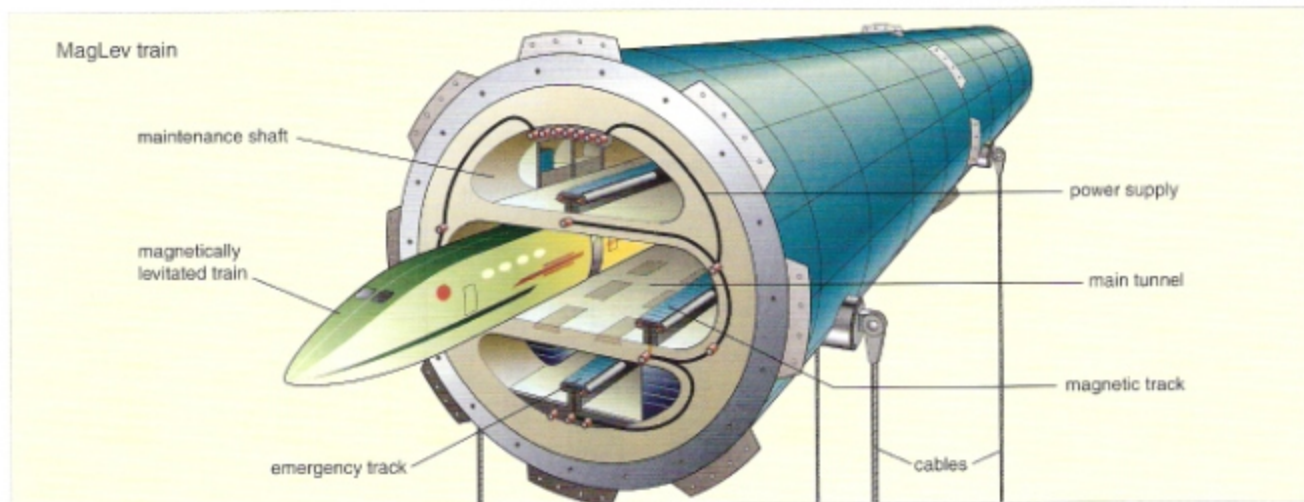
How many? How much?
What colour? What kind?
What size? What type?

To buy ...		
Item	Quantity	Kind, size or colour
screws	50	10 mm
paint	6 large tins	black
glue	2 tubes	superglue
nuts	30	15 mm
oil	15 L	motor oil
bolts	60	25 mm
cement	20 bags	white
nails	2 packets of 50	20 mm

write: 15 L; say: 15 litres



3 Future projects



- Start here**
- 1 Work in pairs. Look at the picture. What is it? How does the vehicle move?
 - 2 42 Listen to this radio interview and complete the specification chart.

Trans-Atlantic MagLev Tube	
Location of tube	(1) <i>Under the Atlantic Ocean from Britain to the USA</i>
Possible date of completion	(2) <i>2100</i>
Length	(3) km
Depth below sea level	(4) m
Number of cables	(5)
Speed of train	(6) km/h
Source of power for train	(7)

Language Use *will* and *won't* to predict a future fact or event.

They/We My company The engineers	will 'll will not won't	build it in 2050.
--	----------------------------------	-------------------

When	will	they/you	build it?	In 2050.
	Will		build it in 2050?	Yes, they will. / No, they won't.

3 Disagree with each statement.

- 1 The engineers will start the tube in 2020. (2080)
- 2 The tube will be under the Pacific Ocean. (Atlantic)
- 3 The tube will connect Britain with Europe. (the USA)
- 4 The train will use diesel. (magnetism)
- 5 The tube will contain compressed air. (a vacuum)
- 6 The trains will travel at 11,000 km/h. (8000 km/h)

Example: 1 They won't start the tube in 2020. They'll start it in 2080.

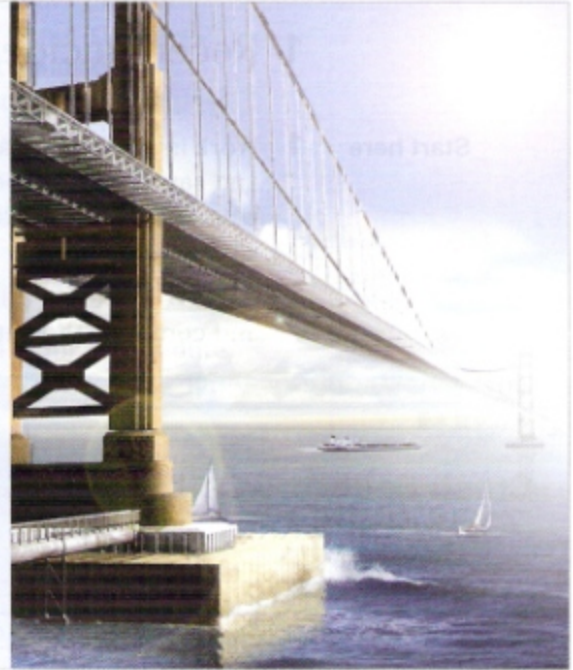
- Reading 4** Read this interview and produce a specifications chart for the bridge (see 2 on page 56). Use the words in the box.

completion date deck height length materials pier pylon span

Bridge of the Future: Europe-Africa Bridge

RadioTech presenter Tom Burns interviews engineer Galal Hamdy.

- Tom: What project are you working on now?
Galal: We're designing the world's longest bridge.
Tom: Where will it be?
Galal: Between Morocco and Spain. It'll connect Europe with Africa.
Tom: What are the specifications of the bridge?
Galal: It will be almost 15 km long. In our design, the bridge will have two spans. Each span will be 4800 m long.
Tom: That's a very long span. How will that be possible?
Galal: The bridge will have three steel pylons, on concrete piers. The pylons will be 1000 m high. The deck will be very light and strong. It'll be made of fibreglass.
Tom: Many engineers think you won't be able to build this bridge.
Galal: I don't agree. I think we'll complete it around 2030.



- Speaking 5** Work in pairs. Ask and answer questions about the specifications of the bridge.

A: *How long will the bridge be?* B: *It will be almost 15 km long.*

- 6** Here is a possible project schedule for the Europe-Africa Bridge. Roleplay an interview between a TV presenter and an engineer.

Task	2024	2025	2026	2027	2028	2029	2030	2031	2032
1 lay foundations	■	■	■						
2 build piers			■	■	■				
3 put pylons on piers					■	■			
4 attach cables to pylons						■	■		
5 make deck			■	■	■	■	■		
6 fix deck to cables							■	■	■
7 build roads								■	■
8 open bridge									■

TV Presenter: When will you build the piers?


Engineer: We'll start in 2026 and finish in 2027.

- Social English 7** How do you think the world will change in the next 20 years. Think about technology, social, political and legal changes.

Example: Computers will control more things in our homes.

1 Recent incidents


Start here

- 1 Work in pairs. Look at the photo and say what's happening. List five common problems you can have with a car.
- 2  43 Listen to this phone call and complete the details in the form.



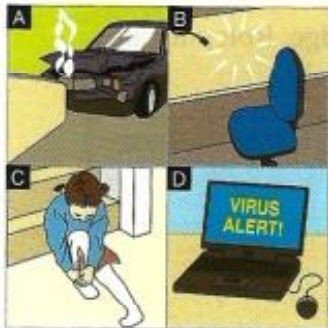
Crash Recovery Co Ltd Online customer call information. Enter details		
Customer name	(1)	
Car Registration No	(2)	
Location: Road	(3)	
Between Junction (4)	and Junction (5)	Going (6)
Problem:	(7) <i>The exhaust pipe</i>	

Listening

- 3  44 Listen to the phone calls and match them with the pictures.
- 4 Complete the sentences with the verbs in the box. Put two words in each gap.

broken cut driven fallen had happened have/has lost taken

- 1 Is that Security? Thieves *have broken* into my office. They _____ my computer.
- 2 Is that the IT hotline? Something _____ to my computer. I _____ all my data.
- 3 I need an ambulance, quickly. My daughter _____ downstairs. She _____ her leg.
- 4 Is that Crash Recovery? I _____ an accident. I _____ my car into a bridge.



Language

You form the *present perfect* with *have/has* + past participle.

- You can use the present perfect to talk about *recent* actions: *My car has broken down. I've changed the tyre.*
- The present perfect does not go with dates, times or time expressions such as *yesterday, a week ago, in 2005*. Use the past simple with these expressions.

- 5 Check you know the past participle of these verbs. Which ones are *irregular*?

buy check crash fall order put repair
sell send speak steal take write

Speaking 6 Work in pairs. Make short dialogues.

A is the supervisor in a car repair workshop. B is a mechanic in the workshop.

- 1 check the brakes ✓ repair the tyres ✗
- 2 order those new parts ✓ buy those tools ✗
- 3 change the tyres ✓ clean the spark plugs ✗
- 4 phone the customer ✗ speak to our supplier ✓
- 5 write that report ✓ send that email ✗
- 6 put in the new fuses ✗ take out the old lamps ✓

A: *Have you checked the brakes?*

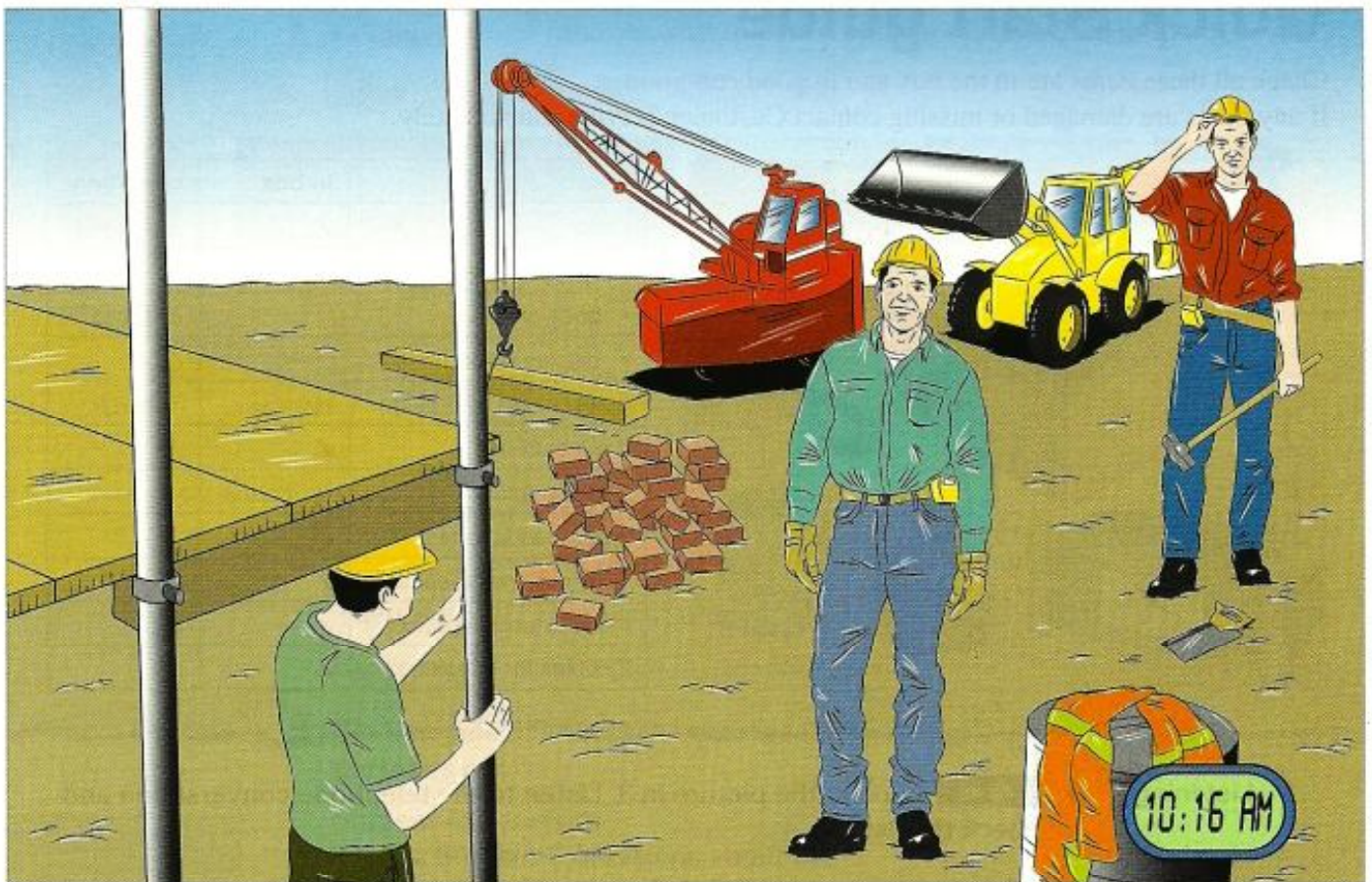
B: *Yes, I have.*

A: *Good. What about the tyres? Have you repaired them?*

B: *No, I haven't. I'll do it now.*

7 Try this memory test.

- Look at the picture on page 113 for one minute.
- Then look at the picture below. How many differences are there? Compare with a partner.



8 It is now 10.16 am. Explain what has happened in the picture since 10:12 am. Use the words and verbs in the box.

beam bricks bucket builder crane digger
hard hat jacket scaffolding sledgehammer

climb down drive fall over lower move back pick up put put on raise take off

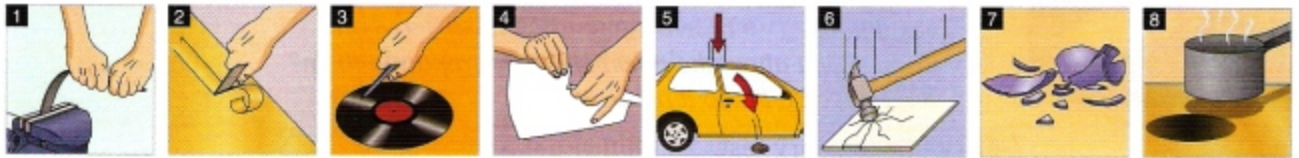
Example: 1 Two builders have taken off their jackets.

2 Damage and loss

Start here 1 Do you have any damaged tools or equipment? Describe the damage to your partner.

Vocabulary 2 Do you remember the verbs in the box? Match them with the pictures.

bend break burn crack cut dent scratch tear

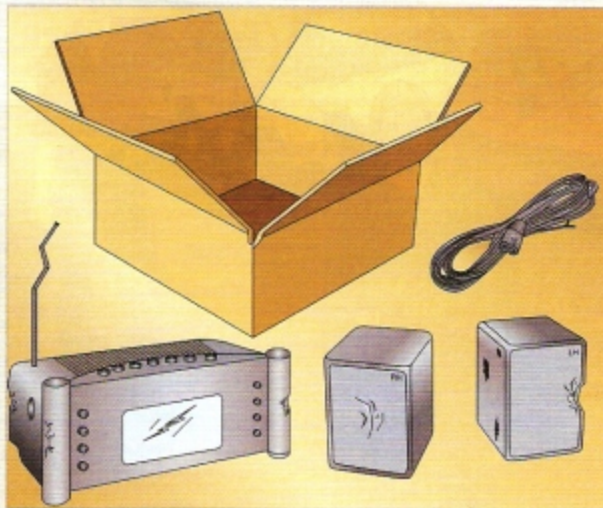


Task 3 Correct the mistakes in this checklist.

Quick Start guide

Check all these items are in the box and in good condition.

If any items are damaged or missing contact Customer Services immediately.



item	in box	condition
radio	✓	<i>damaged</i>
• radio antenna		OK
• body of radio		<i>cracked</i>
• display screen		OK
power cable with plug	<i>no plug</i>	<i>cable OK</i>
4 AA batteries	✓	OK
1 user manual	<i>no manual</i>	-
1 pair headphones	✓	OK
1 LH external speaker	✓	OK
1 RH external speaker	✓	OK
2 cables for speakers	✓	OK

Listening 4 45 Look at the picture in 3. Listen to the telephone conversation and check the list.

Speaking 5 Look at the picture in 3 again. Make sentences about the damage and the things that are missing. Use these sentence patterns.

Ways to report damage	Ways to report something missing
The screen is scratched. There's a scratch on the screen. The speakers are dented. There are some dents on the speakers.	The manual is missing. There's no manual in the box. The cable has no plug. / The cable doesn't have a plug. There's no plug on the cable.

Language

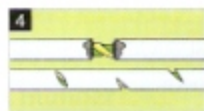
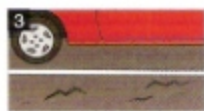
Focus on action			Focus on result of action		
I have	dented	the radio.	The radio	is	dented.
He has	broken	the speakers.	The speakers	are	broken.
	past participle				adjective

6 Rewrite the sentences in the same way as in the table above.

Focus on action	Focus on result of action
1 I've scratched the display screen.	
2 Someone has bent the antenna.	
3 I've burnt the body of the radio.	
4 Someone has dented the top of the speaker.	
5 They've cracked the cover of the plug.	
6 Someone has torn the user manual.	

7 Complete the sentences with the correct form of the words in the box.

bend crack cut dent scratch tear



- The side of the box is _____.
- The lenses of the goggles are _____.
- The surface of the road is _____.
- The insulation of the cable is _____.
- The pipe below the tank is _____.
- The overalls are _____.

8 Rewrite the sentences in 7 to give the same meaning.

There's a ... / There are some ...

Example: 1 There's a dent in the side of the box.

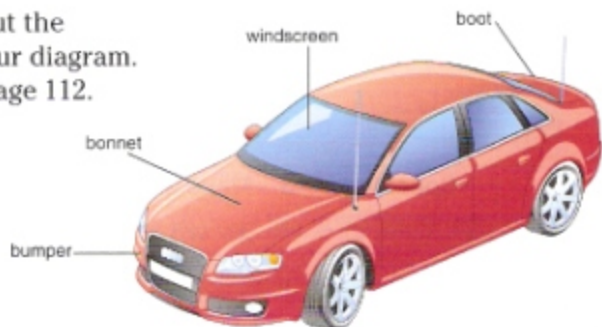
Task 9 Work in pairs. Find out the damage to your partner's car.

Student A:

- Ask Student B questions about the damage to their car. Label your diagram.
- Then change roles. Turn to page 112.

Student B. Turn to page 114.

- What's the problem?
- The door is scratched.
- Which door?
- The back / front nearside one.
- Anything else?



front & rear
The steering wheel is always
offside.

3 Past events

Start here 1 Work in pairs. When did these events happen?

Give the approximate year of the first ...

- | | |
|----------------------|---|
| 1 space station | 6 spacewalk |
| 2 telescope in space | 7 man on the Moon |
| 3 man in space | 8 shuttle in space |
| 4 space tourist | 9 crew to enter the International Space Station |
| 5 satellite | 10 European navigation satellite |

Reading 2 Read this chart and check your answers to 1.



Key dates in the history of space flight

Event	Date
1 The Russians launched Sputnik, the first satellite.	5 October 1957
2 Yuri Gagarin became the first man in space.	12 April 1961
3 Leonov made the first walk in space.	18 March 1965
4 The first men, Armstrong and Aldrin, landed on the Moon.	20 July 1969
5 The Russians launched the first space station, Salyut 1.	19 April 1971
6 The Americans put the first shuttle into space.	12 April 1981
7 NASA sent the Hubble telescope into space.	24 April 1990
8 The first crew entered the International Space Station.	2 November 2000
9 The first space tourist flew into space.	28 April 2001
10 The Europeans launched Galileo, a global navigation satellite.	28 December 2005



Language This is the *past simple* form of the verb.

- You can use it to talk about *past events*.
- Use the past simple with dates, times or expressions such as: *yesterday, last year, When?*

When	did	he/she/it/they/we/you	go travel	there?	
		He/She/It/They/We/You	went travelled	there	in 2007.

Speaking 3 Make questions and answers about the table in 2.

- A: *When did the Russians launch Sputnik?*
 B: *They launched it on the 5th of October 1957.*
 (or: *They launched it in 1957.*)

Use *on* for the exact day:
on the 14th of May 2005.
 Use *in* for a month or a year:
in May; in 2005.

Vocabulary ago = before now

You can say *the fifteenth of November* or *November the fifteenth*.

If it is the 15 th of November today ... • two days ago = 13 th November • two weeks ago = 1 st November • two months ago = 15 th September	If it is 10.15 now ... • five minutes ago = 10.10 • an hour ago = 9.15 • two hours ago = 8.15
--	--

4 Write the name of this month on the calendar. Put a circle round today's date. Then say what the following dates are.

- 1 today
- 2 yesterday
- 3 the day before yesterday
- 4 two days ago
- 5 one week ago
- 6 two weeks ago



5 Make statements about the chart in 2 using **ago** and approximate years from today's date.

Example: 1 The Russians launched Sputnik more than 50 years ago.

6 46 Listen and complete the phone call.

- Hello, Electronic Repairs. Don speaking. How can I help you?
- Hi. My name's Ben Jones. I've (1) _____ my MP3 player. Can you repair it?
- OK, sir. What's the model number?
- It's a Super 30 GB.
- And when did you (2) _____ it?
- Er, let's see ... Yes, I (3) _____ it on the 18th of August.
- And what's the problem?
- I've (4) _____ it and I've (5) _____ the screen.
- And, er ... when did you (6) _____ the screen?
- Yesterday.
- OK, bring it into the shop and I'll look at it.
- Thanks. Bye.

7 Work in pairs. Make similar phone calls.

	Item 1	Item 2	Item 3
Item:	MP3 player	mobile phone	laptop
Model no:	60 GB	9300	Travel 380
Date of purchase:	15 th February	13 th October	21 st July
Damage:	dented cover	dropped in water	broken cover
Date of damage:	three days ago	day before yesterday	two weeks ago

Social English 8 Make a list of interesting things you have done in your life, with their dates.

- climbed Mont Blanc in June 2006
- snorkelled in the Red Sea in August 2007

9 Tell other students in your class about your list.

Review Unit D

1 Make questions for these answers.

- 1 It's about 50 m wide. (the road)

How wide is the road?

- 2 They're 90 m high. (the pylons)

- 3 It's more than 2 km long. (the deck of the bridge)

- 4 It's about 35 m in height. (the scaffolding)

- 5 They're 15 m deep. (the foundations of the building)

- 6 They're about 12 m in length. (the steel beams)

2 Change these nouns to adjectives

- 1 depth _____ 3 width _____

- 2 height _____ 4 length _____

3 Rewrite the sentences to give the same meaning.

- 1 What is the height of the bridge? 4 The length of the new road is 355 km.

How high is the bridge?

This new road is _____.

- 2 The height of the tower is 46 m. 5 What are the widths of the screws?

The tower is _____.

How _____?

- 3 What is the depth of the sea under the bridge? 6 The depth of the well is more than 30 m.

How _____

The well is _____.

_____?

4 Make questions for these answers.

- 1 It has ten. (storeys / building)

How many storeys does the building have?

- 2 He needs 20 kilos. (cement / builder)

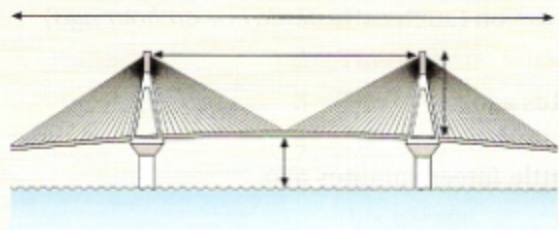
- 3 They're using two. (cranes / men)

- 4 It needs about 4 litres. (oil / car)

- 5 I'm buying 150. (screws / you)

- 6 They can carry about 50 cubic metres. (concrete / ten trucks)

5 Read the text. Label the diagram with all the parts and dimensions in italics.



This cable-stay bridge has 20 *cables*. The *deck* of the bridge is 1.2 km long, and is 185 m above water level. Each *pier* is 35 m wide. The *span* between the two piers is 832 m long. Each *pylon* is 45 m high above the road deck.

6 Work in pairs. Order what you need to build the Burj Dubai skyscraper.

trucks / 40,000 cranes / 3 steel poles / 12,000
 concrete / 150,000 m³ steel / 25,000 tonnes aluminium / 15,000 tonnes

A: I need to order some concrete/some trucks.

B: OK. How much concrete/How many trucks do you need?

A: I need ...

7 Complete the dialogue.

● Engineers are planning to build a tunnel under the sea.

○ Where will the tunnel be?

● It'll be between Spain and Morocco.

○ How long (1) _____ be?

● It (2) _____.

○ How many (3) _____ have?

● It (4) _____.

○ How (5) _____?

● It (6) _____.

○ How (7) _____?

● It (8) _____.

○ When (9) _____ the engineers _____?

● They (10) _____.

Location:

• Between Spain and Morocco

Length:

• 40 km

Number of railway lines:

• 2

Width:

• 8 m

Depth (below sea level):

• 300 m

Completion date:

• 2025

8 Answer these questions.

1 Did they complete the Millau Bridge in 2000? (2004)

No, they didn't. They completed it in 2004.

2 Have you ever worked in an electronics company? (video shop)

3 Will they build a bridge from Africa to Europe? (a tunnel)

4 Are they constructing the tunnel now? (planning and designing)

5 Has NASA ever put men on Mars? (the Moon)

6 Did Russia launch the first satellite in 1960? (1957)

9 Rewrite the sentences using the present perfect tense.

Remember: don't use a time expression (such as *yesterday* or *an hour ago*) with the present perfect.

1 My car broke down five minutes ago.

My car has broken down.

2 NASA launched the space shuttle fifteen minutes ago.

3 A virus attacked our office computers two hours ago.

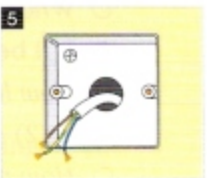
4 I wrote the email and I sent it to the customer yesterday.

5 The technician took the hard drive out of the computer an hour ago.

6 The exhaust pipe fell off my car ten minutes ago.

10 Look at the pictures. Say what's missing, in three different ways.

Example: *I The wheel has no wheel nuts. / The wheel doesn't have any wheel nuts. / There are no wheel nuts on the wheel.*



11 Complete the table.

Focus on action	Focus on result of action
1 He's dented the front bumper.	The front bumper is dented.
2 You've broken the windscreen.	
3 Someone has burnt the rear seat of the car.	
4 We've bent the poles of the scaffolding.	
5 They've torn the safety jackets.	
6 Someone has scratched the rear panel of the car.	

12 Complete the table.

1 He's <i>bent</i> the antenna.	The antenna is _____.	There's a small _____ in the antenna.
2 The fire has <i>burnt</i> the walls.	The walls are _____.	There are two large _____ on the walls.
3 You've <i>cracked</i> the window.	The window is _____.	There are some _____ in the window.
4 I've <i>trorn</i> my shirt.	My shirt is _____.	There's a _____ in my shirt.

13 Rewrite these sentences to give the same or similar meaning.

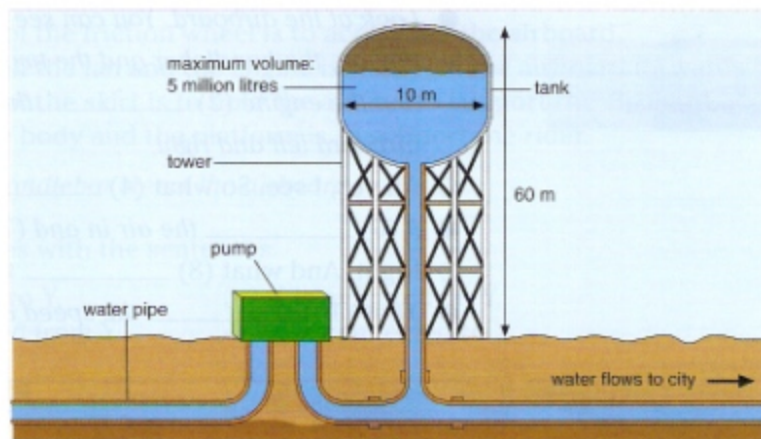
- | | | |
|---|--|----------------------------|
| 1 | There's a scratch on this cover. | This cover is _____. |
| 2 | There are no wheels on the car. | The car has _____. |
| 3 | The cables don't have any plugs. | There are _____. |
| 4 | The windscreens are cracked. | There are some _____. |
| 5 | There's no workshop manual in this garage. | This garage doesn't _____. |
| 6 | There is a dent in the roof of the car. | The roof _____. |

14 Complete this dialogue with the correct form of the verb in brackets.

- *Where did you buy your safety equipment?*
 - I (1) _____ (buy) it online, over the Internet.
- *That's good. How did you (2) _____ (find) the website?*
 - I (3) _____ (find) it through Google. I (4) _____ (key) in the words 'safety gear'.
- *How (5) _____ (you / pay) for it? Did you (6) _____ (use) your own bank card?*
 - No, no. My company (7) _____ (give) me a credit card last week. I (8) _____ (use) that.
- *That's great. When (9) _____ (you / receive) the goods?*
 - They (10) _____ (come) yesterday, by express mail.

15 Write a description of this water tower and how it works. Use the notes below.

Water tower
 Function: store / water
 Parts: The main parts of the water tower are ...
 Materials: tower - galvanised steel
 tank - aluminium and fibreglass
 Dimensions: height & width
 Volume: The tank can ...
 How it works:
 1 water / flow / to / pump
 2 pump / push / water / to / city
 3 extra water / flow / up / into / tank
 4 tank / store / water
 5 extra water / flow / down / from / tank / to / city



Projects 16 Choose one of these projects and follow the instructions.

- 1 Find out some facts about a famous structure (for example a bridge or building). Write a short article about it for an in-flight tourist magazine.
- 2 Design a new bridge, tunnel, or transport link (e.g. railway line or hovercraft route) to connect two places. Find out some facts about the location (for example, the width of a lake, the depth of the lake, the height of the land beside the lake, and so on). Write a short article about it for a technical magazine.
 - a) Draw a simple diagram of your design. Mark the dimensions.
 - b) Produce a specifications chart.
 - c) Write a short description.

1 Operation

Start here

- 1 Work in pairs. How does this vehicle move? Discuss with your partner.
- 2 What do the main parts do? Complete the chart.

Part	Function
	drive the fan
	pull the air in + force the air down
	control the speed and acceleration
	steer the airboard
	support the rider



Listening

- 3 47 Listen and check your answers.

- 4 Listen again and complete the dialogue.

● Look at the airboard. You can see the five main parts: the body, the engine, the fan, the handlebar and the two levers. The body (1) supports the rider and the engine (2) _____ the fan. The handlebar (3) _____ the airboard left and right.

○ Ah yes, I see. So what (4) _____ the fan (5) _____?

● It (6) _____ the air in and (7) _____ it downwards.

○ Right. And what (8) _____ the two levers (9) _____?

● They (10) _____ the speed and acceleration of the airboard.

downwards = upwards

Language

What	does	the engine	do?	It	drive	-s	the fan.
	do	the lever		-s	They	control	the speed.

- 5 Make short dialogues about the parts of the airboard.

1 fan / cool the engine? no → push air downwards

2 engine / drive the wheels? no → drive the fan

3 levers / stop the airboard? no → increase the speed

4 handlebars / control the brakes? no → steer the airboard

A: Does the fan cool the engine?

B: No, it doesn't.

A: So, what does it do?

B: It pushes air downwards.

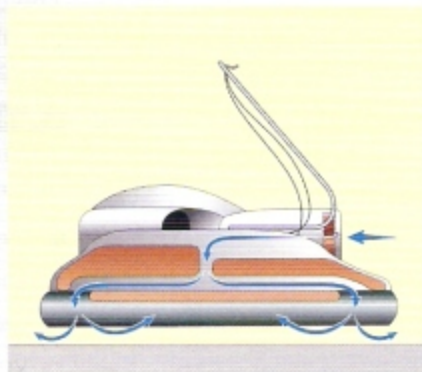
THE AIRBOARD how it works

You stand on the airboard and ride it like a skateboard. The board moves on a cushion of air, like a small hovercraft. It has a fibreglass body, an engine, a large fan, a flexible rubber skirt, a friction wheel, a handlebar and two levers.

The engine and the fan are mounted on the body. The skirt and the friction wheel are suspended from the body. The handlebar is mounted on the body, at the front. The levers are attached to the handlebar.

The engine drives the fan. The function of the fan is to suck air in and to force

it downwards. This pushes the vehicle upwards and propels it forwards. On the body there is a fibreglass platform. This supports the rider. The skirt contains the air and the cushion of air supports the airboard. The rider uses the handlebar to steer the board. One lever controls the speed of the engine and the fan. The other lever controls the friction wheel. The friction wheel touches the ground for one or two seconds and accelerates the airboard into the air. If you want to stop, simply release the levers.



press ≠ release

- 1 What is the friction wheel for?
- 2 Is the skirt above or below the body? What is it made of? Can you bend it?
- 3 Which part of the airboard does the rider stand on?
- 4 What happens if you take your hands off the levers?
- 5 Does *propel* (line 15) mean *pull*, *push*, *hold* or *control*?
- 6 Find words which mean the opposite of (1) *backwards* (2) *upwards*.

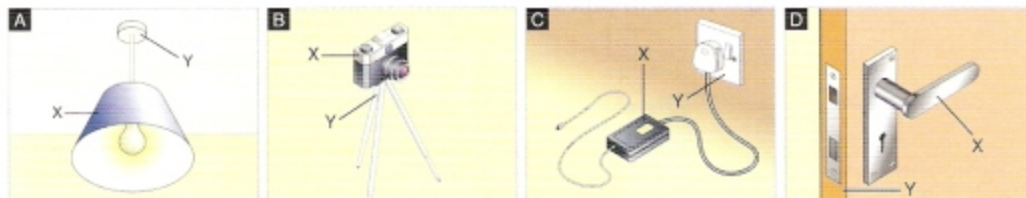
Language 7 Rewrite the sentences to give the same meaning.

- 1 The purpose of the handlebar is to steer the airboard.
- 2 The job of those levers is to control the speed of the airboard.
- 3 The function of the friction wheel is to accelerate the airboard.
- 4 The purpose of the fan and the engine is to propel the airboard forwards.
- 5 The function of the skirt is to hold the air and to support the airboard.
- 6 The job of the body and the platform is to support the rider.

Example: 1 The handlebar steers the airboard.

Vocabulary 8 Match the pictures with the sentences.

- | | |
|--------------------------|------------------------|
| 1 X is attached to Y. | 3 X is mounted on Y. |
| 2 X is suspended from Y. | 4 X is connected to Y. |




9 Complete these sentences. Use each phrase once only.

attached to connected to mounted on suspended from


- 1 The huge cables of the Millau Bridge are _____ steel pylons.
- 2 The pylons and the road deck are _____ concrete piers.
- 3 Close the circuit switch. Now the lamp is _____ the current.
- 4 The shelf is _____ the wall with screws.

2 Hotline

Listening


1  48 Listen to the automated message on the phone. The customer wants to talk to the service technician about a computer problem. Which three keys does the customer press?



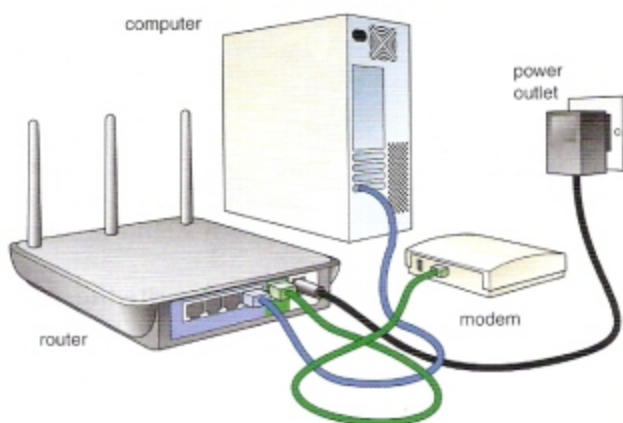
2  49 The customer gets through to the service technician. What does the technician say? Complete the text below.



● Hello, you've (1) _____ the computer service hotline. This is Jan (2) _____. I'm the technician. How (3) _____ I (4) _____ you?

3  50 Listen to this phone call to a service hotline. What mistakes did the customer make when he set up his wireless router? Delete the wrong words.

- 1 The router *is/isn't* connected to the *power outlet/computer/modem*.
- 2 The customer *has/hasn't* connected the computer to the *power outlet/router/modem*.



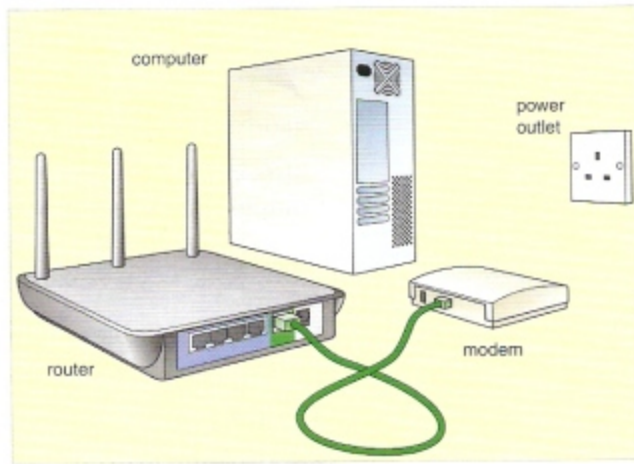
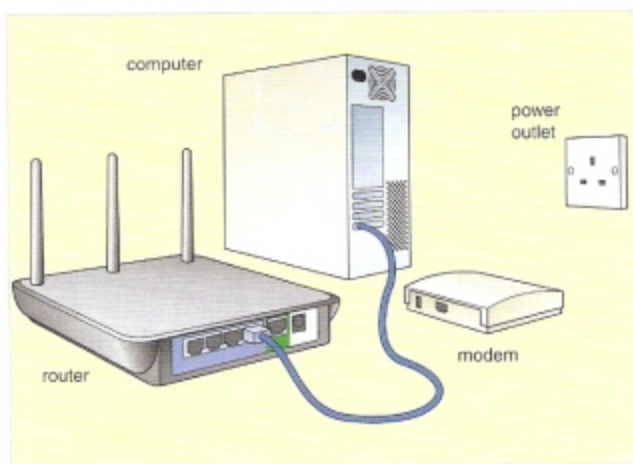
Speaking 4 Work in pairs. Practise similar conversations.

- *Hello, is that the IT hotline?*
- Yes, this is ... speaking. I'm the technician. How can I help you?
- *My router doesn't work.*
- OK. I'll talk you through it. Are you sitting at the computer now?
- *Yes, I am.*
- OK. Look at the back. Is the ... connected to the ...?

USEFUL LANGUAGE

Is the ... connected to the ...?
Have you connected your ... to the ...?


5 Work in pairs. Make more dialogues about the situations in these pictures.



Language

6 Write short form answers for these questions.

- 1 Are the lights on? ✓ *Yes, they are.* ✗ *No, they aren't.*
- 2 Is the computer connected to the adapter?
✓ _____ ✗ _____
- 3 Have you sent the email?
✓ _____ ✗ _____
- 4 Does your new radio work?
✓ _____ ✗ _____
- 5 Did you go to the cinema yesterday?
✓ _____ ✗ _____
- 6 Can I speak to your brother?
✓ _____ ✗ _____
- 7 Do you work in the city?
✓ _____ ✗ _____
- 8 Are you sitting at the computer now?
✓ _____ ✗ _____
- 9 Do those speakers cost a lot of money?
✓ _____ ✗ _____
- 10 Has your car broken down?
✓ _____ ✗ _____

7  51 Look at 6 again and listen to the questions and answers. You will hear only one answer to each question. Repeat each answer.

Task 8 Work in pairs. Find out all the differences between your wiring diagram and your partner's.

Hint: there are at least ten differences of (a) location of sockets and (b) wiring connection.

Instructions.

- Student A, turn to page 115.
- Student B, this is your wiring diagram.

USEFUL LANGUAGE

digital receiver, DVD, VCR, TV, antenna, SCART socket, RF socket, in, out, power, socket

Do you have a/an ... ?

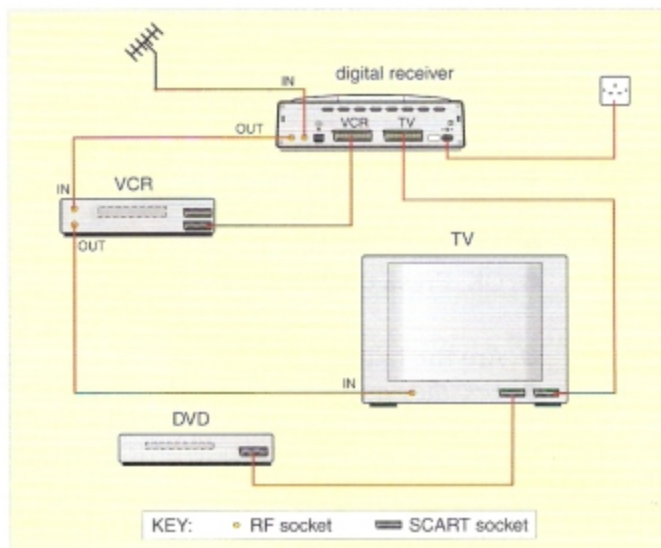
Look at the

Where is the ... ?

Does the ... connect to the ... ?

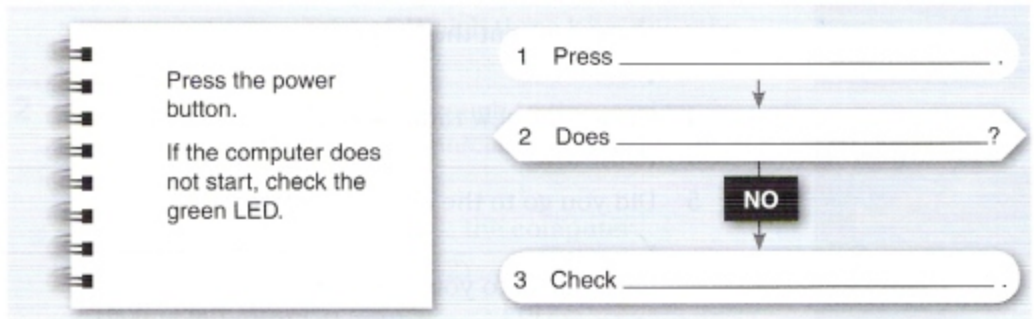
Have you connected the ... to the ... ?

Is the ... connected to the ... ?



3 User guide

Start here 1  52 Listen and complete the flow chart.



Reading 2 Draw a similar flow chart based on the solutions in this troubleshooting guide.

Notebook computer – troubleshooting FAQ

I pressed the power button and opened the display, but the computer does not start or boot-up.

Try these solutions:

- 1 Press the power button again.
- 2 If the computer does not start, check the green LED.
- 3 If the green LED is off, check the power source.
- 4 If the power source is off, switch on the power and press the power button again.
- 5 If the computer does not start, check the disk drive.
- 6 If there is a disk in the drive, take it out and press the power button again.

Language

	Condition	Instruction
If	the car starts,	drive away.
	the car doesn't start,	check the battery.
	the light is off,	press the power button.
	there is a disk in the drive,	take it out.

3 Make sentences with *if* from these short dialogues.


<p>1 ● Is the light on? ● <i>No, it isn't.</i> ● OK. Press the switch.</p>	<p>3 ● Are there any numbers on the screen? ● <i>No, there aren't.</i> ● OK. Press the keys.</p>	<p>5 ● Is the battery flat? ● <i>Yes, it is.</i> ● OK. Either replace it or recharge it.</p>
<p>2 ● Does the airboard start? ● <i>No, it doesn't.</i> ● OK. Turn the key.</p>	<p>4 ● Are the LEDs off? ● <i>Yes, they are.</i> ● OK. Push the power button.</p>	<p>6 ● Do the speakers work? ● <i>Yes, they do.</i> ● OK. Connect them to the computer.</p>

Example: 1 If the light isn't on, press the switch.

1 Rules and warnings

Start here



- 1 Work in pairs. What safety rules are in your workplace or college? Make a list.
- 2  Listen and complete the warnings with the words in the box.

don't might must mustn't

- 1 You _____ wear a hard hat on the building site.
- 2 _____ go through that door!
- 3 You _____ wear safety gloves everywhere in the factory.
- 4 _____ touch that machine! It's very hot.
- 5 Be careful! High-voltage electricity. You _____ get an electric shock.
- 6 You _____ use your mobile phone here.

Reading

- 3 Work in pairs. Why do the signs below have different colours and shapes?
- 4 Read the text. Match the examples to the signs.

The safety signs below follow the ISO international standard. This standard is used in the EU because it has many different languages. There are three types of safety sign:



- **WARNING SIGNS.** These signs warn you about a danger. They say things like this: *Warning. Danger. Be careful. Look out. There is a danger or hazard here. You might injure yourself.* The signs are yellow and black in colour and triangular in shape. Here are some examples:
 - 1 Warning. Poison: see (1) C
 - 2 Danger. Fire hazard here: see (2) _____



- **PROHIBITION SIGNS.** These signs prohibit an action. They say: *Do not do this. You must not do this. Never do this.* The signs are red, white and black in colour and round in shape. Here are some examples:
 - 3 You must not lift this with a hook: see (3) _____
 - 4 Never take the guard off this machine: see (4) _____



- **MANDATORY ACTION SIGNS.** These signs order you to do something. They say: *Do this. You must do this. Always do this.* These signs are blue and white in colour, and round in shape. Here are some examples:
 - 5 Always read the manual before you service this machine: see (5) _____
 - 6 You must use the guard on this circular saw: see (6) _____

Language

	Wear		Do not Don't	
Always		a hard hat here.	Never	touch the machine.
You must	wear		You must not You mustn't	

5 Complete the instructions with the words in the box.

always do do not must mustn't never



- _____ use a lighted match in this workshop.
- _____ wash your hands after using these chemicals.
- _____ enter this small space.
- You _____ wear safety boots when you lift this.
- _____ not smoke in this factory.
- You _____ touch this machine with bare hands. It's hot.

6 Write these signs in another way.

Example: I Do not smoke here.



No smoking



No mobile phones



No running



No entry



No exit



NO
PARKING

Use *might* or *could* to explain the possible result of the hazard.




You	might could	burn your arm. injure/hurt yourself. get an electric shock.
-----	----------------	---

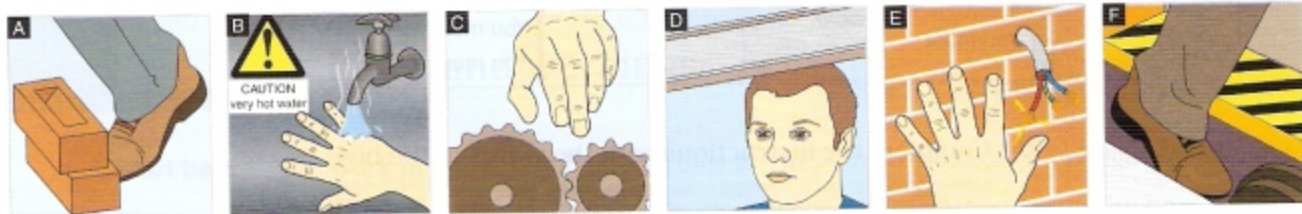
7 Complete these warnings with the words or phrases in the box. You can use the words or phrases more than once.

could might there are there's

- Take care. Heavy weight. You _____ injure your back.
- Warning. _____ a cold surface here. You _____ injure your hands or arms.
- Be careful. You _____ trap your hand in the gears.
- Danger. _____ lasers in this laboratory. You _____ injure your eyes.

2 Safety hazards

Start here **1**  54 Listen and match the warnings with the pictures.



2 Listen again and write the warning number in the table.

Warning	Possible result
	You might burn your hands.
	You could injure your head.
	You might fall into the gap.
	You could trip over the bricks.
	You might trap your hand in the gears.
	You could get an electric shock.

Speaking 3 Say the warnings and their possible results.

*Example: 1 Look out! There's a low beam in front of you.
You could injure your head.*

4 Work in pairs. How many safety hazards can you see?
Make a list.



- 5 You are a safety inspector, inspecting the workshop in 4. Describe what you see.



There is	a	liquid	in the workshop.	A cable	is	damaged.
There's	some	bricks	on the floor.	Two windows	are	locked.
There are	no	boxes	around the bricks.	The fire exit		broken.
		food	on the machines.	Some cables		coiled.
		drink	on the stairs.			
		tools	on the benches.			
		fire extinguishers				
		fire exit				
		cones				
		guards				

Language Past simple of *is* and *are*.

	There was	some liquid	on the floor.
	There were	some boxes	on the stairs.
The fire exit	was	locked.	
Some cables	were	coiled.	

- 6 Change more sentences from 5 into the past.

Writing 7 Complete the inspector's report. Describe all the hazards in the workshop.

Safety inspection report

Visit to: Kwik Automotive Workshop

Date of report: 25th October

I inspected the workshop on 22nd October. Here are my findings.

- 1 There were no fire extinguishers anywhere in the workshop.
- 2 There was a single fire exit, but the door was locked with a padlock.
- 3

- 8 Work in small groups. Write at least ten safety rules for the workshop in 4.

Put away all tools after work.

Do not bring food or drink into the workshop.

No eating or drinking in the workshop.

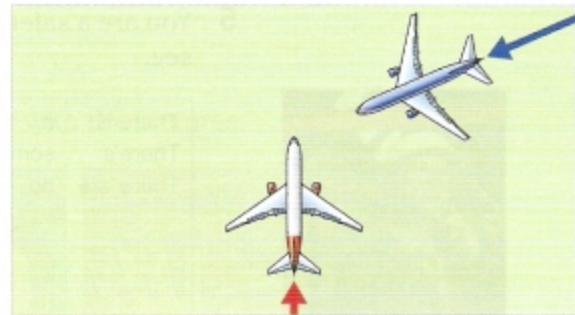
Always ...

Never ...

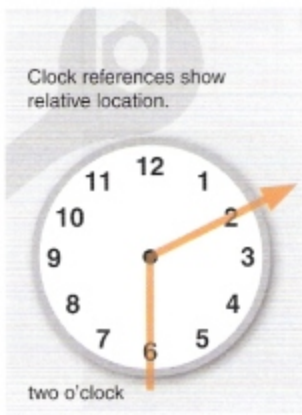
Staff must/must not ...

3 Investigations

- Start here**
- 1** Work in pairs. Discuss these questions.
- What's happening?
 - Which directions are the planes moving in?
 - Who will talk to the pilots?



- 2** **55** Listen and complete the warning to the pilot from air traffic control.
- *ConAir 286. Unknown traffic. (1) _____ o'clock. (2) _____ metres. Crossing right to left.*
 - *ConAir 286. Negative contact. Request vectors.*
 - *Turn (3) _____. Heading (4) _____. Descend. (5) _____ metres.*
 - *Right turn. Heading (6) _____. Descending. (7) _____ metres. ConAir 286. ...*
 - *Con Air 286. All clear. Resume own navigation.*
 - *Roger. ConAir 286.*



- Reading** **3** Read this newspaper article and complete the incident report.

Near Miss Over Manchester

25 November

Last night, a military jet plane almost crashed into a large passenger plane over northern England.

The incident happened in dense clouds 10 km west of Manchester. The Boeing 757 passenger plane was 3505 metres above sea level. At 22.17, the F16 military plane passed at an altitude of 3527 metres. At its closest point, the total distance between the two aircraft was only 36 metres.

The Boeing, flight number BA 4058, had 234 passengers,

and was on a flight path from Manchester to Greece. The military plane was on its way from Scotland to the south of England.

The pilot and passengers on the plane did not see the incident because of the clouds, but the emergency anti-collision system (TACS) in BA 4058 switched on automatically. The TACS system steered the passenger plane safely away from the military plane.

There were no injuries in the incident.



Aviation near-miss incident report

Date of incident:

Time:

Location:

Distance between two planes:

PLANE 1

Type: *Boeing 757 passenger plane*

Altitude:

Flight number:

Number of passengers:

Flying from:

Flying to:

PLANE 2

Type:

Altitude:

Flight number: -

Number of passengers: *none*

Flying from:

Flying to:

Speaking 4 Work in pairs: an investigator and a pilot. Ask and answer these questions.

- | | |
|---------------------------------|---|
| 1 Where / incident / happen | 5 What time / F16 / pass / Boeing |
| 2 When / it / take place | 6 How far / be / jet / from / passenger plane |
| 3 How high / be / Boeing | 7 What / be / flight number / passenger plane |
| 4 What / be / height / of / F16 | 8 How many passengers / be / in / Boeing |

take place = happen

Language

Where	were	the planes?		(They were) 3500 m above NW England.
When	did	the incident	happen?	(It happened) at 22.17.

Task 5 Work in pairs. Follow the instructions.

Student A. Turn to page 112.

Student B:

- Investigate Student A's incident. Ask questions and complete the report form.
- Change roles. Your incident is on page 113.

About the accident	About the injured person
Date: _____	Name: _____
Time: _____	Job title: _____
Location: _____	Injury: _____
Height above ground: _____	Description of accident
Type of accident (tick one box):	
• lifted something and injured self <input type="checkbox"/>	
• received an electric shock <input type="checkbox"/>	
• slipped, tripped or fell on the same level <input type="checkbox"/>	
• fell from a height <input type="checkbox"/>	
• other <input type="checkbox"/> _____	

Social English 6 Complete the dialogue with the words in the box.

are can't don't I'd I'll must

- We (1) _____ go out for a drink soon.
- Yes, (2) _____ like to do that. How about tomorrow? (3) _____ you free tomorrow?
- I'm sorry, I (4) _____ do it tomorrow. What about Saturday?
- Yes, Saturday's fine. What time?
- I (5) _____ know yet. (6) _____ phone you tomorrow morning.
- OK, good. Talk to you then.

7 Work in pairs. Practise the dialogue in 6 with your partner.

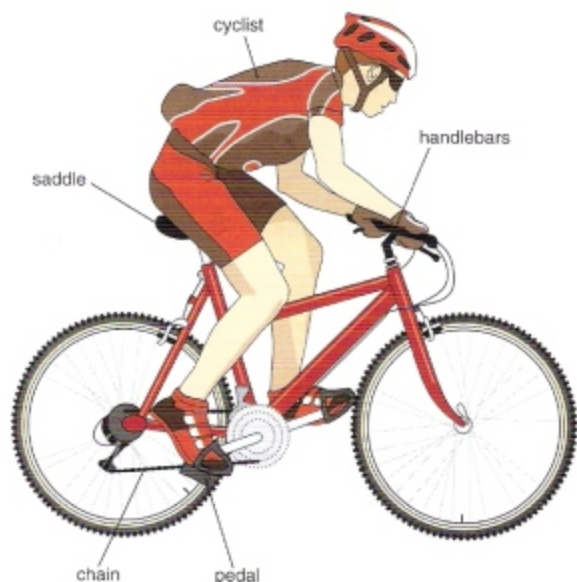
8 Work in pairs. Make similar dialogues. Use different times and days.
go and see a film / have a meal together / go bowling / have a party

Review Unit E

- 1 Complete the sentences with the correct forms of verbs in the box.

control increase move
propel push rotate steer
support turn

- The saddle _____ the cyclist. The cyclist _____ the pedals downwards.
- The pedals _____ the chain and the wheels _____. This _____ the bike forwards.
- The cyclist uses the pedals to _____ the speed. If the cyclist pedals quickly, this _____ the speed of the bike.
- The cyclist _____ the bike with the handlebars.
- If the cyclist _____ the handlebars to the left, the bike goes left.



- 2 Complete the description with the correct form of the verbs in the box.

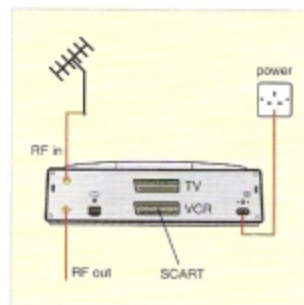
contain drive move suck work

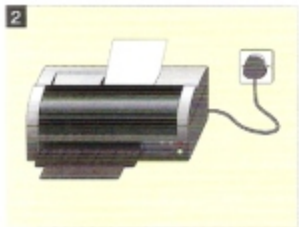
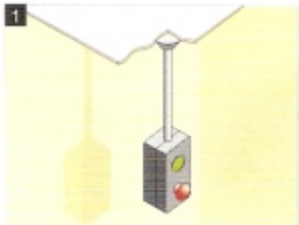
This hovercraft moves over land and water. How does it (1) _____? A powerful engine (2) _____ two large fans. The fans (3) _____ the air in. They force some of the air backwards and push some of the air downwards. A rubber skirt (4) _____ the air and the hovercraft (5) _____ on the cushion of air.

- 3 Complete the sentences with the words and phrases in the box.

above below between in the centre on the left/right to the left/right

- The RF sockets are _____.
- The SCART sockets are _____.
- The SCART sockets are _____ the RF sockets and the power socket.
- The power socket is _____ of the SCART sockets.
- The RF OUT socket is _____ the RF IN socket.
- The TV SCART socket is _____ the VCR SCART socket.





4 Identify the equipment from the description. Use the words in the box.

battery digital receiver disk drive modem router starter motor

- 1 This device can change digital signals into analogue signals for a TV.
- 2 This device stores electricity. When it is flat, you recharge it.
- 3 This equipment can connect two or more computers to one modem.
- 4 This device connects a computer to the Internet through a phone line.
- 5 This machine uses electricity from a battery. It starts the engine of a car.
- 6 This hardware can copy data from a computer to a CD-ROM.

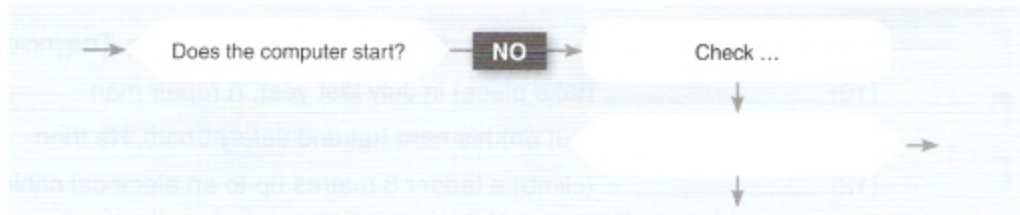
5 Look at the pictures and complete the sentences with the phrases in the box. You can use the words more than once.

attached to connected to disconnected from mounted on suspended from

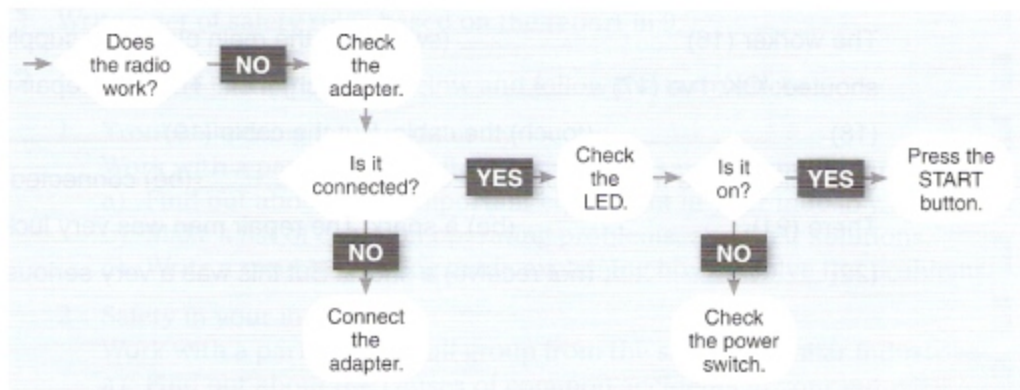
- 1 The switch is _____ the ceiling.
- 2 The printer is _____ the power socket.
- 3 The vice is _____ the workbench.
- 4 The mouse is _____ the computer.
- 5 The hook is _____ the rope. The rope is _____ a bar.
- 6 The speaker is _____ a base. It is _____ the computer.

6 Draw and complete the flowchart.

If your computer does not start, check the adapter. If the adapter is not connected, connect it to the computer. If the adapter is connected, check the disk drive. If there isn't a disk in the the drive, press the power button. If there is a disk in the drive, take it out.



7 Write a troubleshooting guide from this flowchart.



Begin:

If the radio doesn't work, check the adapter

8 Complete the warnings. Use each word once only.

always could don't might must mustn't never

- 1 Staff _____ wear hard hats at all times on this site.
- 2 You must _____ use a lighted match near petrol or gas.
- 3 You _____ smoke in the workshop or on the building site.
- 4 This low beam is very dangerous. You _____ injure your head on it.
- 5 _____ wear gloves if you lift these boxes. They have sharp edges.
- 6 The oven is very hot. You _____ burn yourself. Please _____ touch it.

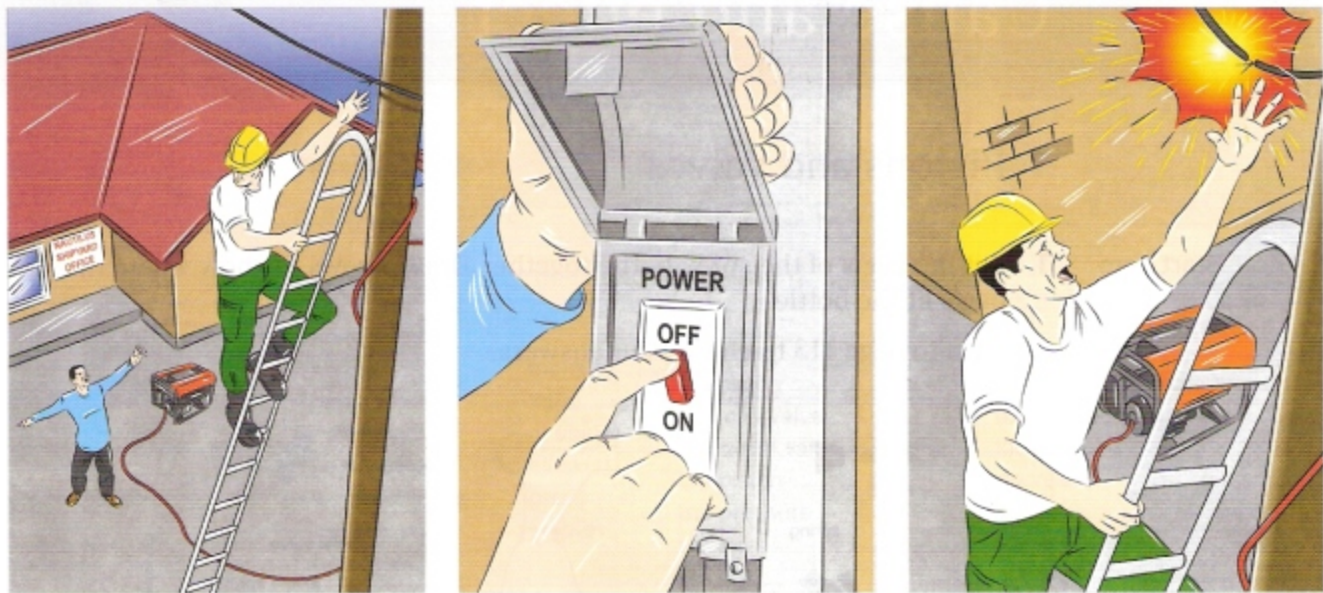
9 Complete the safety report with the correct form of the verbs in brackets.

On 24th August last year, I inspected the Nautilus shipyard. I (1) _____ (find) many safety hazards. Here are the main points of my safety report.

The emergency exit (2) _____ (be) locked. There (3) _____ (be) some ropes on the ground, between two boats. Two fire extinguishers (4) _____ (be) damaged. Five workers (5) _____ (have) no hard hats or safety gloves. One welder (6) _____ (not wear) his safety boots. A high-voltage cable (7) _____ (be) coiled. There (8) _____ (be) many tools on the ground.

A supervisor (9) _____ (tell) me about a near miss. The incident (10) _____ (take place) in July last year. A repair man (11) _____ (put on) his hard hat and safety boots. He then (12) _____ (climb) a ladder 8 metres up to an electrical cable. The cable (13) _____ (be) damaged. It (14) _____ (have) some bare wires. The repair man (15) _____ (shout) to a worker: 'Switch off the power!' The worker (16) _____ (switch off) the main electricity supply and shouted: 'OK, I've (17) _____ (switch) it off!' Then the repair man (18) _____ (touch) the cable. But the cable (19) _____ (not be) connected to the mains supply. It (20) _____ (be) connected to a generator. There (21) _____ (be) a spark. The repair man was very lucky. He (22) _____ (not receive) a shock. But this was a very serious incident.

10 Ask the questions for these answers about the near miss incident in 9.



- 1 It took place in the Nautilus shipyard. (Where / incident)
Where did the incident take place?
- 2 It happened in July last year. (When / happen)

- 3 Yes, he wore his hard hat and his safety boots. (repair man / hard hat)

- 4 He used a ladder. (How / climb / to the cable)

- 5 It was about 8 metres high. (How / cable)

- 6 It had some bare wires. (problem)

- 7 No, he didn't, but there was a spark. (get / electric shock)

- 8 No, it wasn't. It was connected to a generator. (cable / mains supply)

11 Write a set of safety rules based on the report in 9.

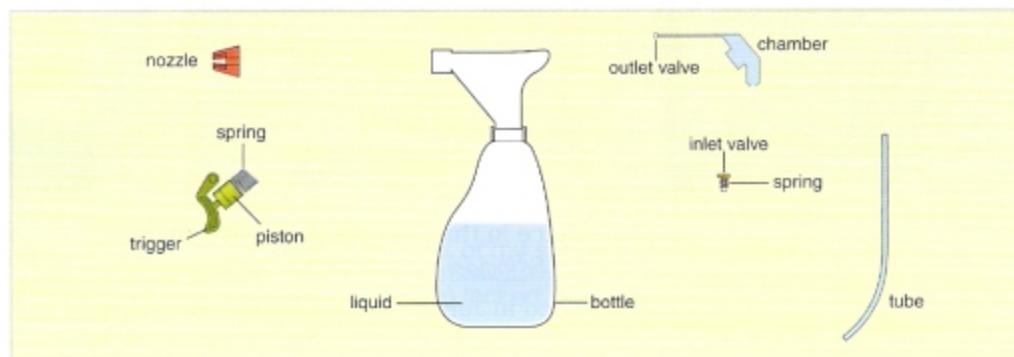
Project 12 Choose one of the projects below and follow the instructions.

- 1 Troubleshooting in your industry
Work with a partner or small group from the same or similar industries.
 - a) Find out about some important equipment in your industry.
 - b) Make a list of common operating problems, and their solutions.
 - c) Write a troubleshooting guide explaining how to solve the problems.
- 2 Safety in your industry
Work with a partner or small group from the same or similar industries.
 - a) Find out about the causes of common accidents in your industry.
 - b) Design a safety poster to avoid one of these accidents.
 - c) Write a set of safety rules for your poster.

1 Pistons and valves

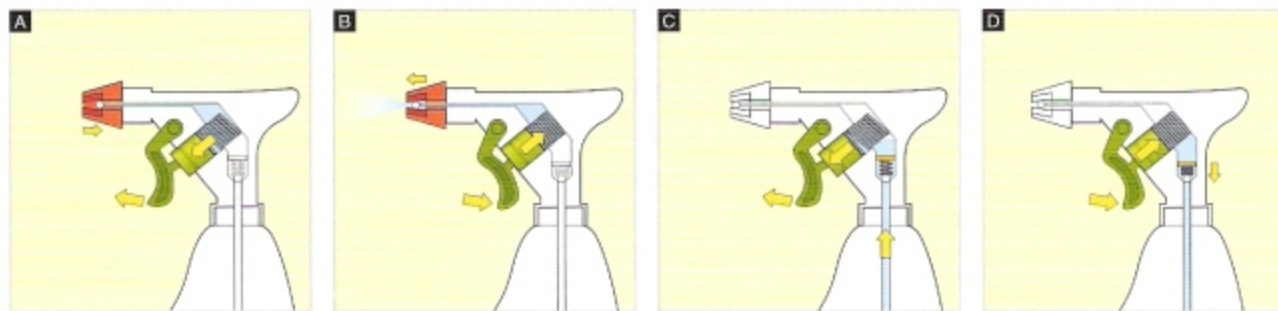
Start here 1 Put the parts of the spray bottle together. Draw arrows to show where the parts fit the bottle.

Turn to page 113 to check your answers.



2 Work in pairs. How does the pump in the spray bottle work? Discuss with your partner.

Reading 3 Match each diagram with a caption below.



increase the temperature/
pressure/speed/volume



decrease the temperature/
pressure/speed/volume



Caption 1: The trigger makes the piston move in. This makes the water pressure increase. The high pressure causes the outlet valve to open. The open outlet valve allows the water to flow out of the chamber.

Caption 2: The piston moves in. This causes the water pressure to increase. The high pressure makes the inlet valve close. The closed inlet valve prevents the water from flowing back into the bottle.

Caption 3: The piston moves out. This makes the water pressure decrease. The low pressure causes the inlet valve to open. The open inlet valve lets water flow from the bottle into the chamber.

Caption 4: The piston moves out. This makes the water pressure decrease. The low pressure causes the outlet valve to close. The closed outlet valve stops air from flowing into the chamber.

Language

The motor	causes	the shaft	to	move.
	makes	the shaft		move.
The open valve	lets	the water		flow out.
	allows	the water	to	flow out.
The closed valve	prevents stops	the water	from	flowing out.

4 Make true sentences about the pump.

The trigger				
The piston	make(s)	the water		flow in/out/back.
The spring	let(s)	the piston		flowing in/out/back.
The two valves	cause(s)	the inlet valve	(to)	move in/out/in and out.
The inlet valve	allow(s)	the outlet valve	(from)	increase.
The outlet valve	prevent(s)	the piston	(-)	decrease.
High pressure		the pressure		open.
Low pressure		the air		close.

5 Rewrite these sentences to give similar meanings. Replace the verb(s) in *italics* with the correct form of the verb(s) in brackets.

- Heat *makes* a metal expand and cold *makes* it contract. (cause)
- Overflow pipes *let* extra water flow out of the tanks. (allow)
- The valve on the oil well *does not allow* the oil to explode. (prevent)
- These powerful pumps *force* the water to rise 30 m up the hill. (make)
- These fire extinguishers *do not allow* electrical fires to spread. (stop)
- Show your ID card and the guard will *allow* you to enter the factory. (let)

6 Delete the wrong words.

expand ≠ contract

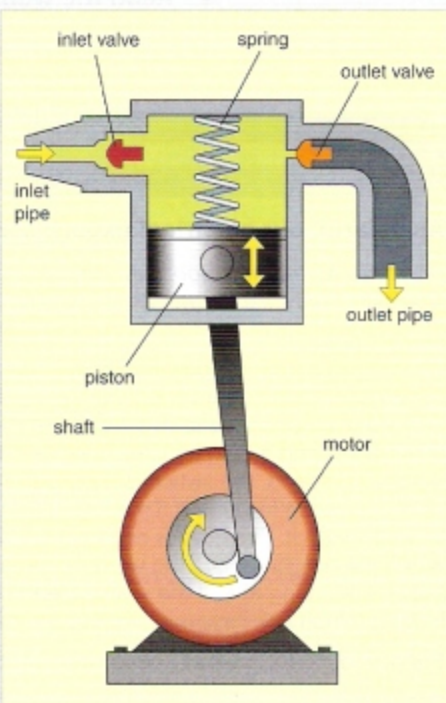
PISTON PUMPS

Piston pumps can pump any fluid. This one pumps water. The pump has a motor, a shaft, a piston, a spring and two valves. The valve on the right is the outlet valve. The valve on the left is the inlet valve.

This is how it works. The motor makes the shaft (1 move/to move) in and out. The shaft makes the piston (2 move/to move) in and out. Let us look at the two movements of the piston.

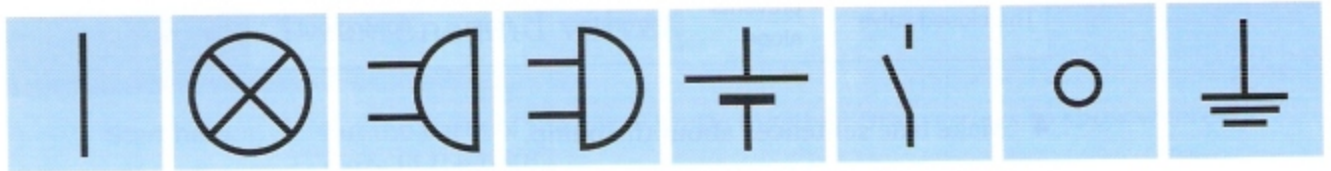
1 The piston moves in. This causes the water pressure (3 increase/to increase). The high pressure forces the outlet valve (4 open/to open). The open valve allows the fluid (5 flow/to flow) out of the pump through the outlet pipe. At the same time, the high pressure makes the inlet valve (6 close/to close). This closed valve prevents the fluid (7 to flow/from flowing) back through the inlet pipe.

2 The piston moves out. This makes the water pressure (8 decrease/to decrease). The low pressure forces the inlet valve (9 open/to open). The open inlet valve lets fluid (10 flow/to flow) into the pump through the inlet valve. At the same time, the low pressure makes the outlet valve (11 close/to close). This closed valve stops the fluid (12 to flow/from flowing) back into the pump through the outlet pipe.




2 Switches and relays

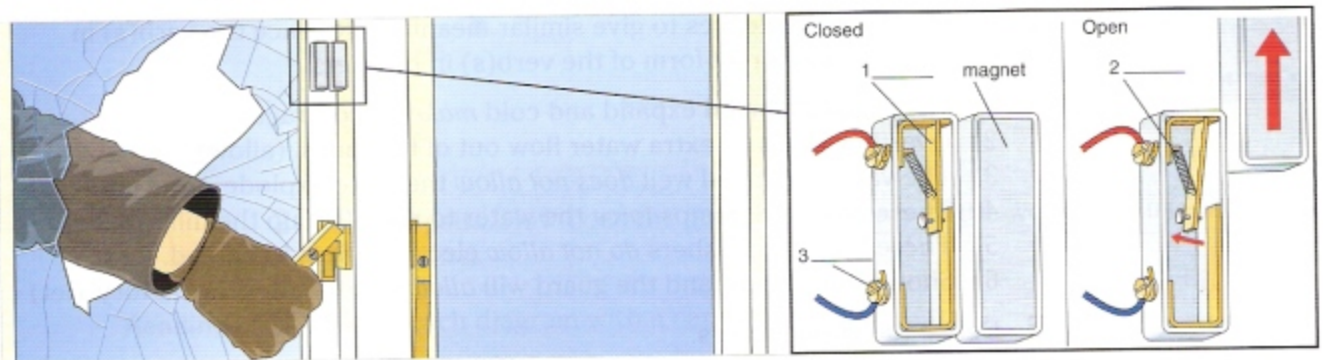
- Start here** 1 Work in pairs. Try this quiz. How many electrical symbols do you know?
battery, bell, buzzer, conductor, earth, lamp, switch, terminal



Answers: see the glossary of electrical symbols on page 109.

- 2  56 Listen and name the sounds. Choose from the list below.
buzzer, door bell, click, siren, horn, beep, alarm bell, dial tone

- Reading** 3 Work in pairs. How does this window burglar alarm work?



- 4 Read the web page. Label the circuit diagram and the diagram in 3.

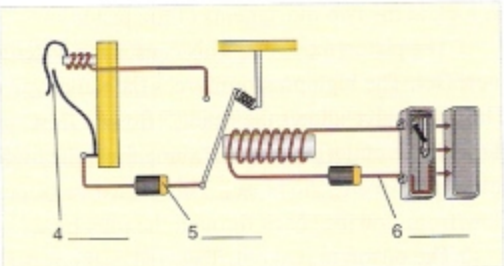
battery buzzer spring switch terminal wire

Ask Mario, our electrical expert. Mario answers all your questions

Hi, Mario. My name's Bob. How does the burglar alarm on my window work?

Mario's answer:
Well, Bob, on your window there's a small magnet. Next to it, on the window frame, there's a metal switch and two terminals. The terminals are attached to two wires and the wires are connected to a battery and a buzzer. They make a simple circuit. When the window is closed, the switch is next to the magnet. The magnet pulls the switch towards it. This closes the circuit and electricity flows through it. The buzzer does not sound.
When the burglar opens the window, he breaks the circuit. The magnet moves away from the switch and this allows the spring to pull the switch back. This opens the circuit. The open circuit prevents the current from flowing. When this happens, the buzzer makes a sound.

But how does the buzzer sound when there is no circuit?



- 5 Work in pairs. What is the answer to Bob's second question?

6 Read the next part of the web page. Check your answer to 5.

Because there is another circuit. The buzzer has its own circuit. When the window circuit opens, this makes the buzzer circuit close.

How does this happen?

The buzzer circuit has its own battery, an electro-magnet and a relay switch. This is how it works:

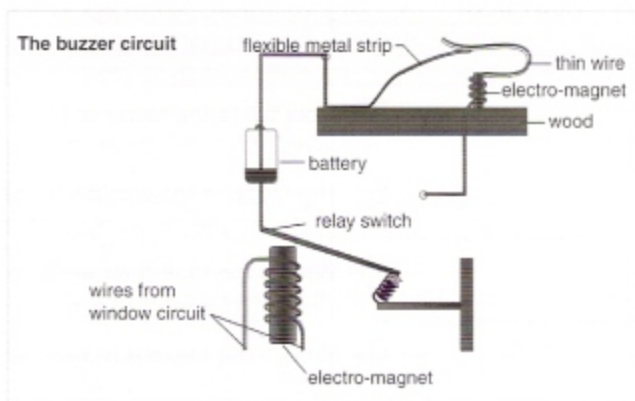
- 1 The window circuit opens.
- 2 This causes the electro-magnet in the window circuit to switch off.
- 3 The electro-magnet releases the relay switch on the buzzer circuit. This allows the spring to push the switch. The buzzer circuit closes.
- 4 The current flows from the battery around the buzzer circuit. This makes the buzzer produce a loud noise.

OK, I understand the circuit. But how does the buzzer make a sound?

That's easy. Here's what happens:

- 1 The current flows through the buzzer circuit.
- 2 The current makes the electro-magnet switch on.
- 3 The electro-magnet pulls the metal strip away from the thin wire.
- 4 This causes the current to switch off again.
- 5 When the current switches off, the electro-magnet switches off.
- 6 This allows the metal strip to spring back towards the thin wire.
- 7 The metal strip moves quickly up and down. This makes the loud buzzing noise.

Thanks, Mario. I get it now.



7 Answer these questions about the complete burglar alarm.

- 1 How many circuits are there?
- 2 How many electro-magnets are there? What is an electro-magnet?
- 3 How many switches are there?
- 4 What makes each switch open and close?

Language **8** Complete the sentences with the correct form of the verbs in the box.

allow cause let make prevent stop

- 1 The electro-magnet _____ the relay switch move away from the contact.
- 2 The magnet _____ the window switch from opening.
- 3 The wires _____ the electric current to flow from the battery to the electro-magnet.
- 4 The open switch _____ the current from flowing around the window circuit.
- 5 The spring _____ the window switch to break the window circuit.
- 6 The closed switch _____ the current flow around the buzzer circuit.

Speaking **9** Work in pairs. Explain how the burglar alarm works. Look at the circuit diagram, but don't look again at the reading text.

3 Rotors and turbines

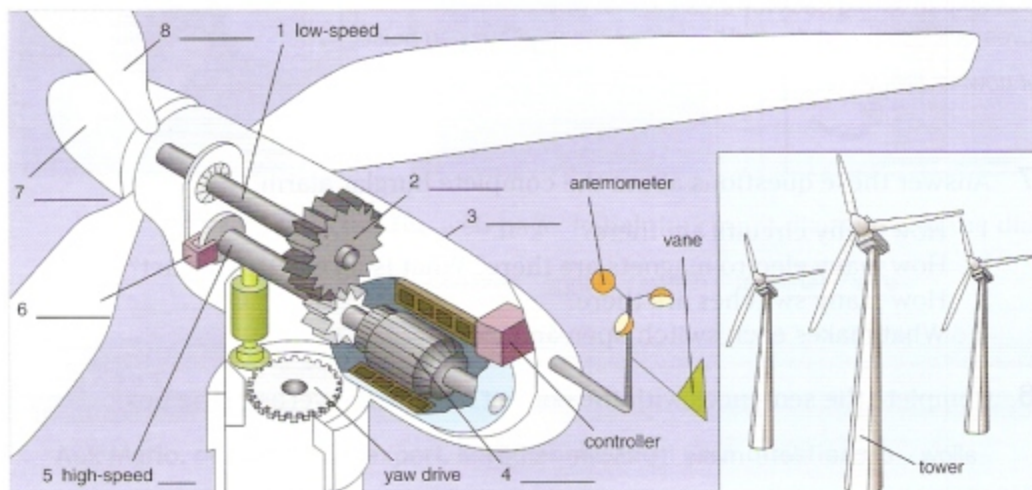
Start here 1 Try this quiz. What do you know about wind turbines?

- 1 **How tall is the tower of the world's tallest wind turbine?**
a) about 100 m b) about 180 m c) about 200 m
- 2 **How high is the world's highest turbine?**
a) about 1800 m b) about 2300 m c) about 2600 m
- 3 **What's the minimum wind speed for a large wind turbine?**
a) about 15 km/h b) about 20 km/h c) about 25 km/h
- 4 **What's the maximum wind speed for a large wind turbine?**
a) about 45 km/h b) about 70 km/h c) about 90 km/h

2  57 Listen to this radio programme and check your answers to the quiz.

Vocabulary 3 Label this diagram with the parts of a wind turbine in the box.

blade brake gear generator housing hub shaft



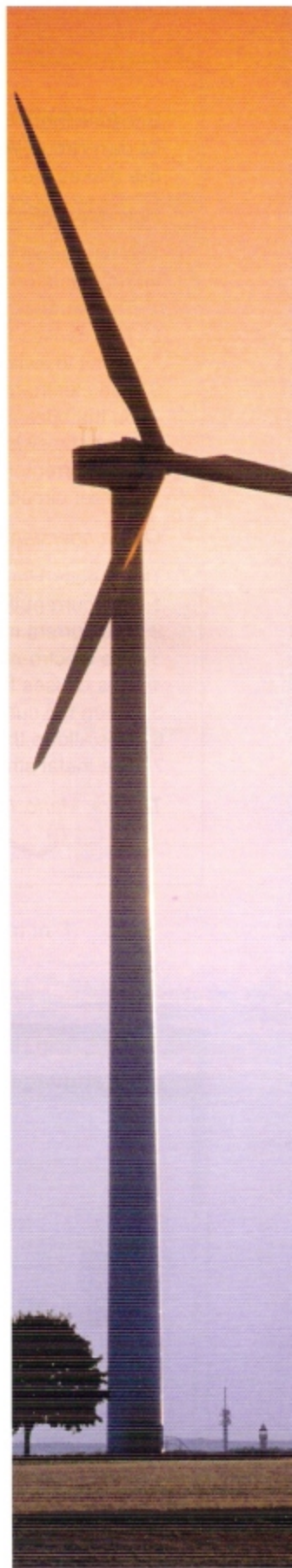
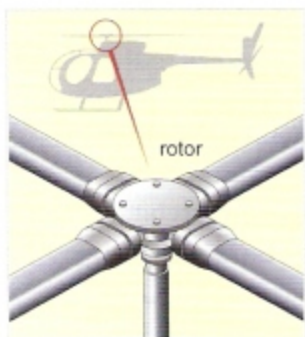
4 Read the text. Check your answers to 3.

The wind turbine consists of a tower, a rotor and a housing. The rotor consists of three blades, and a hub.

The housing is a strong rigid container. It contains a low-speed shaft, a high-speed shaft, two gears, a generator, a controller, and a brake.

The low-speed shaft connects the rotor to the gears. The high-speed shaft connects the gears to the generator.

Inside the housing, at the back, behind the generator, is the controller.



Reading 5 Read the web page and answer the questions below.

TECHNO CHANNEL: the TV channel for people who love technology

Yesterday, Techno Channel interviewed the wind turbine expert, Dr Roger Jones. Here is part of the script. To download the whole script, [click here](#).

How does the wind turbine work?

5 The wind blows on the blades and makes them rotate. This causes the shaft to rotate at a speed of about 30–60 rpm.

But isn't that too slow? The shaft in a generator must rotate at about 1200–1400 rpm.

10 That's right. There are two shafts. There's a low-speed shaft and a high-speed shaft. The low-speed one is attached to a large gear. The high-speed one is attached to a small gear. The large gear makes the small gear turn and the small gear makes the high-speed shaft rotate. This shaft rotates at 1200–1400 rpm.

Ah, I see. And it drives the generator at this speed?

15 That's right. And then the generator produces AC electricity.

What happens if the wind is too strong?

The anemometer measures the speed of the wind. It sends this data to the controller. (The controller is a small computer.) If the speed of the wind is more than about 90 km/h, the controller automatically switches off 20 the wind turbine. This prevents the wind from damaging the turbine.

- 1 Which part makes the low-speed shaft turn?
- 2 What are the two main functions of the controller?
- 3 Which part transmits rotation to the generator?

6 What do these words refer to? Choose the correct answer.

- | | | | |
|------------------------|--------------------|---------------------|---------------|
| 1 <i>one</i> (line 10) | a) generator | b) shaft | c) gear |
| 2 <i>it</i> (line 14) | a) low-speed shaft | b) high-speed shaft | c) small gear |
| 3 <i>It</i> (line 17) | a) anemometer | b) speed | c) wind |

Language 7 Complete the sentences with the correct form of the verbs in the box.

cause make prevent

- 1 The wind _____ the blades rotate.
- 2 The controller _____ the wind turbine from operating in a strong wind.
- 3 The blades _____ the low-speed shaft to rotate.

Speaking 8 Work in pairs. Explain how the wind turbine works. Look at the diagram, but don't look again at the reading text.

Social English You can use *let's* (= *let us*) to suggest something for you and others to do together.

Let's go to the café after work. Let's have a party for our class next week.

You can also say: *Why don't we go to the café after work? Why don't we have a party next week?*

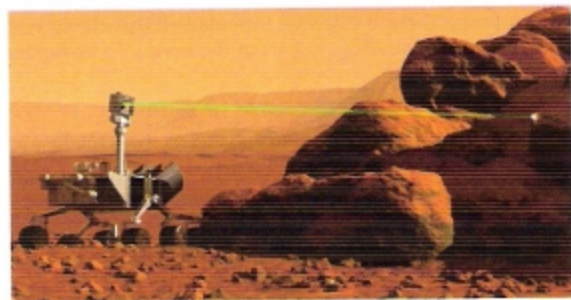
9 Make your own suggestions.

- 1 A: *We have a free period after this class.*
B: Let's _____.
- 2 A: *Work finishes early today.*
B: Why don't we _____?
- 3 A: *Next week is the half-term holiday.*
B: _____.
- 4 A: *The cinema is closed, so we can't see the film.*
B: _____?

1 Data

Start here 1 Work in pairs. You are a TV reporter. Prepare questions about the Mars rover.

Reading 2 Read the text quickly. Does the text answer any of your questions?



include ≠ *exclude*
 Weight of boat = 1000 kg.
 This *excludes* crew, passengers and fuel.
 Weight of crew, passengers and fuel = 200 kg.
 Total weight of boat = 1200 kg.
 This *includes* crew, passengers and fuel.

range = from *minimum* to *maximum*

Use *mass* on Mars, not *weight*.
 If you travel to Mars, your weight changes, but your mass stays the same.

The Mars Science Laboratory, or MSL, is a rover, or mobile robot. It can move around on the surface of Mars.

Look at the diagram of the rover. It has a body, six wheels, two robot arms, two antennas and a mast. The antennas and the mast are mounted on the body, and the robot arms are attached to the front of the body.

There are special tools at the end of each robot arm. Some tools break pieces of rock. Other tools dig and collect samples of soil. Scientific instruments in the rover then analyse the soil and rock powder.

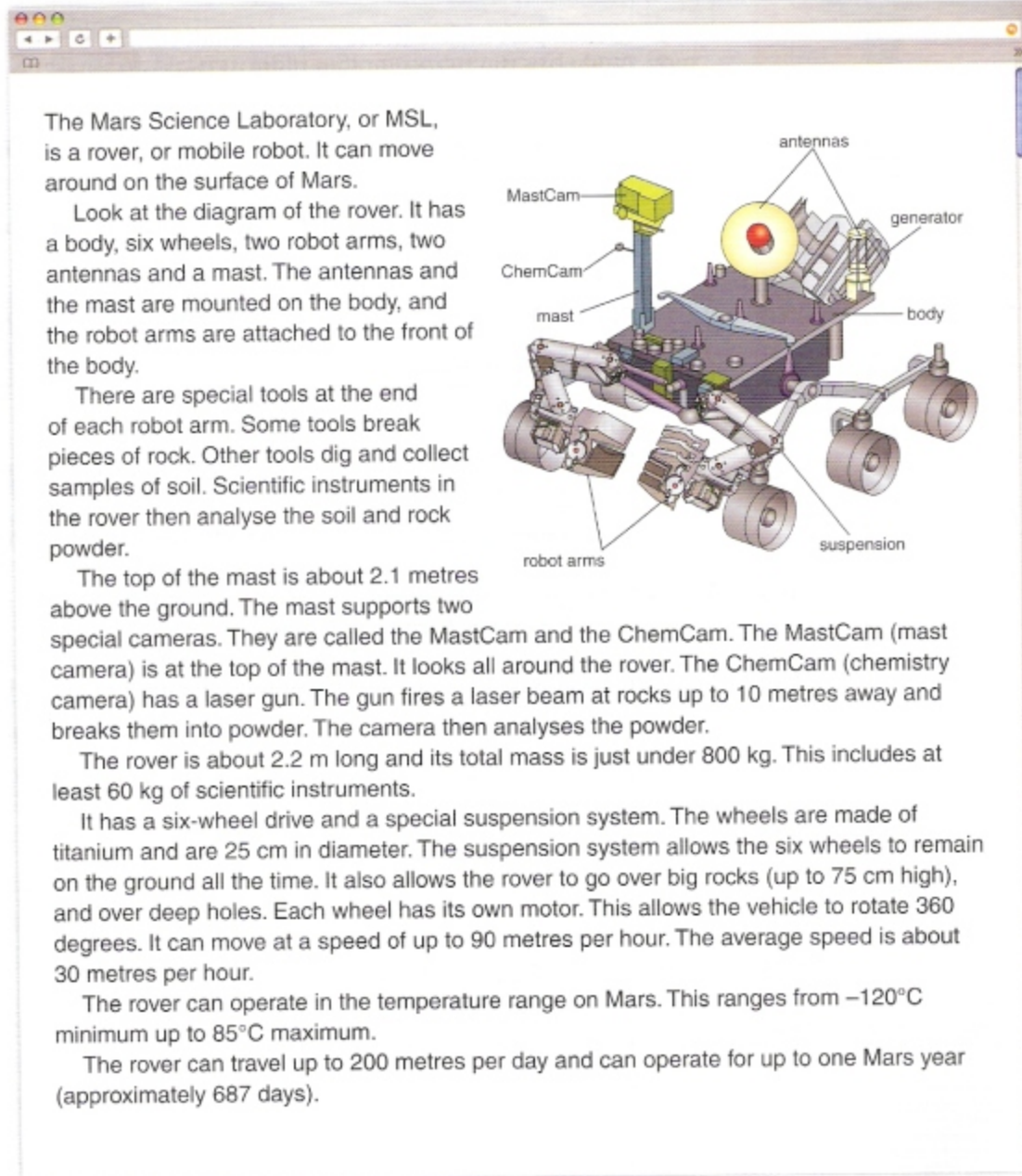
The top of the mast is about 2.1 metres above the ground. The mast supports two special cameras. They are called the MastCam and the ChemCam. The MastCam (mast camera) is at the top of the mast. It looks all around the rover. The ChemCam (chemistry camera) has a laser gun. The gun fires a laser beam at rocks up to 10 metres away and breaks them into powder. The camera then analyses the powder.

The rover is about 2.2 m long and its total mass is just under 800 kg. This includes at least 60 kg of scientific instruments.

It has a six-wheel drive and a special suspension system. The wheels are made of titanium and are 25 cm in diameter. The suspension system allows the six wheels to remain on the ground all the time. It also allows the rover to go over big rocks (up to 75 cm high), and over deep holes. Each wheel has its own motor. This allows the vehicle to rotate 360 degrees. It can move at a speed of up to 90 metres per hour. The average speed is about 30 metres per hour.

The rover can operate in the temperature range on Mars. This ranges from -120°C minimum up to 85°C maximum.

The rover can travel up to 200 metres per day and can operate for up to one Mars year (approximately 687 days).



3 Read the text again and complete this specification chart.

Mars Science Laboratory (Mars rover): specifications			
1	Total height	7	Maximum rotation of rover
2	Total length	8	Maximum obstacle height
3	Total mass	9	Maximum speed
4	Mass of instruments	10	Average speed
5	Number of wheels	11	Max./Min. temperature range
6	Wheel size	12	Maximum daily distance

Vocabulary Ways to express approximation:

- about, approximately	> more than, over	≤ up to
	< less than, under	≥ at least

4 Complete the sentences. Use the information in brackets.

- The Mars rover _____
(height - 2.1 m; length - 2.2 m)
- The rover _____
(mass > 750 kg)
- The scientific instruments _____
(mass ≥ 60 kg)
- The wheels _____
(rotation ≤ 360°)
- The rover _____
(distance > 100 metres per day; operation ≤ - 687 days)

Speaking **5** Write questions for these answers about the rover.

- It's called the Mars Science Laboratory.
- It has six wheels.
- Titanium.
- They're attached to the front of the body.
- It's mounted on the top of the body.
- About 2.1 metres.
- It looks at the whole area around the rover.
- It fires a laser beam at rocks and analyses them.
- Around 60 kilograms.
- Up to 90 metres per hour.

6 Work in pairs. Practise asking and answering the questions in 5.

7 Work in pairs. Student A guess the answers. Then check them with Student B.

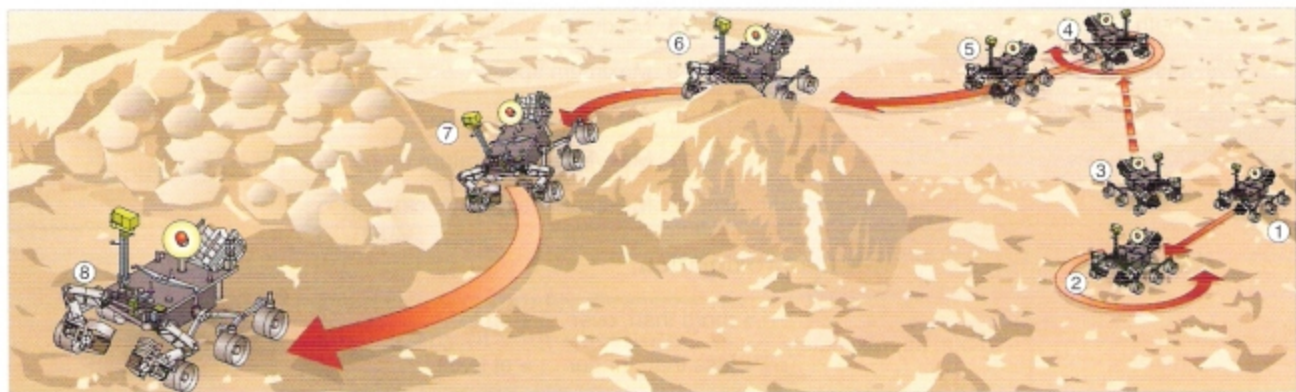
- The diameter of Mars is ... a) - 4280 km. b) - 6740 km. c) - 11,290 km.
- Mars rotates 360° in ... a) - 24 hours. b) - 36 hours. c) - 48 hours.
- Mars is ... kilometres from the Sun. a) - 220 million. b) - 150 million. c) - 300 million.
- Mars orbits the Sun in ... a) - 365 Earth days. b) - 685 Earth days. c) - 905 Earth days.


Example: 1 The diameter of Mars is about 4280 km. Is that right?

Student B: Turn to page 113.

2 Instructions

Start here 1 Make a list of the instructions to give the Mars rover.



2  58 Listen and complete the dialogue between the controller and the rover.

- Move forwards 200 cm.
- *Confirmed. I'm (1) _____ forwards 200 cm.*
- Now rotate 15 degrees to the left.
- *Confirmed. I'm (2) _____ 15 degrees to the left.*

3 You are the rover. Confirm your actions.

Instruction	Confirmation
1 Move forwards 200 cm.	<i>I'm moving forwards 200 cm.</i>
2 Rotate 15 degrees to the left.	
3 Reverse for 300 cm.	
4 Rotate 80 degrees to the right.	
5 Go up the hill.	
6 Roll down the hill.	
7 Go round to the left of the rocks.	
8 Stop.	

Listening 4  59 Listen and complete the dialogue.

A is training B how to control the Mars rover.

A: *Right. I'll give you an instruction. First, do it. Then confirm what you're doing, OK?*

B: OK.

A: *Then confirm what the rover's doing. Is that clear?*

B: Yes.

A: *Right. Let's go. First, (1) _____ the rover (2) _____ 200 cm.*

B: OK. I'm (3) _____ the joystick forwards.

A: *Good. Now what's (4) _____?*

B: The rover (5) _____ moving.

A: *Right. Wait five seconds. Now what's happening?*

B: OK. It's (6) _____ forwards now.

Task 5 Work in pairs. Discuss the question below.

In this simulation on Earth, the Mars rover responds after five seconds. If the rover is on Mars, it responds after about ten minutes. Why?

Speaking 6 Complete the table. Use information from the table in 3 and the notes below.

Instruction	Confirmation	After 1 second	After 5 seconds
1 Make the rover move forwards 200 cm.	OK. I'm pushing the joystick forwards.	The rover isn't moving.	Now it's moving forwards.
2			
3			
4			

- 1 push joystick forwards
- 2 turn wheel left
- 3 pull joystick backwards
- 4 press 'rotate' button

7 Work in pairs. Practise the dialogues, using the notes in 3. Try not to look at the table.

Begin:

A: Make the rover move forwards 200 cm.

B: OK. I'm pushing the joystick forwards.

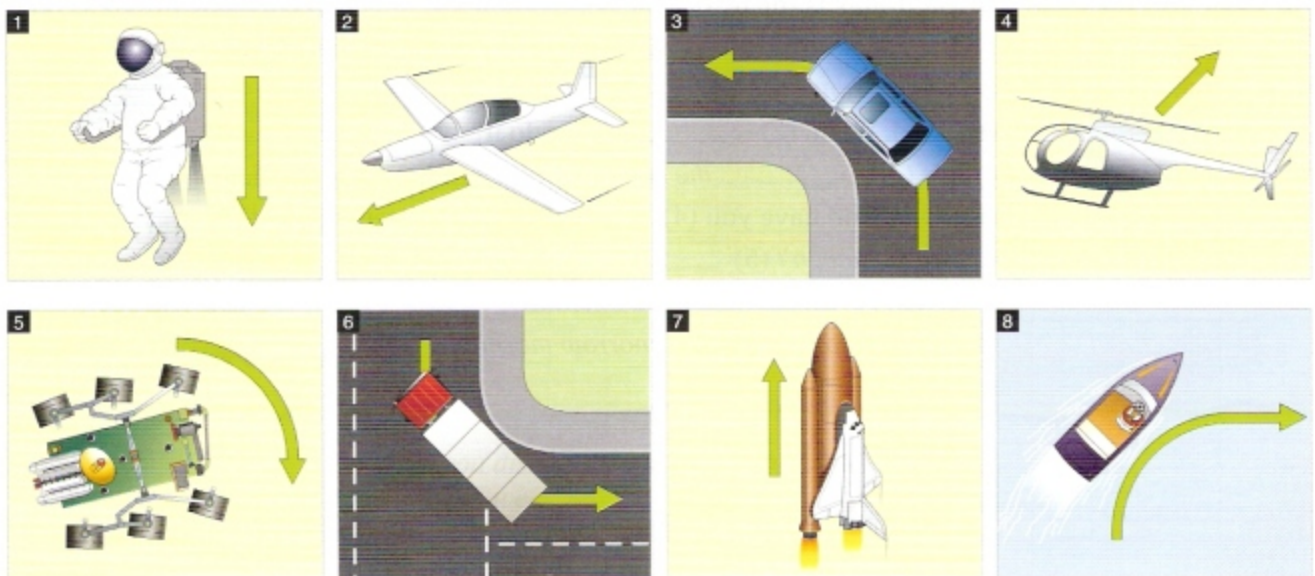
A: Good. What's happening now?

B: The rover isn't moving.


A: That's OK. Wait for five seconds. Is it moving forwards now?

B: Yes, it is.

8 Test your memory. Look at the pictures for 10 seconds. Then turn to page 113.



3 Progress

- Start here** 1  Listen to the astronaut talking about his work. Complete the list of tasks with the verbs in the box.

assemble attach bring connect
disconnect dismantle inspect
remove repair replace take test

(1) Test the equipment for the spacewalks.

On spacewalk 1: (2) _____ the damage.

(3) _____ photographs of the tank. Plan the repair and prepare for the next spacewalk.

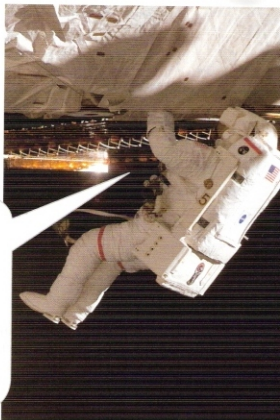
On spacewalk 2: (4) _____ the pipes. (5) _____ the tank. (6) _____ the tank into the station.

(7) _____ the tank. (8) _____ the damage or

(9) _____ the part. (10) _____ the tank.

On spacewalk 3: (11) _____ the tank to the space station.

(12) _____ the pipes to the tank.



- Vocabulary** 2 Find the opposites of these words in 1.
connect, assemble, damage, remove

- Listening** 3  Listen to the controller talking to the astronaut. Complete the dialogue.

The controller is speaking from the control centre on Earth. The astronaut is on a space station.

- OK, today is the 6th of June, 7 pm in the evening. I'm checking progress on the space station. Have you (1) _____ the first spacewalk yet?
 - Yes, we have.
- Good. When (2) _____ you do it?
 - We (3) _____ the spacewalk yesterday, on the 5th of June.
- Right. And have you (4) _____ the oxygen tank yet?
 - No, we haven't (5) _____ it yet. We're still (6) _____ it.
- When (7) _____ you finish it?
 - We'll complete the job tomorrow morning.

Task	June		
	5	6	7
Do first spacewalk.			
Repair the oxygen tank.			

Language You can use *yet* with some questions and negatives in the present perfect. It means *up to now*.

- 1 We *haven't* repaired the oxygen tank *yet*.
- 2 A: *Have you* repaired the oxygen tank *yet*? B: No, *not yet*.

Speaking 4 Work in pairs. Make similar dialogues. Today is 17th June.

Task	June											
	10	11	12	13	14	15	16	17	18	19	20	21
Test equipment for first spacewalk.	█											
Do first spacewalk.		█										
Take photograph of damaged tank.		█										
Inspect damage to tank.			█	█								
Remove tank.					█	█						
Repair tank.							█	█	█			
Replace tank.										█	█	
Dismantle old ventilation system.						█	█	█				
Lubricate moving parts on all fans.									█	█	█	
Install new valves on pumps.												█

Task 5 Work in pairs. Follow the instructions.

- Student A: Turn to page 115.
- Student B:

It's 8th August. You're doing a progress check. Ask Student A questions and complete your checklist.

Task	Y/N?	Notes
Dismantle old water system	<input checked="" type="checkbox"/>	Completed 4 th Aug.
Assemble new water system	<input type="checkbox"/>	_____
Install water system	<input type="checkbox"/>	_____
Test equipment for third spacewalk	<input type="checkbox"/>	_____
Take video of damaged nose cap	<input type="checkbox"/>	_____
Inspect damage to waste tank	<input type="checkbox"/>	_____
Assemble new robot arm	<input type="checkbox"/>	_____
Attach new robot arm	<input type="checkbox"/>	_____

- B: *Have you dismantled the old water system yet?*
 A: *Yes, we have.*
 B: *When did you complete the job?*

Review Unit F

1 Complete the sentences with the correct form of the verbs in the box.

allow cause let make prevent stop

- 1 The water flows down onto the water wheel. This _____ the wheel turn.
- 2 The valve opens. This _____ the water flow in.
- 3 The valve closes. This _____ the water from flowing out.
- 4 The switch touches the contact. This _____ the electric current to flow.
- 5 The switch moves away from the contact. This _____ the electric current from flowing.
- 6 The water level rises. This _____ the float to rise.

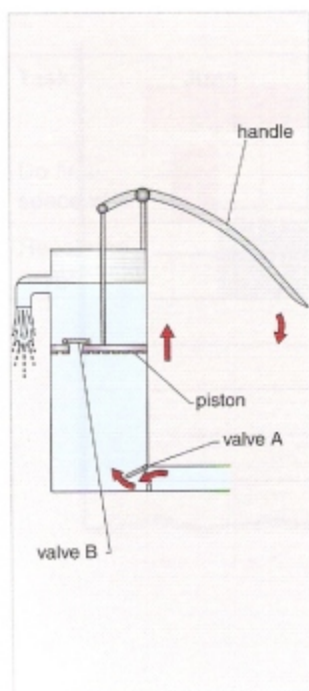
2 Complete the driving instructor's words with the correct form of the verbs in brackets.

- 1 If you _____ (press) the accelerator pedal, this _____ (make) the car _____ (go) faster.
- 2 If you _____ (push) the brake pedal down, this _____ (cause) the car to _____ (stop).
- 3 If you _____ (pull) the parking brake up, this _____ (prevent) the car from _____ (move).
- 4 If you _____ (release) the parking brake, this _____ (allow) the car to _____ (move) again.

3 Complete the sentences with the correct form of the verbs in the box.

close flow from go down open rise to

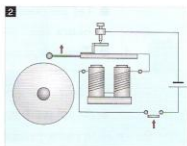
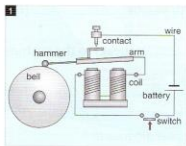
- 1 You push the handle down. This makes the piston _____.
- 2 The piston rises. This makes valve B _____ and causes valve A _____.
- 3 Valve B closes. This prevents water _____ into the chamber.
- 4 Valve A opens. This allows water _____ into the chamber.
- 5 You pull the handle up. This causes the piston _____.
- 6 The piston goes down. This makes valve B _____ and causes valve A _____.



- 4 Draw a line from each word or phrase to its opposite.

increase expand bring decrease low assemble
 contract dismantle inlet outlet less than
 take more than high connect
 remove replace disconnect approximately exactly

- 5 Complete this explanation of how the electric bell works with the correct form of the words in the box.

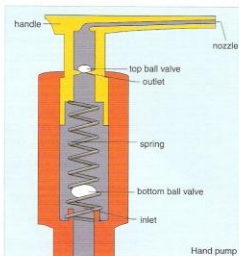


close flow make move open pull strike

How an electric bell works

Someone presses the bell button, and the switch (1) _____.
 An electrical current (2) _____ through the coil. This
 (3) _____ the coil become an electromagnet. The electromagnet
 (4) _____ the metal arm towards it. (Diagram 1). This causes the
 hammer to (5) _____ the bell. At the same time, it
 (6) _____ the circuit. Now the coil is not a magnet. The hammer
 (7) _____ away from the coil. (Diagram 2). This
 (8) _____ the circuit again. The hammer (9) _____ the
 bell again and again.

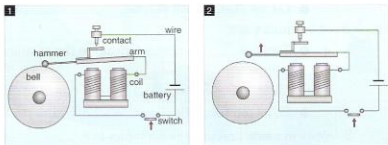
- 6 Work in pairs. Explain how this hand pump works.
 7 Write your explanation of how the hand pump works.



- 4 Draw a line from each word or phrase to its opposite.

increase expand bring decrease low assemble
 contract dismantle inlet outlet less than
 take remove more than high connect
 replace disconnect approximately exactly

- 5 Complete this explanation of how the electric bell works with the correct form of the words in the box.

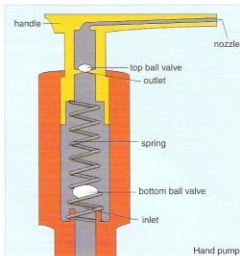


close flow make move open pull strike

How an electric bell works

Someone presses the bell button, and the switch (1) _____.
 An electrical current (2) _____ through the coil. This
 (3) _____ the coil become an electromagnet. The electromagnet
 (4) _____ the metal arm towards it. (Diagram 1). This causes the
 hammer to (5) _____ the bell. At the same time, it
 (6) _____ the circuit. Now the coil is not a magnet. The hammer
 (7) _____ away from the coil. (Diagram 2). This
 (8) _____ the circuit again. The hammer (9) _____ the
 bell again and again.

- 6 Work in pairs. Explain how this hand pump works.
 7 Write your explanation of how the hand pump works.



8 Complete these dialogues. Use the correct form of the verbs in brackets.

A supervisor in a car repair workshop is reporting on progress to his manager.

- 1 ● The men have _____ (replace) the windscreen.
○ *Good. When did they _____ (replace) it?*
● Let me check the file ... They _____ (replace) it yesterday.
- 2 ● They've _____ (take) out the old brake system.
○ *That's good. When did they _____ (take) it out?*
● Let me see ... They _____ (take) it out this morning.
- 3 ● Bob has _____ (drive) the car to the body repair shop.
○ *That's great. When did he _____ (drive) it there?*
● Let me check ... Ah yes, he _____ (drive) it there about two hours ago.
- 4 ● Tom has _____ (speak) to the customer about the damage to her car.
○ *Great. When did he _____ (speak) to her?*
● Er, let me see ... He _____ (speak) to her yesterday.

9 Work in pairs. Practise the dialogues in 8.

10 Work in pairs. Practise the dialogue below. The supervisor is checking progress with a mechanic. Then make new dialogues using the information from the table.

- Have you repaired the brakes yet?
- *Yes, I have.*
- Good. When did you do that?
- *I did it yesterday.*
- Right. And have you replaced the windscreen yet?
- *No, I haven't. I'm replacing it now.*
- OK. And what about the main shaft? Have you lubricated it?
- *No, I haven't. I'll do that tomorrow morning.*

Repair brakes	✓ yesterday
Replace windscreen	✗ in progress
Lubricate main shaft	✗ tomorrow morning

Lubricate axles and shafts	✓
Inspect damaged fuel tank	✓ last week
Disconnect fuel pipe from fuel tank	✓ yesterday
Take photographs of dented panels	✗ tomorrow morning
Remove old radiator	✗ tomorrow afternoon
Install new cooling system	✗ in progress
Repair dented bumpers	✓
Replace damaged valve on water pump	✗ in progress
Service the brake system	✗
Repair damaged radio	✗ later today
Connect battery to starter motor	✓ two days ago
Test new air conditioner	✓ 8.00 this morning

11 Write a description of this dam and how it works, using all the information and the words in the box.

allow carry cause drive enter flow generate
leave make open pass produce rotate turn

Function of dam

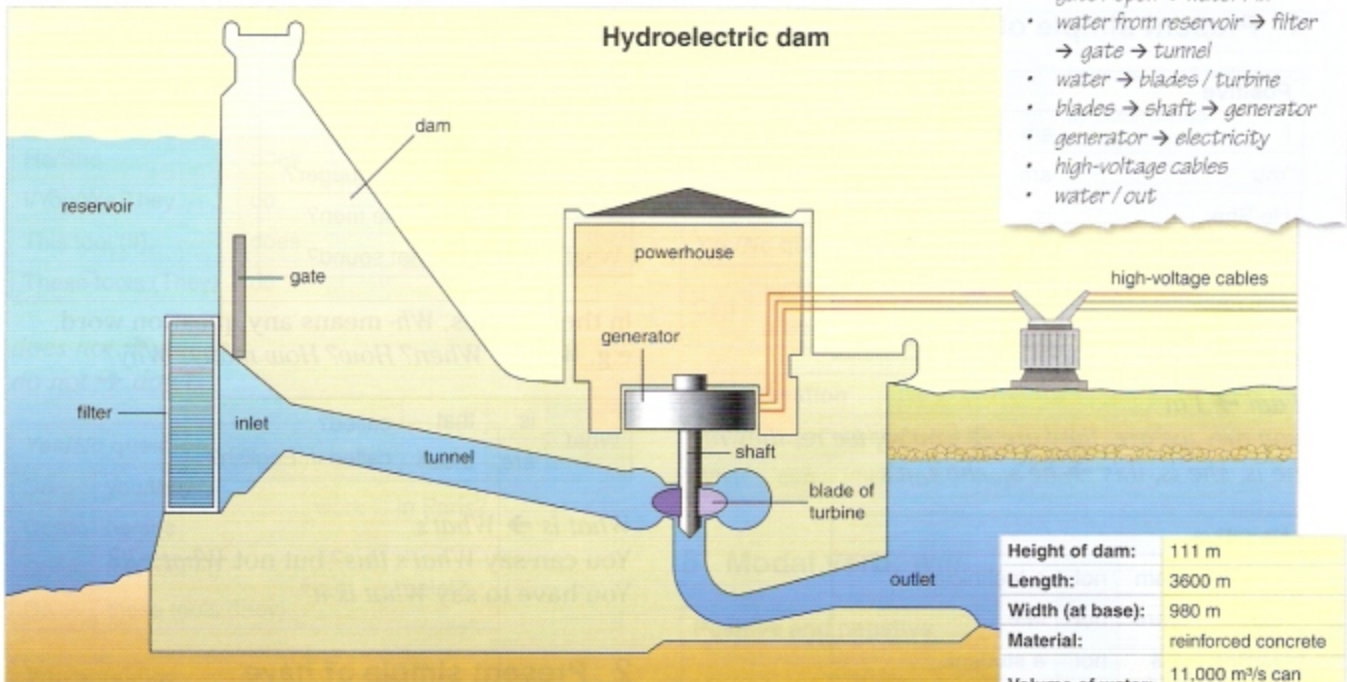
Main parts

Dimensions

Material

How the dam works

- gate / open → water / in
- water from reservoir → filter → gate → tunnel
- water → blades / turbine
- blades → shaft → generator
- generator → electricity
- high-voltage cables
- water / out



Height of dam:	111 m
Length:	3600 m
Width (at base):	980 m
Material:	reinforced concrete
Volume of water:	11,000 m ³ /s can pass through dam
Size of reservoir:	132 km ³

Project 12 Find out some facts about a major engineering project in your country or region.

- 1 Draw a simple labelled diagram.
- 2 Make a specifications chart.
- 3 Write a short description of the project:
 - Function of project
 - Dimensions
 - How it works
 - Main parts
 - Materials



Grammar summary

1 Present simple of *be*

Positive			
I	am	a student.	
You	are	early.	
He/She	is	a technician.	
The machine (It)	is	on.	
The switches (They)	are	off.	
We/They	are	electricians.	

I am → *I'm*

you are, we are, they are → *you're, we're, they're*
he is, she is, it is → *he's, she's, it's*

Negative			
I	am	not	a technician.
You	are	not	late.
He/She	is	not	a student.
That	is	not	an M6 spanner.
We/They	are	not	from Italy.

I am not → *I'm not*

you are not → *you're not* or *you aren't*

he is not/she is not → *he isn't/she isn't* or *he's not/she's not*

it is not → *it isn't* or *it's not*

we are/they are → *we aren't/they aren't* or *we're not/they're not*

Yes/No question		
Am	I	early?
	we	late?
Are	the switches	on?
	you	the manager?
Is	he/she	a technician?
	that	an AC adapter?

Don't use contractions in a short answer.

Are you French? *Yes, I am.* (Not ~~*Yes, I'm.*~~)

Is he a technician? *Yes, he is.* (Not ~~*Yes, he's.*~~)

Wh- question			
Where	are	we	now?
	is	the manager?	
Who	are	those men?	
What	is	that sound?	

In these tables, *Wh-* means any question word, e.g. *Where? When? How? How many? Why?*

What	is	that	called?
	are	those	called in English?

What is → *What's*

You can say *What's this?* but not ~~*What's-it?*~~

You have to say *What is it?*

2 Present simple of *have*

Positive		
I/You/We/They	have	25 screws.
My bike (It)	has	21 gears.

Negative				
I/You/We/They	do	not	have	any screws.
My bike (It)	does			27 gears.

does not → *doesn't*

do not → *don't*

Yes/No question			
Do	you/we/they	have	any screws?
Does	your bike (it)		27 gears?

In colloquial English:

Have you got any screws? (BrE) = *Do you have any screws?* (AmE)

I've got 25 screws. (BrE) = *I have 25 screws.* (AmE)

Wh- question				
How many	gears	does	your bike (it)	have?
	screws	do	you/we/they	

3 Present simple of other verbs

Positive			
He/She	works	in Paris.	
I/You/We/They	work		
This tool (It)	cuts	wood.	
Those tools (They)	cut		

Negative				
He/She	does	not	work	in Rome.
I/You/We/They	do			
This tool (It)	does	not	cut	metal.
These tools (They)	do			

does not → doesn't

do not → don't

Yes/No question			
Do	you/they	work	in Paris?
Does	he/she		
Does	this tool (it)	cut	metal?
Do	these tools (they)		

Wh- question			
Where	do	you/they	work?
	does	he/she	
What	does	this tool (it)	do?
	do	these tools (they)	

Spelling

There are three different ways to spell the ending of a present simple verb:

+ -s	+ -es	-y → -ies
flow flows	go goes	carry carries
move moves	pass passes	study studies
rise rises	push pushes	fly flies

Pronunciation

There are three different ways to say the -s/-es ending of a present simple verb:

z	s	iz (rhymes with his)
flows	sinks	rises
moves	stops	passes
burns	strikes	presses
goes	hits	pushes

4 Modal verb: can

Positive		
I/You/He/She/We/They	can	operate this machine.
A helicopter (It)	can	fly backwards.

Negative		
I/You/He/She/We/They	can	not operate the forklift truck.
An aeroplane (It)	can	not fly backwards.

can not → can't or cannot

Yes/No question		
Can	I/you/he/she/we/they	operate this machine?
	a helicopter (it)	fly backwards?

Wh- question			
How	can	I/he/she/we/they	help you?
What	can	I/he/she/we/they	do for you?

5 Modal verb: will

Positive and negative			
I/You/He/She/We/They	will	build	the wall tomorrow.
	will not		

will not → won't

I will, you will, he will, she will, it will, they will → I'll, you'll, he'll, she'll, it'll, they'll

Yes/No question			
Will	I/you/he/she/we/they	build	the wall tomorrow?

Wh- question			
When	will	I/you/he/she/we/they	build the wall?

6 Modal verbs: must, could and might

You **must** wear a hard hat here.

You **must not** / **mustn't** touch the machine.

You **might** / **could** burn your arm, hurt yourself.

Time expressions

Some time expressions you can use with the past simple:

- *yesterday, this morning, the day before yesterday*
- *three minutes ago, two days ago, five weeks ago*
- *last week, last month, last year*
- *in 2005, on the 20th October, at 6.30 am*

10 Past simple and past participle forms

The past participle is part of the present perfect verb. Here are some examples of verbs in this book.

Most verbs are regular. Both the past simple and the past participle end in *-ed*.

Regular (ending in <i>-ed</i>)	
verb	past simple/past participle
attach	attached
close	closed
connect	connected
cool	cooled
crack	cracked
crash	crashed
damage	damaged
dent	dented
disconnect	disconnected
drop	dropped
fit	fitted
happen	happened
inspect	inspected
launch	launched
mount	mounted
press	pressed
remove	removed
repair	repaired
replace	replaced
scratch	scratched
suspend	suspended
travel	travelled

Some verbs are irregular. The past simple and the past participle don't end in *-ed*.

Irregular (not ending in <i>-ed</i>) past simple = past participle	
verb	past simple/past participle
bend	bent
bring	brought
build	built
burn	burnt
buy	bought
cut	cut
find	found
get	got
have	had
hold	held
leave	left
let	let
lose	lost
make	made
put	put
read	read
say	said
sell	sold
send	sent
sit	sat
tell	told

Irregular (not ending in <i>-ed</i>) past simple ≠ past participle		
verb	past simple	past participle
become	became	become
break	broke	broken
do	did	done
drive	drove	driven
fall	fell	fallen
fly	flew	flown
go	went	gone
rise	rose	risen
run	ran	run
speak	spoke	spoken
steal	stole	stolen
take	took	taken
tear	tore	torn
write	wrote	written

Pronunciation

There are three different ways to say the *-ed* ending of a past simple verb:

d	t	id*
flowed	launched	mounted
moved	increased	added
changed	dropped	inspected
opened	gripped	rotated

* rhymes with *did*

Here are some past participles often used as adjectives:

Damage

cracked, damaged, dented, punctured, scratched, broken, stolen, torn, bent, burnt, cut

Location

connected (to), disconnected (from), suspended (from), mounted (on), attached (to)

Example: *The pipe is cracked. The switch is connected to the battery.*

11 Past simple of *be*

Positive		
I/He/She	was	in London last year.
You/We/They	were	in the workshop yesterday.

Negative		
I/He/She	was	not in Dubai last year.
You/We/They	were	not in the workshop last week.

was not → *wasn't*

were not → *weren't*

Yes/No question		
Was	I/he/she	in Dubai last year?
Were	you/we/they	in the workshop last week?

Wh- question			
When	was	I/he/she	in London?
	were	you/we/they	in the workshop?

12 Zero conditional

If	the sun	shines	,	the current flows from the panel.
	the sun	does not/doesn't	shine	, the current flows from the battery.

If	the battery	is	full	,	the current doesn't flow into the battery.
	the lamps	are not/aren't	on	,	the current flows into the battery.

13 Countable and uncountable nouns

screws are countable		cement is uncountable	
a	screw	some	cement
one			
some			
two	screws		
a bag of		a bag of	
two bags of		two bags of	

Countable nouns can be both singular and plural. Examples: *screw, nail, hammer, bottle.*

Uncountable nouns are always singular. Examples: *concrete, cement, sand, oil, water.*

How much/How many

Do you need	some/any	screws?	How	many	screws	do you need?
		cement?		much	cement	

14 Verb constructions

cause, allow + to infinitive

make, let + bare infinitive

stop, prevent + from + gerund

The motor	causes	the shaft	to	move.
The open valve	allows	the water	to	flow out.
The motor	makes	the water		flow out.
The open valve	lets			
The closed valve	prevents	the water	from	flowing out.
	stops			

15 Describing damaged or missing items

Passive

The screen	is	scratched.
The speakers	are	

have/don't have

The cable	has	no	plug.
	doesn't have	a	
The cables	have	no	plugs.
	don't have	any	

There is/There are

There is	a scratch	on the screen.
	no manual	in the box.
There are	some scratches	on the screen.
	no batteries	in the box.

there is → *there's*

there are → *there're*

Reference section

1 Abbreviations

SI units of measurement

Abbreviations are usually *singular* (e.g. 50 metres is 50 m, not 50 *ms*)

Abbreviations are usually *lower-case* (e.g. mm, not *MM*) with very few exceptions. Note that:

- *litre* can be *L* or *l*
- *ampere* (*A*), *watt* (*W*) and *volt* (*V*) use upper-case (capital) letters

Length

mm	millimetre(s)
cm	centimetre(s)
m	metre(s)
km	kilometre(s)

Area

mm²	square millimetre(s)
m²	square metre(s)
km²	square kilometre(s)

Volume/Capacity

mm³	cubic millimetre(s)
m³	cubic metre(s)
km³	cubic kilometre(s)
ml	millilitre(s)
cl	centilitre(s)
L (or l)	litre(s)

Mass/Weight

mg	milligram(s)
g	gram(s)
kg	kilogram(s)
t	tonne(s)

Electricity

A	ampere(s) or amp(s)
Ah	ampere hour(s)
W	watt(s)
kW	kilowatt(s)
kWh	kilowatt hour(s)
V	volt(s)

Speed

m/s	metre(s) per second
km/s	kilometre(s) per second
km/h	kilometre(s) per hour
rpm	revolution(s) per minute

Other units in common use

gal	<i>gallon(s)</i>	1 gal (US) = 3.7854 L 1 gal (UK) = 4.5461 L
pt	<i>pint(s)</i>	1 pt (US) = 0.4732 L 1 pt (UK) = 0.5683 L
in	<i>inch(es)</i>	1 in = 25.4 mm
yd	<i>yard(s)</i>	1 yd = 0.9144 m
mi (or m)	<i>mile(s)</i>	1 mi = 1.61 km
mph	<i>mile(s) per hour</i>	100 mph = 161 km/h
lb	<i>pound(s)</i>	1 lb = 0.4536 kg
oz	<i>ounce(s)</i>	1 oz = 28.3495 g

Temperature

°C	degree(s) Celsius
°F	degree(s) Fahrenheit

To convert Celsius to Fahrenheit:

$$^{\circ}\text{F} = ^{\circ}\text{C} \times 9/5 + 32.$$

To convert Fahrenheit to Celsius:

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9.$$

Some other abbreviations used in this book

am	in the morning
AC	alternating current
approx.	approximately
CD	compact disc
CD-ROM	compact disc, read-only-memory
DC	direct current
DVD	digital video disc
etc.	and so on/etcetera
FAQ	frequently asked questions
GB	gigabytes
ID	identity
ISO	International Organisation for Standardisation
IT	information technology
LED	light-emitting diode
LH	left-hand
MB	megabytes
n/a	not applicable; write this when there is no possible answer, or no need to answer a question on a form
no.	number
NS	near-side (of car), away from the steering wheel
N, S, E, W, NW	north, south, east, west, north west
OS	off-side (of car), next to the steering wheel
pm	in the afternoon (or evening)
qty	quantity
R&D	research and development
ref.	reference/with reference to
RF	radio frequency; the RF IN socket on a TV comes from the antenna
RH	right-hand
SCART	a connector between two audio-visual machines, e.g. a TV and a DVD player, also called a Euro-connector
SI	International System of Units; metric units
TV	television
VCR	video cassette recorder

2 Numbers, times and dates

Numbers up to 100

1	one	14	fourteen
2	two	15	fifteen
3	three	16	sixteen
4	four	17	seventeen
5	five	18	eighteen
6	six	19	nineteen
7	seven	20	twenty
8	eight	21	twenty-one
9	nine	22	twenty-two
10	ten	23	twenty-three
11	eleven	24	twenty-four
12	twelve	25	twenty-five
13	thirteen		
30	thirty	70	seventy
40	forty	80	eighty
50	fifty	90	ninety
60	sixty	100	a hundred/one hundred

Numbers over 100

100	a hundred/one hundred
1000	a thousand/one thousand
10,000	ten thousand
100,000	a hundred thousand/one hundred thousand
1,000,000	a million/one million
1,000,000,000	a billion/one billion

Ordinal numbers

1 st	first	11 th	eleventh	21 st	twenty-first
2 nd	second	12 th	twelfth	22 nd	twenty-second
3 rd	third	13 th	thirteenth	23 rd	twenty-third
4 th	fourth	14 th	fourteenth	24 th	twenty-fourth
5 th	fifth	15 th	fifteenth	25 th	twenty-fifth
6 th	sixth	16 th	sixteenth	26 th	twenty-sixth
7 th	seventh	17 th	seventeenth	27 th	twenty-seventh
8 th	eighth	18 th	eighteenth	28 th	twenty-eighth
9 th	ninth	19 th	nineteenth	29 th	twenty-ninth
10 th	tenth	20 th	twentieth	30 th	thirtieth
				31 st	thirty-first

Decimal numbers

0.1	nought point one/zero point one
15.1	fifteen point one
15.15	fifteen point one five
15.015	fifteen point oh one five/fifteen point zero one five

Times

24-hour clock	12-hour clock	Some ways to say it
05.15	5.15 am	oh five fifteen five fifteen in the morning five fifteen am
10.30	10.30 am	ten thirty in the morning ten thirty am
14.45	2.45 pm	fourteen forty-five two forty-five in the afternoon two forty-five pm
21.55	9.55 pm	twenty-one fifty-five nine fifty-five pm nine fifty-five in the evening

Months

January, February, March, April, May, June, July, August, September, October, November, December

Days

Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday

Saying years

- 1998 = *nineteen ninety-eight*
- 2000 = *two thousand*
- 2008 = *two thousand and eight* (BrE); *two thousand eight* (AmE)

Writing dates

- 2011-06-14 (yyyy-mm-dd) – ISO 8601: an international standard
- 14/06/11 (dd/mm/yy) – commonly used in Europe
- 06/14/11 (mm/dd/yy) – commonly used in the US
- 14th June 2011
- 14 June 2011
- June 14, 2011
- June 14th, 2011

Saying dates

- *the fourteenth of June, two thousand and eleven* (BrE); *two thousand eleven* (AmE)
- *June the fourteenth, two thousand (and) eleven*

3 Symbols

General warnings and safety symbols
danger/warning/caution/hazard



Specific hazards



flammable



toxic/poison



Danger
high voltage

high voltage

Safety equipment or help



emergency exit/ fire exit



fire alarm



fire
extinguisher



hospital



first aid



emergency stop

Prohibitions



no entry



no exit



no smoking

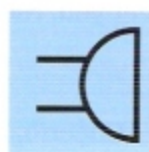
Some electrical symbols



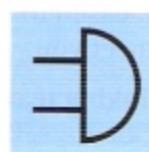
conductor



lamp



buzzer



bell



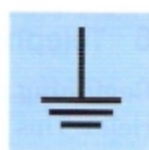
battery



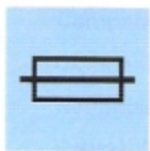
switch



terminal



earth



fuse

Other symbols

- + plus/positive
- minus/negative
- # hash/number
- ° degree(s)
- ± plus or minus
- = equals
- ≠ does not equal
- ≥ at least (also more than or equal to)
- ≤ up to (also less than or equal to)
- ~ approximately/about (also has other uses)
- < less than, under
- > more than, over
- ✓ tick
- ✕ cross
- . point (decimal number)

Currency symbols

- € euro(s)
- \$ dollar(s)/peso(s)/real(s)
- £ pound(s)
- ¥ yen
- 元 renminbi/yuan
- ₪ rial(s)/riyal(s)
- Rs Rp rupee(s)

Internet symbols

- @ at
- .com dot com
- A-B A hyphen B / A dash B
- A/B A slash B / A forward slash B
- A_B A underscore B

4 Useful words

Industries and technologies

aerospace
agriculture
automotive engineering
biotechnology
chemical engineering
civil engineering
building and construction
electrical engineering
electronics/electronic engineering
environmental engineering
information technology/IT
information and communications technology/ICT
manufacturing
marine engineering
materials testing
mechanical engineering
petroleum
public health
security
telecommunications/telecoms
transport

Names of jobs

engineer
manager
technologist
technician
supervisor
team leader
mechanic
operator

Materials

Metals: aluminium, titanium, copper, iron, lead, tin

Alloys: steel, chrome, cromoly

Plastics: polycarbonate, polyester, polystyrene, nylon

Composites: fibreglass, graphite

British and American English

Here are some of the words used in this book, but there are many more. Key the words *American British English* into an Internet search engine or *Wikipedia* to find complete lists. Some AmE words and spellings are now used also in BrE, for example, *antenna*, *disk*. Some BrE words are now used in AmE, for example, *car*.

British English (BrE)	American English (AmE)
accelerator	gas pedal/gas
aerial	antenna
aeroplane	airplane
aluminium	aluminum
cable/wire (<i>electricity</i>)	cord
car	automobile
centre	center
colour	color
disc	disk
earth (<i>electricity</i>)	ground
fibreglass	fiberglass
flat (<i>battery</i>)	dead
lift (<i>in a building</i>)	elevator
litre	liter
metre, kilometre,	meter, kilometer,
millimetre	millimeter
mobile/mobile phone	cellphone
petrol	gas/gasoline
polystyrene	styrofoam
postal code	zip code
spanner	wrench
storey (<i>in a building</i>)	floor/story
torch	flashlight
tyre	tire
vice (<i>in a workshop</i>)	vis
windscreen	windshield

5 Social phrases

Meeting a friend or co-worker

Hello. Hi. Morning. Good morning.
How are you? How are things? How are you doing? How's it going?
Fine, thanks. Great. How about you?

Introducing yourself

I'm Hans. My name's Hans.

Introducing someone else

This is Mia. She's a student here. She's a technician.

Meeting someone for the first time

Pleased to meet you. Nice to meet you. Good to meet you

Taking leave

Goodbye. Bye. Cheerio.
See you. See you later. See you tomorrow.

6 Telephone phrases

Beginning a phone call

Hello. This is Mike. It's Mike. Mike here. Mike speaking.
Hello. Is that Mike?
Yes, this is Mike. Is that Jim?

Listening to a voicemail

Thank you for calling ABC Computers.
You've reached the voicemail of John Wilson.
Please leave a message after the tone.

Leaving a voicemail

Hello. My name is ...
My phone number is ...
My email address is ...
My address is ...
I'd like to order/buy ...
I'd like some information about ...
Could you please send me your catalogue/brochure.
Please call me back. It's urgent.
Please get back to me when you can. Thanks.
Thank you.

Listening to an automatic message

Thank you for calling ABC Computers.
For the sales department, please press 1.
To hear information about our services, press 2.
To speak to a service technician, please hold.
Please wait.

Answering a call from a customer

Thank you for calling ABC Computers.
This is the service department.
My name's Jason. This is Jason. Jason speaking.
I'm the service technician.
How can I help? How can I help you? What can I do for you? What's the problem?

7 Forms and email conventions

Forms

Title (Mr/Ms/Mrs)	Mr
Full name	Jan Lorenz Nowak
First name(s)	Jan Lorenz
Surname	Nowak
Occupation	Marine technician
Designation/Job Title	Team Leader, Section 2
Company	Fleet Engineering Co.
Company address/Work address	Unit 34, Marina Docks, Ring Road, Bristol BS98 4NT
Nationality	Polish
Passport number	n/a
Date of birth (dd/mm/yy)	10/12/90
Qualifications	Diploma in Marine Technology
Home address	14 Watling Street, Bristol BS88 9Q1
House number	14
Postal code	BS88 9Q1
Mailing address*	same
Billing address**	same
Email address	nowak.jl43@fleet.co.uk
Office telephone number	01234 8856967
Extension	x 340
Mobile	07734 123 456

* we'll send the goods to this address

** we'll send the invoice to this address

Email

Subject: Re: Steering problem
From: info@motors.co.uk
To: Peter Jones

Dear Mr Jones
Thanks for your email of 07/11.
With reference to your steering problems, I've inspected your car. It needs a new power steering pump.
Do you want me to install a new pump?
Please confirm.
Regards
John Stevens

Hi Peter*
Thank you for
Re /With regard to/Concerning Would you like me to
Please let me know. Best regards/Best/Best wishes John*

* Use this form when you know your customer well.

Extra material

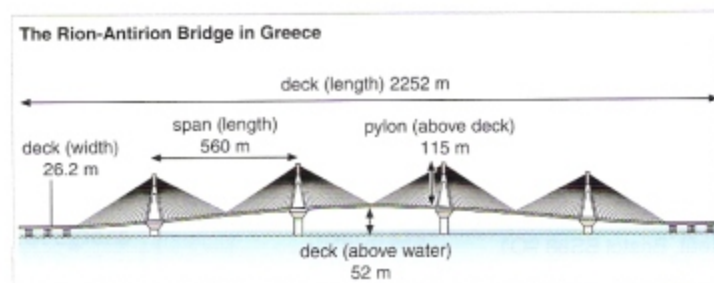
7 Specifications

1 Dimensions

Task exercise 9 page 53

Student A

2 Answer Student B's questions about the Rion-Antirion Bridge.



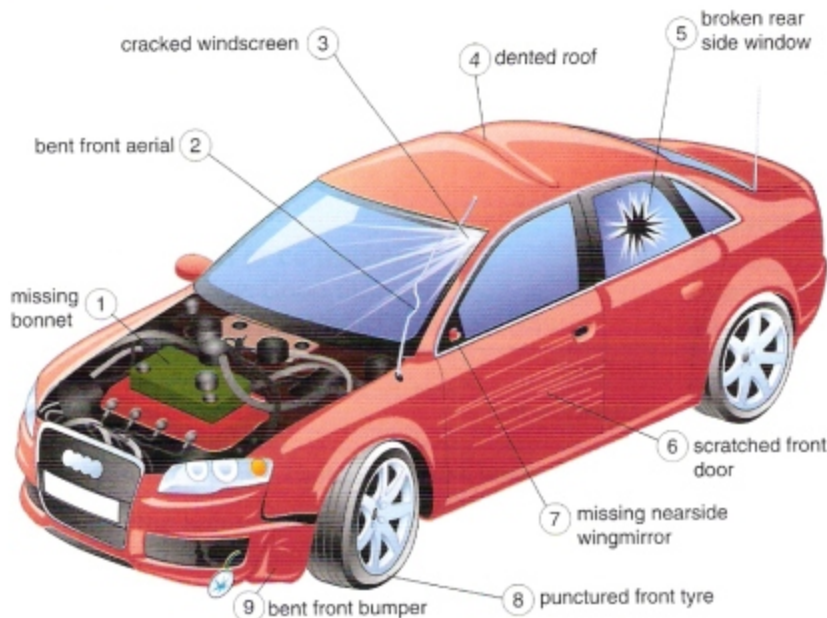
8 Reporting

2 Damage and loss

Task exercise 9 page 61

Student A

2 Answer Student B's questions about the damage to your car.



10 Safety

3 Investigations

Task exercise 5 page 79

Student A

1 Read about your incident and answer Student B's questions.

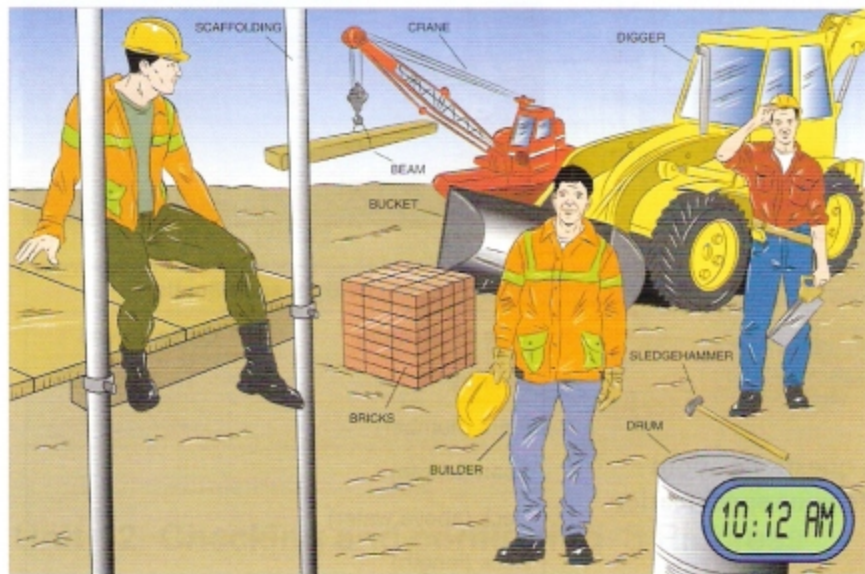
Two days ago, 23rd November, a builder called Gino Petri had an accident on the 3rd floor of the new building. The accident happened at 09.38. Mr Petri was about 20 m above the ground at the time. He tripped over a metal girder and he fell from the 3rd floor to the 2nd floor. He fell into a safety net and received no injuries from the fall, but the girder cut his leg.

2 Then change roles. Investigate Student B's incident. Ask questions and complete the report form on page 79.

Unit 8 Reporting 1 Recent incidents

Speaking exercise 7 page 59

Look at this picture for one minute. Then turn back to page 59.



10 Safety

3 Investigations

Task exercise 5 page 79

Student B

- 2 Read about your incident and answer Student B's questions.

Yesterday, 15th July, an electrician called Pedro Gomez had an accident on the #1 scaffolding. The accident happened at 14.46. Mr Gomez was about 10 m above the ground at the time. He raised his right arm. His arm touched a live wire and received a small electric shock. He had a small 2 cm burn on his right arm, but received no other injuries.

Unit 12 Checking and confirming 1 Data

Speaking exercise 7 page 91

Student B

Confirm or correct Student A's answers.

Mars

- 1 6747 km
- 2 24 hours and 37 minutes
- 3 228 million km (average)
- 4 687 Earth days

Yes, that's right.

No, that's wrong. Change it to ...

Unit 12 Checking and confirming 2 Instructions

2 Instructions

Speaking exercise 8 page 93

Write down what is happening in the pictures using the words in the box.

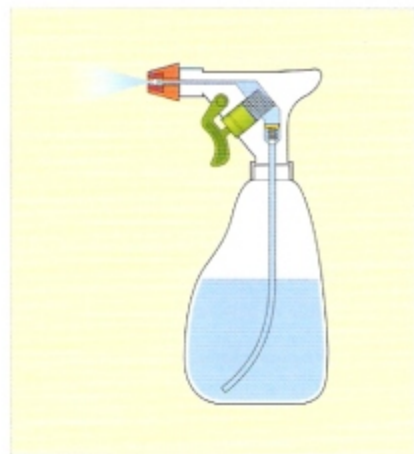
astronaut car helicopter
motorboat plane rover
shuttle truck

Unit 11 Cause and effect

1 Pistons and valves

Start here exercise 1 page 84

Check your answers.

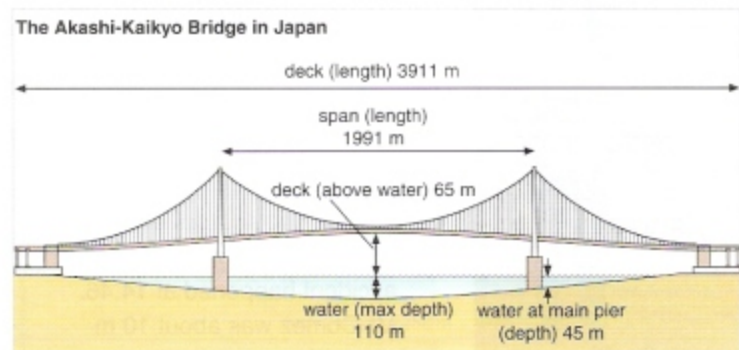


7 Specifications 1 Dimensions

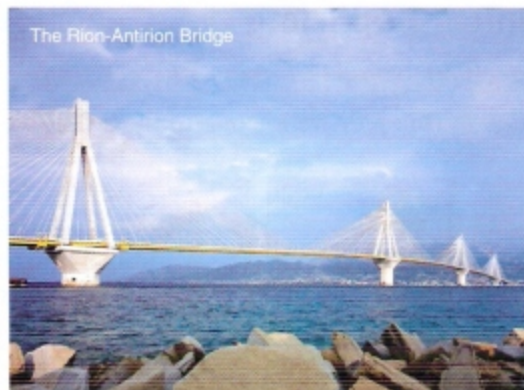
Task exercise 9 page 53

Student B

- 1 Answer Student A's questions about the Akashi-Kaikyo Bridge.



- 2 Then change roles. Ask Student A questions about the Rion-Antirion bridge. Complete your specification chart.



Rion-Antirion Bridge: specifications

Type of structure	Cable-stayed
Country	
Piers (number)	
Span (length)	
Deck (above water)	
Deck (length)	
Deck (width)	
Pylon (above deck)	

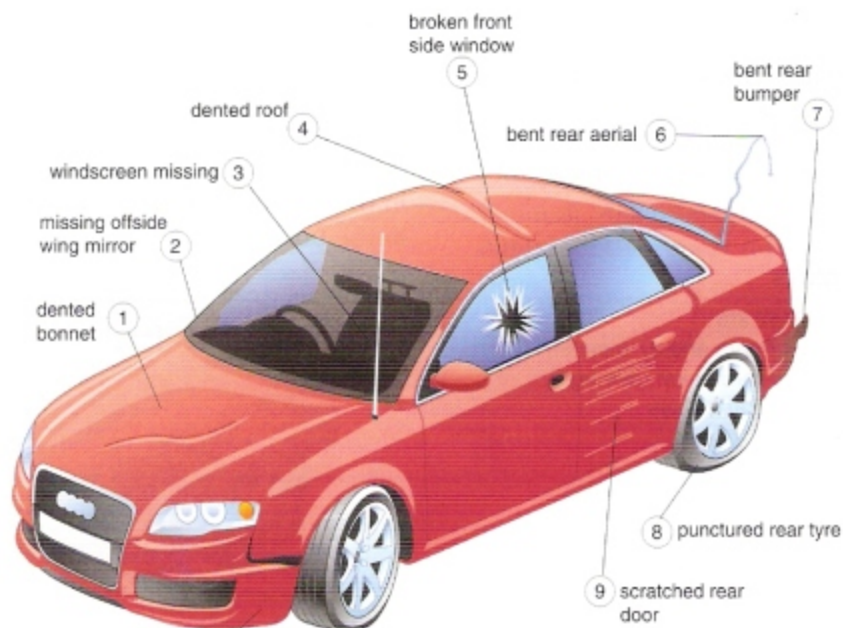
8 Reporting

2 Damage and loss

Task exercise 9 page 61

Student B

- 1 Answer Student A's questions about the damage to your car.
- 2 Then change roles. Now ask Student A questions about the damage to their car. Turn back to page 61. Label your diagram.



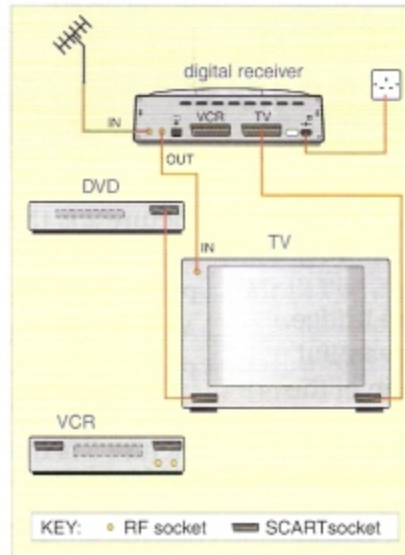
9 Troubleshooting 2 Hotline

Task exercise 8 page 71

Student A

Find out all the differences between your wiring diagram and your partner's.

Hint: there are at least ten differences of (a) location of sockets and (b) wiring connection.



USEFUL LANGUAGE

digital receiver, DVD, VCR, TV, antenna, SCART socket, RF socket, in, out, power, socket

Do you have a/an ... ?

Look at the

Where is the ... ?

Does the ... connect to the ... ?

Have you connected the ... to the ... ?

Is the ... connected to the ... ?

Unit 12 Checking and confirming 3 Progress

Task exercise 5 page 95

Student A

It's 8th August. Answer Student B's questions about your chart.

Task	August												
	2	3	4	5	6	7	8	9	10	11	12	13	
Dismantle old water system	█	█	█										
Assemble new water system				█	█								
Install water system							█	█					
Test equipment for third spacewalk				█									
Take video of damaged nose cap					█								
Inspect damage to waste tank							█	█					
Assemble new robot arm							█	█	█	█			
Attach new robot arm										█	█	█	█

B: Have you dismantled the old water system yet?

A: Yes, we have.

B: When did you complete the job?