Unit

3 Building the world

Lesson	Objectives/Outcomes
Everything on Earth! Pages 34–35	• Be aware of, and arouse interest in, the topics for the unit • Understand and practise target vocabulary: elements
Elementary! Pages 36–37	• Understand spoken information about compounds, elements and mixtures • Pronounce names of elements with the correct stress • Say sentences using target vocabulary from the lesson
Thank you for listening Page 38	• Pronounce chemical symbols from the unit with the correct stress • Be able to use some different phrases for ending a talk • Give a short talk with a clear ending about data, information and action
Finding the solution Page 39	• Understand and practise target vocabulary: mixtures and solutions • Use vocabulary and language from the lesson to complete an information-gap activity
English in action: Talking about laboratory instruments Pages 40–41	• Talk about the purpose of laboratory instruments • Ask and answer questions with *be* and other verbs
A + B → an eruption! Pages 42–43	• Understand a text describing a process • Identify the subject and verb in longer sentences • Explain a chemical reaction
Water, water, everywhere Pages 44–45	• Identify SVO in written sentences • Practise writing suitable objects in SVO sentences • Research information for, and write a paragraph about, osmosis using the TOWER process
Over to you!	• Consolidate language and new knowledge from the unit in freer, independent activities • Use target vocabulary and language from the unit in a communicative activity • Use all four skills to complete a project on the topic of the unit • Demonstrate understanding of content of the unit • Revise vocabulary from the unit

Everything on Earth!

Be aware of, and arouse interest in, the topics for the unit
Understand and practise target vocabulary: elements

Introduction
Give students time to look at all the photographs. They should be able to name some of these without looking at the word box. Elicit a few ideas, but do not confirm or correct. Don't say anything about the labels (letters) under the photographs at this point.

A

1. Set for pairwork. Elicit some ideas, but do not confirm or correct.
2. Play the recording. Feed back. Check the stressed syllables, then drill, chorally and individually. Test students on the items, by saying numbers randomly and eliciting the name.

Answers & Transcript 041

1. balloons
2. a sign
3. a diamond
4. a SIM card
5. a steel beam
6. wire
7. a thermometer
8. exhaust gas
9. cleaning fluid
10. salt
11. a computer chip
12. sugar

B

Go through the example and check that students have clearly understand the task. Once they are clear, point out that the letters are *chemical symbols* – drill the expression.

The exercise is basically a puzzle. They must work out what each chemical symbol means and then how it relates to the photograph. They must try to produce sentences about the relationship, as in the example.

Monitor and assist. Get a general feeling for ones which are causing problems, but do not do a general feedback at this point.

Play the recording. Elicit an answer for each photograph/symbol and a sentence that describes the photograph.

Answers & Transcript 042

1. *He* is the chemical symbol for helium. They are helium balloons.
2. *Ne* is the chemical symbol for neon. It's a neon sign.
3. *C* is the chemical symbol for carbon. This is a diamond. Diamonds are a form of carbon.
4. This is a SIM card. SIM cards have gold plates. *Au* is the chemical symbol for gold.
5. This is a steel beam. Steel is a mixture of iron and carbon. The chemical symbol for iron is *Fe*, and for carbon, it's *C*.
6. The chemical symbol for copper is *Cu*. This is copper wire, for electrical work.
7. The chemical symbol for mercury is *Hg*. This is a mercury thermometer.
8. Car exhaust contains several gases, including nitrogen and carbon dioxide. There is also water vapour. So we have N_2 for nitrogen, CO_2 for carbon dioxide and H_2O for water, of course.
9. We can clean with fluids containing sodium hypochlorite and water. The chemical symbol for sodium is *Na*, and for chlorine, it's *Cl*. *O* means oxygen, of course.
10. So cleaning fluid has sodium and chlorine in it. But so does salt! In fact, salt is sodium chloride for scientists.
11. This is a computer chip. It is made from silicon. The chemical symbol is *Si*.
12. Finally, we have sugar. Sugar is a carbohydrate, so it contains carbon, hydrogen and oxygen.

Subject note
You may want to refer students to the periodic table in the Resources on CB page 154. The elements after *chlorine* in the periodic table have symbols from old names/foreign names for the element so students must actually learn these in English if they don't know them already. You can also point out that all the single letter elements appear at the beginning of the table and they are then 'used up', so later elements beginning with the same letter need a second letter. The second letter in the symbol is often, but not always, the second letter of the element name; cf. *Al* – *aluminium* and *Mg* – *magnesium*.

The synthesized elements, 113 and above, have three letters.

C

Work through the first one as an example. Set for pairwork. Feed back, getting students to produce as much language as possible in their answers, e.g., *1. Hydrogen, oxygen, neon and argon are all gases. Magnesium is not a gas. It's a metal.* Write the word *reaction* on the board. This is used throughout the unit.

Answers

	Connection	Odd one out
1.	all gases	Mg (metal)
2.	all metals	Br (liquid)
3.	solid at room temp	Hg (liquid)
4.	radioactive	Fe (not radioactive, magnetic)
5.	inert gases = do not take part in chemical reactions normally	O (takes part in many chemical reactions)

D

Give students plenty of time to look at the pie charts and to work out the chemical composition of each one. Make sure students realize that the size of the 'slice' = the percentage.

1. Elicit the chemicals in Figure 1 by asking checking questions, e.g., *Is there any sodium in Figure 1?*, etc. Then set for pairwork.
2. Check the meaning and pronunciation of the four items.

   living things
   the atmosphere
   the Earth
   the oceans

   Set for pairwork. Monitor, but do not confirm or correct.
3. Play the recording. Feed back, ideally with a visual medium of the pie charts.
4. Refer students to the Pronunciation box. Ask students to estimate the percentage of a few of the elements, e.g., oxygen in Figure 1. Set for pairwork or group work.
5. Play the recording. Feed back, eliciting the correct percentages and, if possible, writing them in the correct place on the visuals.

Answers

1. Refer students to the periodic table in the Resources on CB page 154.

2.–3.
Figure 1: the Earth
Figure 2: the atmosphere
Figure 3: the oceans
Figure 4: living things

4.–5.
Figure 1: O = 47%; Si = 28%; Al = 8%; Fe = 5%
Figure 2: N = 78%; O = 21%; Ar = 0.9%
Figure 3: H = 60%; O = 30%; Cl = 4%; Na = 4%,
Figure 4: O = 65%; C = 18%, H = 10%

Transcript 043

Figure 1 shows the chemical composition of the Earth. Figure 2 is the composition of the atmosphere. Figure 3 is the oceans and Figure 4 is living things.

Transcript 044

1. The main constituent of the Earth is oxygen – 47%. Twenty-eight per cent is silicon, and 8% is aluminium. Five per cent is iron.
2. The main gas in the atmosphere is nitrogen. It is 78% of the atmosphere. Oxygen is vital, of course, but it is only 21% of the atmosphere. Argon is 0.9%. Carbon, in the form of carbon dioxide, is less than 1%.
3. The ocean is salt water, so we have hydrogen and oxygen. Hydrogen is 60% and oxygen is 30%. And the salt – well, chlorine – is 4% and sodium is 4%.
4. The human body has a lot of oxygen – 65% is oxygen, in fact. Carbon makes up 18% and hydrogen another 10%.

Pronunciation: Saying numbers (5)

Refer students to the box before, or at some point during Exercise D.

Play the recording and get students to repeat the numbers. Check the stress.

Say a few more percentages, including some with decimals, and get students to write them down, then read them back to you.

Answers & Transcript 045

(underline = stressed syllable)
five per cent
sixty-four per cent
seventy-seven per cent.

E

Set for group work. Feed back, eliciting answers from several groups before confirming.

Answers

1. Hydrogen is twice the level of oxygen, because water is H_2O.
2. Because CO_2 is a greenhouse gas – it contributes to climate change.
3. Because we need silicon for computer chips.
4. In the blood.

Elementary!

Understand spoken information about compounds, elements and mixtures

Pronounce names of elements with the correct stress

Say sentences using target vocabulary from the lesson

Introduction

Refer to the lesson heading. Point out that the word comes from *element*, meaning *basic thing*, so *elementary* means *simple* or *basic*.

Give students time to read the subheading. Point out the importance of this role for scientists – making new materials which do things better.

A

Focus students on the photographs. They will probably be most interested in the cow with the gas tank on its back. This is a real experiment – to collect the methane from the bottoms of cows!

Students discuss the questions in pairs or small groups. Elicit ideas, but do not confirm or correct. Students may be able to guess the connection because they know the lesson is about chemical composition and they know that water and sugar both have hydrogen and oxygen in them. They may not know about methane or the chemical formula for methane.

Do not give the answers – students listen to check in Exercise B.

Answers

See Exercise B.

B

1. Check students understand the concept of a *club*. It's for people with a common interest – often students at school, college or university. Clubs often happen after lessons/lecture. Give examples of any clubs which students might know. Play the recording of Manuel's introduction. Elicit the names of the items in the photographs and the answers to Exercise A.

2.–3. Focus students' attention on the title of the talk. Check the meaning of *difference*. Ask students to think about the missing words in the title, but do not elicit. Play the recording again for students to check their answers and order the words.

Answers

1. The items are water, sugar and methane: they all contain hydrogen – formulas are H_2O, $C_{12}H_{22}O_{11}$ and NH_4.
2. What is the difference between <u>compounds</u> and <u>mixtures</u>? And why is it <u>important</u>?
3. A group of elements together is either a compound or a mixture.

Transcript 046

Good evening, everyone. First of all, look at these photographs. What are these items? We've got water, of course, then sugar, and finally … no, not a cow. I'm interested in the balloon on the back of the cow. What's in the balloon? It's methane. Methane on Earth comes partly from animals – cows, mainly. Where does it come from? I think you can guess.
OK, what's the connection between these items? They are very, very different, aren't they? Water is a liquid, sugar is a solid and methane is a gas. But they have one thing in common. What is it? Well, they all contain the element hydrogen. Strange, isn't it? One element, three very different substances. Now, everything in the world is made of elements – hydrogen, chlorine, iron, but most everyday things are like water, sugar and methane. They are *groups* of elements. For example, the atmosphere is a group of gases and the oceans contain gases and other elements. A group of elements together is either a *compound* or a *mixture*. A compound or a mixture. But what's the difference? What is the difference between compounds and mixtures? And why is the difference important? That's my talk today.

Pronunciation: Spelling ≠ sound

Divide the class into pairs to discuss the examples and choose the best answer. Do not elicit.

Play the recording for students to check their ideas. Elicit answers. Play the recording again, pausing for repetition. Finally, students read the advice at the bottom of the box. Ask them to give examples of other words where spelling does not help with pronunciation, for example, *what*, *eight*, *one*, etc.

Answers

1. a. all
2. b. chlorine
3. a. about

Transcript 047

Water – Water, sugar and methane all contain hydrogen.
Chemical – We can change sodium and chlorine into salt.
Compound – Carbon dioxide is a compound of carbon and oxygen.

Listening skill: Recognizing and using examples

Go over the information in the box. Point out that *like* can be a verb. When it is used for examples, it is a preposition: *There are many elements on Earth, like hydrogen, oxygen and carbon.*

NOTE Students will hear the word *like* used colloquially as an *adverb*. It is used very commonly this way by younger people in the USA and Britain. For example, *She was like really angry./I said, like, 'What are you talking about?'* In this case, it means *in this way.*

C

Exploit the visuals only on the slides. (Avoid explaining the notes – students should try to understand them in context during the talk.)

1. Tell students to look for *e.g.* on each slide and find the examples. Do not elicit. Tell students not to worry about the meaning of any they find difficult at this stage.
2. Give students time to read the notes on the slides and circle any new words. Students can compare in pairs, but do not elicit. Reassure students the new words will be dealt with later.

Answers

See Exercise D.

D

1. Check students understand what they have to do. Play the next part of the talk. Pause after a few lines to check students are adding examples to the slides. Then continue. At the end of the talk, students compare answers in pairs. Do not elicit.
2. Refer students to the transcript for track 048 so that they can further check their answers. Ask students to underline the examples in the transcript. You could play the recording again with students following the transcript. Use a visual medium to show the completed slides as a final check.
3. Students discuss the question in pairs. Elicit ideas.
4. Elicit which words students originally circled in Exercise C2. Check the meaning and practise the pronunciation, particularly *element, electron, atom, molecule, mixture.*
   Elicit or suggest words with similar pronunciation of stressed vowels to these words, for example:
   share: *where, air, pair* (same vowel sound /eə/)
   ocean: *hope, no, know* (same vowel sound /əʊ/)
   oxygen: *on, top, solid* (same vowel sound /ɒ/)
   crude: *you, two, who* (same vowel sound /uː/)
   contain: *name, say, day* (same vowel sound /eɪ/)
   join: *oil, enjoy, employ* (same vowel sound /ɔɪ/)

Answers

1.–2.

Elements
- 118, e.g., *hydrogen, oxygen, carbon, iron*
- chemical symbol, e.g., *H, O, C, Fe*
- an element = atom with no. of electrons, e.g., *H = 1, O = 8, Au = 79, U = 92*

Compounds
- many common substances, e.g., *water, carbon dioxide, petrol*
- compounds = two or more atoms = molecules
- atoms can share electrons, e.g., $2H = 10 = H_20$, $C + 20 = C0_2$

Mixtures
- many common substances, e.g., *sea water, atmosphere, crude oil*
- mixtures = elements and compounds = not chemically joined
- e.g., *atmosphere* = N, O, Ar; *sea water* = H_20, *NaCl*

3.–4.
Students' own answers.

Transcript 048

Right. So, let's think about elements first. Look at slide one. As you know, we have lots of elements – in fact, scientists know 118 at the moment, including hydrogen, oxygen, carbon and iron. Each element has a chemical symbol, for example, *H, O, C* and *Fe*. But what is an element? An element is an atom with a particular number of electrons. For example, hydrogen has one electron, and oxygen has eight electrons. There are elements with many electrons, such as gold, with 79 electrons and … um, well, uranium with 92.
Now, many elements can form compounds. Slide two. Many common items are compounds, such as water, carbon dioxide and petrol. A compound is two or more atoms. The atoms join together, chemically. And the result is a molecule. Atoms in compounds make molecules.
For example, two hydrogen atoms join with one oxygen atom to make … H_2O … which is water, of course. Another example is carbon dioxide – one carbon atom joins with two oxygen atoms … which makes … Have you worked it out? CO_2 – carbon dioxide. Maybe you are thinking: *How do the atoms join together?* Well, they share electrons, but I'm not going to explain that today.
OK, finally, we have mixtures – have a look at slide three. Once again, many common items are mixtures, including sea water in the oceans, the atmosphere around us and crude oil – I mean the oil in the ground. So, what's the difference between compounds and mixtures? Well, elements are joined in a compound. They are chemically joined. But the parts of a mixture are not chemically joined. So, for example, in the atmosphere, we have several elements, like nitrogen and oxygen and argon, and in sea water, for example, we have water – H_2O, a compound, and salt, *NaCl*, another compound. Other mixtures, like crude oil, have lots of elements and compounds.

E

Set for individual work, then checking in small groups. Tell students to make a few notes as they listen, then share their ideas at the end. Play the recording. Monitor the group work and try to ensure that they are sharing their understanding.

Feed back, checking the new verb *break down* = get back to the elements in a compound or mixture.

Answers

Students' own answers, but possible answers are:
Scientists must understand composition so they can:

1. break down and get original elements. (We deal with this more later.)
2. add new elements to make new compounds and mixtures – a lot of chemistry is now about making new materials.

Transcript 049

Now, why is this important? Why must we understand the chemical composition of a compound or mixture? Because we can use that knowledge. We can break the compound or mixture down – I mean, we can get the different elements from the compound or mixture. Or we can add other elements to make new materials. Scientists look at the world and say: 'Ah, that's how it works. Now, I can change it, make it better.' Scientists understand the world and build a better one.

Grammar for listening: Recognizing positive and negative sentences

You can work through the box at any suitable point after Exercise D.

Students practised listening for negatives with the verb *be* in Unit 2. Remind students how negatives are formed in the present simple tense and, if necessary, refer them to the Grammar reference on CB page 179.

Go through the information in the box.

Play the recording, pausing after each sentence for students to give their answers.

Answers & Transcript 050

1. Atoms have electrons. ✔
2. Electrons are important in elements. ✔
3. Steel isn't an element. ✘
4. Compounds and mixtures are different. ✔
5. Salt isn't a mixture. ✘
6. Hydrogen and oxygen atoms form water molecules. ✔
7. I don't have a job. ✘
8. I know the answer. ✔
9. We don't work here. ✘
10. They don't have a lesson this afternoon. ✘

F

Set for individual work and the checking in small groups.

Possible answers

Elements
There are 118 elements, like hydrogen, oxygen, carbon and iron.
Each element has a chemical symbol, such as *H*, *O*, *C* and *Fe*.
An element is an atom with a number of electrons. For example, hydrogen has 1 electron, gold has 79 electrons and uranium has 92.

Compounds
Many common substances are compounds, including water, carbon dioxide and petrol.
Compounds have two or more atoms. They are molecules.
Atoms can share electrons, for example, two hydrogen atoms share one oxygen atom, and one carbon atom shares two oxygen atoms.

Mixtures
Many common substances are mixtures, such as sea water, the atmosphere and crude oil.
Mixtures contain elements and compounds, but they are not chemically joined.
For example, in the atmosphere, there are separate elements such as nitrogen, oxygen, argon, and in sea water, there is water or H_2O and salt or *NaCl*.

Thank you for listening

Pronounce chemical symbols from the unit with the correct stress
Be able to use some different phrases for ending a talk
Give a short talk with a clear ending about data, information and action

Speaking skill: Ending a talk

On this occasion, it is best to begin with the Speaking skill. Remind students how to begin a talk (see Unit 1, CB page 11); in particular, making sure you have everyone's attention before starting, greeting and saying your name.

Go through the information in the box. Play the recording for repetition and pronunciation work.

Transcript 051

I hope you enjoyed my talk.
Thank you for listening.
Are there any questions?

A

Remind students about everyday substances. Elicit some examples from the previous lesson – you might even refer them back to the spread if they are struggling.

Tell students they are going to hear a student talk and they must try to guess the everyday substance before the student finishes the talk.

Play the recording, pausing at the end of each sentence. Ask: *What is it?* the first few times and then just look quizzical! Elicit ideas, then play the next part. Even if someone guesses correctly, do not confirm.

Transcript 052

I'm going to talk to you today about an everyday substance.
It is a gas.
It's a compound.
The elements are hydrogen and oxygen.
The chemical formula is H_2O.
We use it to make electricity.
It is water at 100°C.
What is it?
That's right. It's steam. Steam is water at 100°C.
Thank you for listening.
Are there any questions?

B

See also notes in the Teacher's Book Introduction for giving talks. If students have done the previous two units, they should now be more familiar with the procedure for giving a talk.

Once you have divided the class into groups, they can start working on their sentences. Refer students to the relevant Resources page in the Course Book (Group A page 154, Group B page 165, Group C page 170). Monitor and give help where necessary.

Remind students they should make full sentences like the example talk in Exercise A. Check students have agreed on acceptable sentences for each note. Monitor while students are rehearsing their talks. You could also drill some words or sentences with each group.

Answers

Students' own answers.

Pronunciation: Saying chemical symbols

Choose a suitable point during the lesson to exploit the box.

Go through the information. Play the recording and practise pronunciation.

Ask students to give more chemical symbols and formulas.

Transcript 053

H
C
O
Ee
Si
Cl
NH_4
CO_2
$C_{12}H_{22}O_{11}$
CO_2/carbon dioxide
H_2O/water

C

Redivide the class into groups of three. Remind the class about some of the aspects of giving talks they learnt in Units 1 and 2. Point out the task for listeners. They can give answers, but they must use a full question: *Is it (a/n) ...?*

Make sure the student giving the talk stands up. Monitor and make a note of common errors for feedback.

Finding the solution

Understand and practise target vocabulary: mixtures and solutions

Use vocabulary and language from the lesson to complete an information-gap activity

Introduction
Refer students to the lesson heading and subheading. This lesson is about solutions – a particular kind of mixture – but, of course, it is also about finding solutions in a more general sense – to exercises and problems. Students may get the joke by the end!

Ask students if there is a solution. Elicit ideas, but do not confirm or correct. Say they will know the answer by the end of the lesson.

Point out that getting chemicals out of solutions is a basic problem in science. For example, getting the salt out of the salt water in the oceans could help to solve the global fresh water shortage.

A

Set for individual work and pairwork checking. Feed back, going quickly round the class getting answers. Point out the use of *take* (= *have*) for sugar and milk.

Answers

Students' own answers.

B

Set as a quiz, for small groups. Give students plenty of time to answer the questions, then record their answers, e.g., Group 1: 1a, 2b, 3b, etc.

Do not confirm or correct as the answers.

Answers

See Exercise C.

C

Set for individual work and pairwork checking. Monitor and assist.

Feed back on the sentence completions first. Play the recording. Then check the answers to the quiz in Exercise B and find the winning group.

Check the pronunciation of new words:
melt
dissolve
combine
solution
solvent
solute
evaporate
freeze

Write the following three new words on the board:

- *crystallization*
- *distillation*
- *filtration*

Explain that these are the main ways of separating a solute from a solvent in a solution.

Point out that they are going to find out the exact methods in the next exercise.

Answers

B

1. c.
2. b.
3. c.
4. b.
5. a.
6. c.

C

Answers & Transcript 054

1. A cup of coffee is a solution of water, milk, sugar and coffee powder.
2. Solutions are one kind of mixture.
3. Sugar is the solute and water is the solvent.
4. The solute dissolves in the solvent.
5. We can separate some mixtures with physical reactions.
6. For example, we can separate sugar from water by evaporating the water.
7. But we cannot separate milk from coffee with filtration or distillation.

D

Put students into three groups, or sets of Groups A, B and C with a large class. Refer students to the relevant Resources page in the Course Book (Group A page 165, Group B page 166, Group C page 170).

Check students understand that they must answer all the questions for their method only.

Monitor and help where necessary. Try to ensure that, as a group, they have correctly answered all the questions, but do not confirm or correct until Exercise E.

Answers

See Exercise E.

E

Redivide the groups.

1. Set the exercise and demonstrate with one group of three. Give students plenty of time to draw their figure and label it – they can look back to the Resources page, but they mustn't copy from there.
2. Get students to ask and answer the questions from Exercise D.
3. Play the recording. Feed back by going through and pausing at key points for students to complete the sentence.

NOTE This is a deep-end strategy activity where students try to use their existing linguistic resources to explain something. Do not expect students to do very well – the point is they recognize what is to be learnt, and listen more carefully to the model explanation.

Answers & Transcript 055

Crystallization

The solution is in the beaker at the beginning.
You heat the solution with a Bunsen burner.
The solvent evaporates. The liquid changes to a gas.
The solute crystallizes on the sides of the beaker.
You can't make drinking water with this method because the water evaporates.

Distillation

The solution is in the flask at the beginning.
You heat the solution with a Bunsen burner.
The solvent evaporates. The liquid changes to a gas.
The gas condenses in the tube and flows into the beaker.
The solvent is now in the beaker.
The solute is in the flask.
You can make drinking water with this method, because the water changes to water vapour then changes back to water.

Filtration

The solution is in the beaker at the beginning.
You pour the solution into the filter funnel.
The solvent flows into the flask.
The solute stays on the filter paper.
You can make drinking water with this method, but you must filter the water many times and use chemicals in the filter funnel to catch harmful bacteria.

F

Set for group work, or for whole-class work. Feed back, building up the table on the board. Discuss any which the students have problems with.

Extra practice

Ask students to research methods of separating the substances in the mixtures in Exercise F.

Answers

Substance	Mixture/ Solution	Contents	Separation?
air	a solution	gases	distillation
sea water	a solution	salt is dissolved in water	distillation
steel	a solution (alloy)	two solids, iron and carbon	You can't!
blood	a mixture	a liquid and solids	leaving to stand in a test tube, then using a centrifuge (spinning)
bread	a mixture	a solid and a gas	putting in a solvent, e.g., water and filtering, but you lose the gas
crude oil	a solution	liquids, solids and gases	distillation

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English in action: Talking about laboratory instruments

Talk about the purpose of laboratory instruments

Ask and answer questions with *be* and other verbs

Introduction
Exploit the visual. Ask students which instruments they can name. Do not confirm or correct.

A

Set for individual work and pairwork checking. Feed back, making sure students can point to the correct instrument in each case. Drill the pronunciation.

Answers

1. adding liquids to a mixture: pipette
2. holding instruments: stand
3. growing bacteria: Petri dish
4. heating chemicals: Bunsen burner
5. holding filter paper: funnel
6. grinding chemicals to a powder: mortar and pestle
7. distilling substances: retort

B

Make sure students understand who the people are.
Play the recording.

1. Get students to read the question and discuss the answer in pairs.
2. Set the task.
3. Ask each of the questions and ask students to reply, but do not confirm or correct at this stage.
4. Play the recording again for students to check their answers.
5. Drill the questions. Note the intonation for *Wh~* questions: high start and low finish. Then set for pairwork practice.
6. Continue the pairwork, then refer students to the transcript for track 056 to check their answers.

Answers

1. A Liebig condenser.
2. 2 A what?
   3 How do you spell *Liebig*?
   5 How does it work?
   7 What do you do then?
   8 What happens?
   4 What's it for?
   1 What's that called?
   6 Where?
3. See transcript for track 056.

Transcript 056

A: What's that called?
B: It's a Liebig condenser.
A: A what?
B: A Liebig condenser.
A: How do you spell *Liebig*?
B: L-I-E-B-I-G
A: What's it for?
B: It's for changing a gas into a liquid.
A: How does it work?
B: You fill the instrument with water.
A: Where?
B: Here, around the tube.
A: What do you do then?
B: Then you let the gas go into the tube.
A: What happens?
B: The gas condenses on the side of the tube and flows into the beaker.

C

Set up the role plays carefully. Make sure students understand their roles each time. Refer them to the relevant Resources page in the Course Book (Student A page 155, Student B page 165).

Monitor, but do not interrupt or correct unless specifically asked for help. Make a note of common errors and feed back on them at the end.

A + B → an eruption!

Understand a text describing a process
Identify the subject and verb in longer sentences
Explain a chemical reaction

Introduction
Focus on the lesson heading and subheading. Ask students for the meaning of *eruption*. If they don't know, refer them to the visual. Mime an eruption with your hands if necessary. Ask what the lesson heading means. If you mix two household chemicals together, you get *an eruption*.

Elicit the names of some household chemicals, for cooking and cleaning, e.g.:

cooking	**cleaning**
bicarbonate of soda	*washing-up liquid*
yeast	*washing powder*
sugar	*dishwasher power*
salt	*bleach*
vinegar	*cleaning fluid*
lemon juice	*soap*

Subject note
Students have probably done this experiment in their Science classes. Ask if this is the case. Even if they have, it does not reduce the importance of the lesson because here they learn to talk about it in English and to describe the chemical processes in detail, which they may not have done.

A
Exploit the visual. Work through the questions as a whole-class activity.

NOTE Do not get bogged down in the present perfect, even though one of the questions – *Have you ever seen …?* – uses it. Students can just answer *No*, or *Yes* + past simple.

B
Refer students to the heading. Continue with whole-class work. See if students have any ideas.

Elicit ideas to answer the question and put some key vocabulary on the board, e.g., *mix*, *chemicals*, *together*, *pour*, *add*.

If students did this experiment at school, they may know the names of the actual chemicals to create an eruption, but do not confirm at this stage.

Answer
Students' own answers. The idea is to raise interest and questions in the students' minds.

C
Make sure students read the first paragraph only. Get them to cover the rest of the article.

Set the activity for individual work and pairwork checking.

Feed back, orally. Check that students can pronounce the words with the correct stress. Elicit that sulphur dioxide = SO_2.

Answers
(<u>underline</u> = stressed syllable)

1.	<u>cra</u>ter	3	a gas from a volcano
2.	<u>ac</u>tive	2	not dead
3.	sulphur di<u>ox</u>ide	4	send gas, ash and lava out suddenly
4.	e<u>rup</u>tion	1	the hole at the top
5.	ash	6	the liquid matter from the volcano
6.	<u>la</u>va	5	the solid matter from a volcano

D
Get students to cover the first paragraph. Work through the first one or two as examples. Point out that all the endings are noun phrases – so nouns with or without articles and adjectives.

Set for pairwork. Monitor, making a note of sentences which cause difficulties.

Allow students to uncover the first paragraph and self-check.

Get students to cover the first paragraph again and say the full sentences.

Answers
1. A volcano is a kind of <u>mountain</u>.
2. The hole at the top is called <u>a crater</u>.
3. Gas often escapes from the crater of <u>active volcanoes</u>.
4. The gas is water vapour, CO_2 and <u>SO_2</u>.
5. Sometimes, there is <u>an eruption</u>.
6. Ash shoots into <u>the air</u>.
7. Lava pours out of <u>the crater</u>.
8. It travels down the sides of <u>the volcano</u>.
9. The lava reaches speeds of up to <u>700 kilometres an hour</u>.
10. Finally, the volcano goes back to <u>sleep</u>.

Reading skill: Understanding a process

Go through the information with the class. Tell them they will find examples of processes in the text.

Go over the example, then ask students to continue marking the stages individually. Point out that the illustrations show the process, which should help with the new verbs and nouns. Monitor and give help where necessary. Students compare answers in pairs. Elicit answers.

Answers

Firstly, you **(1) make a cone from cardboard** with a hole at the top. Next, you **(2) put a small plastic container in the top**. A holder for pills is good. **(3) Put two spoonfuls of baking soda in the container**. Then you **(4) add a spoonful of washing-up liquid to the baking soda**. It does not take part in the chemical reaction. It is just a liquid to make the 'lava' flow. Next, you **(5) use a pipette to add five drops of red food colouring, and five drops of yellow food colouring**. The colouring isn't important, either. It just makes the 'lava' orange! Finally, you **(6) pour 30 millilitres of vinegar into the container**. The 'volcano' erupts.

E

Ask students to read the final paragraph. Then put students in pairs or small groups to answer the question. Elicit ideas until, hopefully, you get the correct one.

If students are struggling, put the chemical formulas on the board and encourage students to think of the possible products of the chemical reaction:

$NaHCO_3 + CH_3CO_2H \rightarrow$

Answers

They should be able to work out that carbon dioxide is a product of the chemical reaction and that gas causes the eruption. If they are struggling:

$NaHCO_3 + CH_3CO_2H \rightarrow NaCH_3CO_2 + CO_2 + H_2O$

Grammar for reading: Identifying the subject and the verb

Work through the table. Get students to tell you the subject and the verb in each case. Don't worry about the extra information after the verb – this is dealt with later.

Put students into pairs to find the subjects in paragraph 1. Feed back, ideally with a visual medium of the text for marking up.

Answers

(<u>underline</u> = subject of each sentence; **bold** = verb)
<u>A volcano</u> **is** a kind of mountain. At the top, <u>it</u> (a volcano) **has** a round hole called a crater. <u>Gas</u> often **escapes** from the crater of active volcanoes, like Mount Vesuvius in Italy and Mount Fuji in Japan. <u>Most of the gas</u> **is** water vapour, but <u>some of it</u> (the gas) **is** carbon dioxide and <u>some</u> (the gas) **is** sulphur dioxide. Sometimes, <u>an eruption</u> **happens**. Firstly, <u>ash</u> **shoots** into the air. Sometimes, <u>millions of kilograms of ash</u> come out of a volcano and (they) **fly** into the atmosphere. Next, <u>lava</u> **pours** out of the crater and (<u>it</u>) **travels** down the sides at up to 700 kilometres an hour. Finally, <u>the volcano</u> **stops** erupting and (the volcano) **goes back** to sleep. <u>The power of a real volcano</u> **is** enormous, but <u>you</u> **can make** a volcano on your kitchen table. Well, <u>it</u> (the kitchen table volcano) **looks** like a volcano, and <u>some of the products</u> **are** the same.

Extra practice

Get students to make a list of verbs of movement/action in the text.

Answers

add
erupt
escape
flow
make
pour
put
shoot
travel
use

Water, water, everywhere

Identify SVO in written sentences
Practise writing suitable objects in SVO sentences
Research information for, and write a paragraph about, osmosis using the TOWER process

Introduction

Refer students to the subheading. Highlight *global water shortage*. Make sure students understand *global* means *the whole world* and *shortage* means *not enough*. Ask students why there is not enough water. Students might say *too many people*. Point out that we have lots of sea water, and elicit that we can't drink that because of the salt.

Explain that the first part of the lesson builds up information for a solution to this problem.

A

Remind students about processes – from the last lesson. In this exercise, students must try to identify the process from the information. Explain that they will probably be able to identify it, although they may not know the word in English. Try not to give away the final product of this process until students have completed the tasks!

1. The activity focuses on present simple verbs. With weaker classes, you can write all the verbs in random order on the board. Students can then select a verb for each space.
2. Students discuss the answer in pairs. Elicit the answer. Note that the word is almost universal, although the form and pronunciation may be slightly different in other languages.

Answers

1. This process happens in plants. They take in water during the process. Water in the soil passes into the roots. In other words, the roots absorb water. The water travels up the roots to the rest of the plant. The process also happens in the human body. We see it in human digestion. It takes water out of the digestive system into the blood.
   We can demonstrate the process in a simple experiment. A potato in a salt solution gets slightly smaller or shrinks. A potato in fresh water solution expands slightly. Why? Because water flows from a weak solution to a strong solution. At the end of the process, the solutions have the same strength.
2. osmosis

Extra practice

Ask questions or write prompts on the board for students to ask and answer.

What do plant roots do?	They absorb water.
Where does the water go?	It travel up the roots to the rest of the plant.
What does the process do in humans?	It takes water out of the digestive system into the blood.
What happens to the potato in salt solution?	It shrinks.
Why?	Because the water in the potato flows into the salt solution.
What happens to the potato in freshwater?	It expands.
Why?	Because the freshwater flows into the potato.

B

Exploit the visual of the potato experiment and ask students if they did this experiment at school. Give students time to study and understand the diagram.

1. Ideally, do this as a jigsaw reading, with the sentences cut up. Students can do the activity in pairs or small groups, taking turns to explain the process. Monitor and give help where necessary. Feed back.
2. Set for pairwork. Allow students to look at the diagram of the experiment. Monitor and assist.
3. This is a reminder of the key point about osmosis – water flows from a weak solution to a strong solution. The process is trying to produce the same strength in each solution.

Subject note

Notice that osmosis is slightly surprising – the movement is from a weak solution to a strong solution – because, in other cases in nature, it seems that the movement is in the other direction, e.g., hot to cold in water, high pressure to low pressure in the atmosphere.

Answers

1. 2 Fill another beaker with fresh water.
   1 Fill one beaker with a salt solution.
   8 It passes into the potato.
   6 It passes into the salt solution.
   3 Put a raw potato in the first beaker.
   4 Put another raw potato in the second beaker.
   5 The potato in the first beaker loses water.
   7 The potato in the second beaker absorbs water.
2. Students' own answers.
3. Due to water entering or leaving the potato as a result of osmosis.

GED0132_MIScience_TB.indd 53 28/04/2016 14:06

Grammar for writing: Subject, verb, (object), extra information (SVO)

Go over the information in the table.

Objects can be *nouns* or *pronouns*. Note that noun phrases sometimes contain adjectives and prepositions, but these cannot be objects by themselves. This is different from *complements*, which can be nouns or adjectives or prepositional phrases.

Note also that some verbs, e.g., *happens* in the osmosis text, do not need an object.

Ask students to find the S, V and O of some of the sentences in Exercise A. Students could use highlighters to mark up the text. Alternatively, use a visual medium to display some of the sentences and elicit answers.

Answers

nouns and pronouns

Subject	Verb	Object	Extra information
This process	happens		in plants.
They	take in	water	during the process.
Water in the soil	passes		into the roots.
… the roots	absorb	water.	
The water	travels		up the roots …
The process	(also) happens		in the human body.
We	see	it	in human digestion.
It	takes	water	out of …
We	can demonstrate	the process	in a simple experiment.
A potato in a salt solution	gets	slightly smaller …	
A potato in fresh water solution	expands	slightly.	
… water	flows		from a weak solution …
… the solutions	have	the same strength.	

C

Go over the examples and show how *dirty water* changes to *it* in sentence 2. The word *water* is an uncountable word and, therefore, is singular.

Students complete individually, then compare answers in pairs. Check students have used the correct pronoun (*it*, *them*) where appropriate.

Check the vocabulary and content of the sentences, especially:

one billion people = $\frac{1}{7}$ *of the world's population*
polluted rivers
near the coast
distillation – from a previous lesson
energy, e.g., electricity

Get students to cover the sentences. Elicit the content by giving them the beginning of each sentence and asking students to complete them, e.g., *About one billion people in the world don't drink … clean water.*

Answers

1. About one billion people in the world don't drink clean water.
2. They drink dirty water. They often get it from polluted rivers.
3. Scientists must help them.
4. Many of them occupy cities and towns near the coast.
5. But they cannot drink sea water because it contains salt.
6. Distillation can take the salt from sea water, but the process needs a lot of energy.
7. We need a better process to get fresh water.
8. We can use reverse osmosis to get it.

D

Note that this is important preparation for the writing task. Students must be given all the vocabulary and structures which they will need for the next exercise.

Explain that each diagram shows a *pipe*. Check the meaning of *membrane*. Skin is a membrane. Sweat, for example, can pass through skin – from inside to out – and creams (including medicine) can pass through the skin, from outside to in.

Students discuss the questions in pairs or groups. Monitor, checking on common problems with vocabulary and sentence structures.

After a few minutes, elicit some of their ideas. Put model answers on the board, but do not let students write anything! At the end, point out that osmosis and reverse osmosis do not use a lot of energy.

GED0132_MIScience_TB.indb 54 28/04/2016 14:06

Model answers

Osmosis

Firstly, we put a membrane in a pipe.
Fresh water is in one side.
Sea water is in the other side.
Next, osmosis starts.
Fresh water flows into the sea water.
The process does not use a lot of energy.

Reverse osmosis

Firstly, we put a membrane in a pipe.
Fresh water is in one side.
Sea water flows in the other side.
Then, osmosis starts.
Fresh water flows into the sea water.
Next, we put pressure on the salt water.
We reverse the process.
Finally, fresh water flows out of the salt water.
The process does not use a lot of energy.

E

Show students how the notes relate to the model answer on the board, but do not let them copy!

Set for individual work. Monitor and assist.

F

Exercises F and G introduce students to a writing task as a process (see the Teacher's Book Introduction).

In pairs, students exchange their draft paragraphs and edit each other's work. Show students how they should edit each other's work. If necessary, elicit, agree on and write a checklist on the board:

- Read and check you can understand the sentences.
- Circle any mistakes: grammar, spelling, punctuation. BUT don't correct!
- Add any other comments, e.g., handwriting, vocabulary, etc.

Monitor while students are editing to check it is being carried out correctly. However, it may take a few lessons before students understand how to edit effectively.

G

Students should now be looking at their own work, which has been edited by another student. They should use the marking symbols provided by their partner to make corrections and then produce a final draft. Monitor to check students understand the exercise and give help where necessary. The final version can be done in class or for homework. The best examples could be displayed.