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Cambridge Lower Secondary

Science

WORKBOOK 8

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1 Respiration

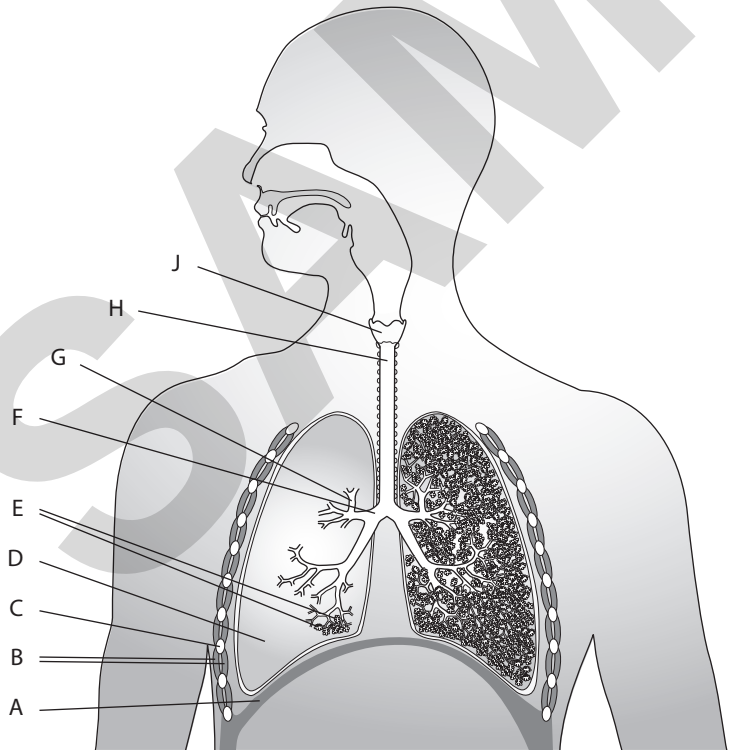
1.1 The human respiratory system

Exercise 1.1 Structure and function in the respiratory system

This exercise helps you to recognise the parts of the respiratory system on a diagram. You can then try describing their functions, and think about what it would be like to travel down through the system.

Focus

The diagram shows the human respiratory system.



1 Complete the table by naming each of the parts shown on the diagram.

Choose from these names.

air sacs **bronchiole** **bronchus** **diaphragm** **lung** **larynx (voice box)** **intercostal muscles** **rib** **trachea**

Letter	Name
A	
B	
C	
D	
E	
F	
G	
H	
I	

Practice

2 Describe the function of each of the labelled parts listed in this table.

Letter	Function
C	
D	
E	
F	
G	
H	
I	

Challenge

3 In your own words, describe the pathway that air takes as it travels from outside your body into the air sacs.

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1.2 Gas exchange

Exercise 1.2 Lung surface area and body mass

This exercise provides you with data about six different mammals. You will practise looking for correlations in data, and suggesting explanations for the patterns that you find.

Focus

The table shows the body masses of six mammals. It also shows the total surface area of the air sacs in the mammals' lungs.

Mammal	Body mass in g	Total surface area of air sacs per m^2
human	80000.1	70
mouse	20.2	0.1
rabbit	400.3	8
rat	300.4	0.8
sheep	68000.5	60
fox	20000.5	40

1 The entries in the table are not in a very helpful order.

Complete the table by reorganising the entries in a way that makes it easier to see any patterns in the data.

Mammal	Body mass in g	Total surface area of air sacs per m^2

Practice

2 Describe the relationship between body mass and total surface area of the air sacs.

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Challenge

3 Suggest an explanation for the relationship you have described.

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1.3 Breathing

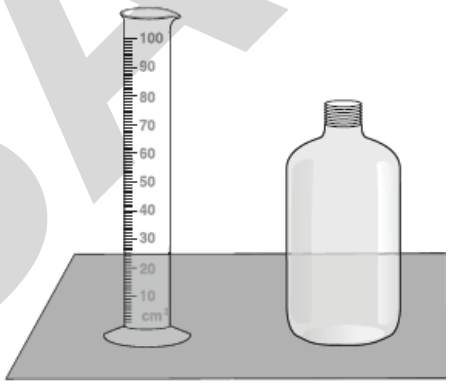
Exercise 1.3A Measuring lung volumes

Focus

In this exercise, you complete a results table. Then you calculate mean values and draw a bar chart.

Sofia and Zara want to know if learners who play wind instruments in the school orchestra can push more air out of their lungs than learners who play stringed instruments.

The girls take a large, empty bottle. They mark a scale on the side to show volumes.



1 Describe how Sofia and Zara can make the scale on the bottle.

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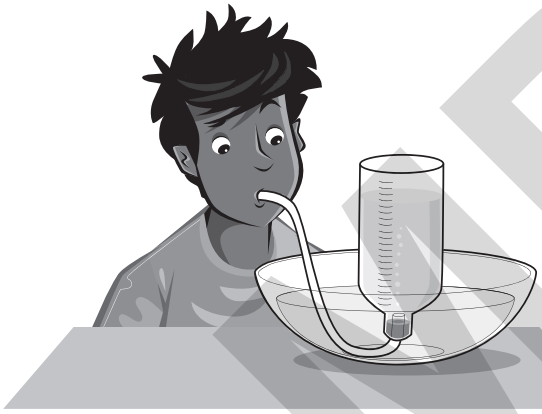
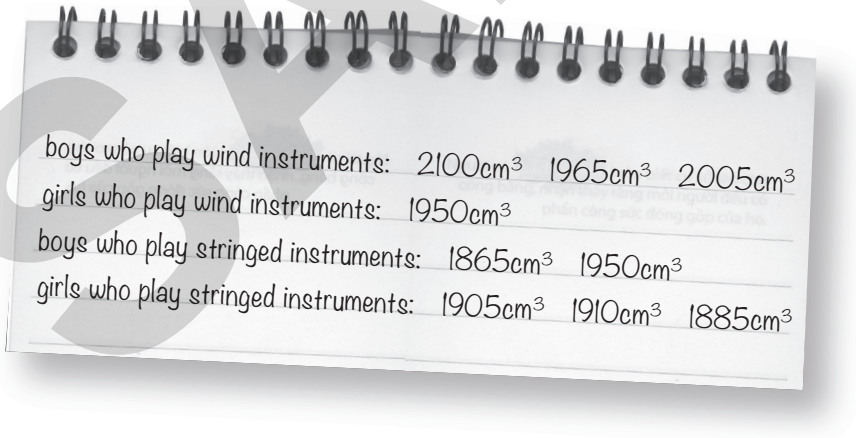
Sofia and Zara fill the bottle with water. They turn the full bottle upside down, with its open top in a large container of water.

Marcus plays a wind instrument. The girls ask Marcus to blow into the bottle as hard as he can. They use the scale to record how much water Marcus can push out of the bottle.

They then test eight more musicians.



Here are the results that Sofia and Zara collect.



2 Complete Sofia and Zara's results table.

Person	Boy or girl	Wind or string player	Volume displaced in cm^3
1	boy	wind	2100

3 Calculate the mean volume displaced (pushed out) for the boys who play wind instruments.

Remember: To calculate the mean of three values, add them up and divide by 3.

Show your working.

..... cm^3

4 Calculate the mean volume displaced for the boys who play stringed instruments.

Show your working.

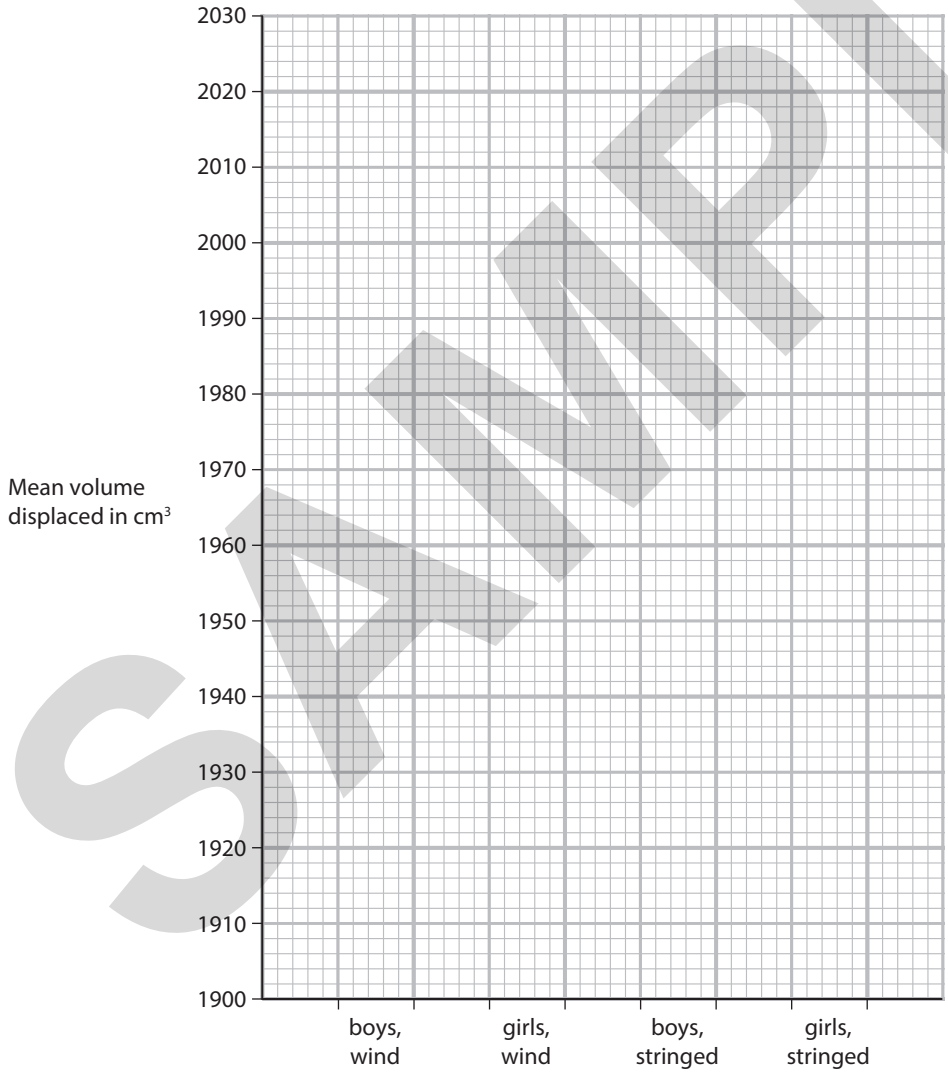
..... cm^3

5 Calculate the mean volume displaced for the girls who play stringed instruments.

Show your working.

..... cm^3

6 Complete the bar chart to show Sofia and Zara's results.



Exercise 1.3B Looking at data on lung volumes

Practice

In this exercise, you will look for patterns in data.

Then you think about how to improve an experiment.

Look at the experiment that Sofia and Zara did, which is described in Exercise 1.3A.

Sofia and Zara discuss what their results show.

1 Is Sofia right? Explain your answer.

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2 Is Zara right? Explain your answer.

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3 The girls' teacher says they cannot draw any definite conclusions from their results.

She asks them to try to improve their experiment.

What will improve the girls' experiment?

Tick (✓) **two** boxes.

- Collecting more results from more people in the orchestra. ☐
- Finding out whether playing a percussion instrument affects lung volume. ☐
- Making three measurements for each person. ☐
- Measuring how fast each person can run. ☐

Exercise 1.3C Lung volume at different ages

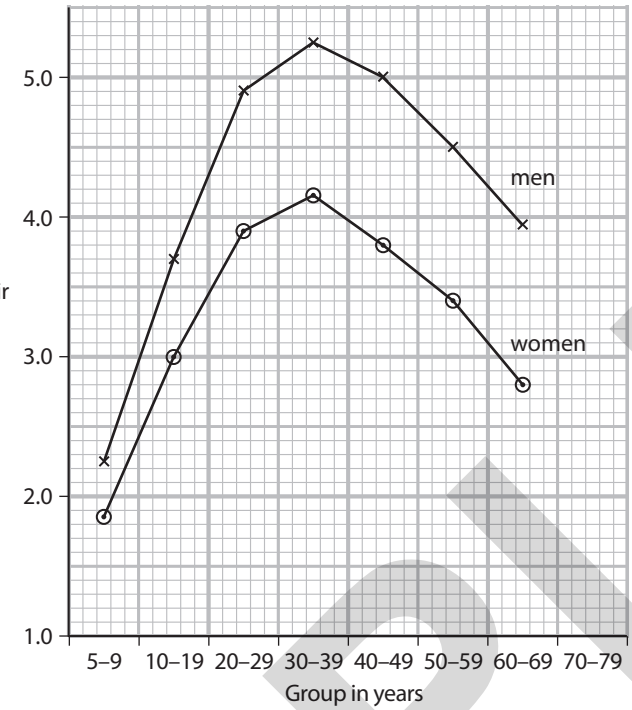
Challenge

In this task, you will practise finding information on a graph. You will do a simple calculation, and use evidence from the graph to make predictions.

Scientists measured the lung volumes of several hundred men and women of different ages. The people were asked to push out as much air from their lungs as they could, in one breath.

The mean values of the volume of air pushed out for each age group were calculated.

The graph shows the results.



1 Suggest why the researchers collected results from several hundred men and women, rather than just a few in each age group.

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2 State the mean volume of air pushed out for women in the 20–29 age group.

Remember to give the unit with your answer.

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3 Calculate the difference between the mean volumes of air pushed out for men and women in the 40–49 age group.

Show your working.

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4 Describe how the mean volume of air that can be pushed out by women changes with age.

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5 Use the graph to predict a value for the mean volume of air that can be pushed out by men aged between 70 and 79.

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1.4 Respiration

Exercise 1.4 Respiration by yeast

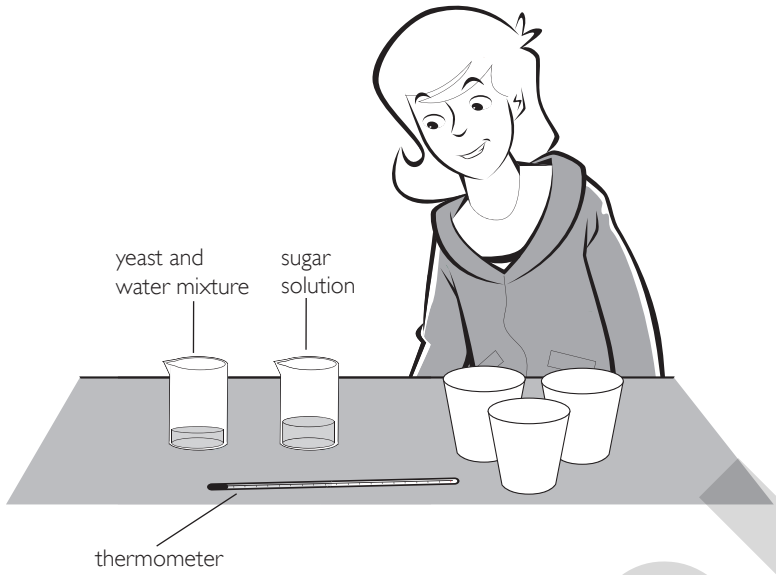
In this exercise, you think about how to choose apparatus, and the correct way to use a thermometer. You make a prediction about temperature change and also think about using this apparatus to plan an experiment to test a hypothesis.

Focus

Yeast is a living micro-organism. Sofia wants to find out what happens to the temperature of yeast when it respires.

She has some yeast mixed with water. She measures 25 cm^3 of it and puts into an insulated cup.

Then she adds 25 cm^3 of sugar solution.



1 One piece of apparatus that Sofia needs is missing from the diagram.

State what this apparatus is, and why Sofia needs it.

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2 Sofia measures the temperature of the mixture of yeast and sugar solution in the cup.

How should Sofia measure the temperature?

Tick (✓) **all** the correct statements.

Hold the thermometer in the liquid and then take it out to read it carefully. ☐

Stand the thermometer in the cup so it is resting on the bottom. ☐

Hold the thermometer in the liquid and stir gently. ☐

Make sure her eyes are level with the meniscus to read the temperature. ☐

Practice

3 Predict what will happen to the temperature of the mixture in the cup.

Explain your prediction.

Prediction .....

Explanation .....

.....

4 Sofia has missed out something very important from her experiment.

What has she missed out?

Look at what Sofia is trying to find out.

Think about what she needs to do to be sure any temperature change she measures is due only to the yeast respiring.

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Challenge

5 Describe how Sofia could use her apparatus to test this hypothesis:

> The more sugar the yeast is given, the faster it will respire.

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1.5 Blood

Exercise 1.5A The components of blood

Focus

In this exercise, you will think about the three components that make up blood.

Human blood has three components:

- plasma
- red blood cells
- white blood cells.

1 Which of these three components is a liquid?

.....

2 Which of these three components have nuclei?

.....

3 Which component has each of these functions?

a transporting oxygen from the lungs to all the respiring cells in the body

.....

b protecting against pathogens that have got into the body

.....

c transporting blood cells, nutrients and carbon dioxide

.....

Exercise 1.5B Functions of blood components

Practice

In this exercise, you will think about suitable words to complete sentences about blood.

Choose the best words to complete the sentences.

antibodies **bacteria** **carbon dioxide** **cytoplasm**
glucose **haemoglobin** **least** **like** **most nucleus**
oxygen **plasma** **unlike**

Blood contains a pale yellow liquid, called ..... .

This liquid carries red blood cells and white cells around the body.

It also transports several different substances in solution, including ..... and ..... .

Red blood cells are the ..... abundant cells in the blood.

Their function is to transport ..... from the lungs to all the cells in the body that are respiring. To help them to do this, they contain a red pigment called. .....

White blood cells, ... red blood cells, contain a nucleus.

Their function is to destroy pathogens, such as ....., that get into the body. Some of them do this by producing chemicals called ....., which attach themselves to the pathogens and kill them. Other white blood cells kill pathogens by taking them into their ..... and digesting them.

Exercise 1.5C Rats at altitude

Challenge

In this challenging task, you will use information to make a prediction. You will draw a graph to display a set of results, and think about the design of an experiment.

Red blood cells carry oxygen around the body. At high altitudes, there is less oxygen in the air.

A team of scientists did an experiment to find out how the number of red blood cells in rats changed when the rats were taken to high altitude.

1 Make a prediction about what might happen to the number of red blood cells when the rats were taken to high altitude.

Explain your prediction.

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This is what the scientists did.

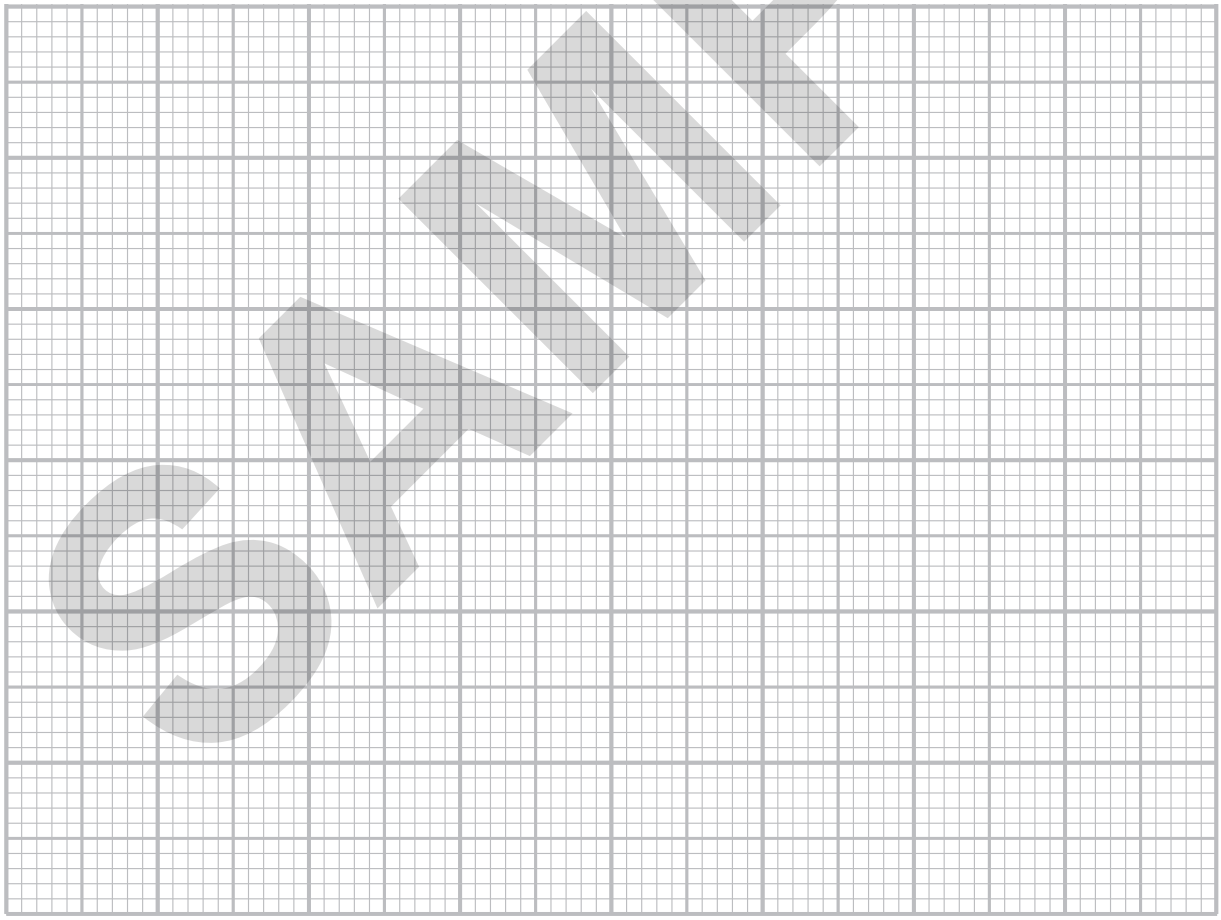
- They kept one group of rats at sea level, and took another group to high altitude.
- They took blood samples from each rat on days 1, 3, 7, 15 and 20.
- They measured the number of red blood cells in a certain volume of blood from each rat. This is called the red blood cell count.
- They calculated the mean red blood cell count for each group of rats.

The table shows their results.

Time in days	Mean red blood cell count	
	Rats at sea level	Rats at high altitude
1	6.5	6.5
3	7.0	8.5
7	6.5	10.0
15	6.5	10.5
20	7.0	11.5

2 On the grid, construct line graphs to show these results.
Draw two lines on the same pair of axes.

Tip: Take care with the scale on the horizontal axis.



3 What was the independent variable in the experiment?

.....

4 What was the dependent variable in the experiment?

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5 Suggest **two** variables that the scientists should have kept the same.

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6 Calculate the increase in red blood cell count for the rats at high altitude from day 1 to day 20.

Show your working.

.....

7 Use your answer to question 6 to calculate the mean rate of increase per day.

Show your working.

.....

8 After 20 days, the rats at high altitude were taken back down to sea level.

Predict what would happen to their red blood cell count over the next few weeks.

Explain your answer.

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2 Properties of materials

2.1 Dissolving

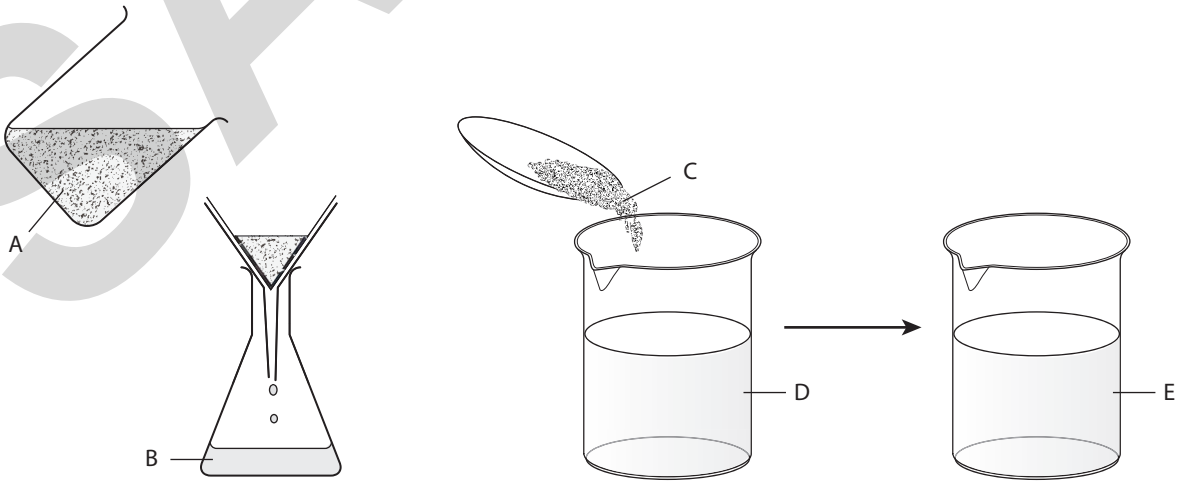
Exercise 2.1A Using the correct scientific term

Focus

This exercise will help you to use the correct scientific terms.

Use the terms given below to label the diagrams. Each term may be used once, more than once or not at all.

dissolves	**solution**	**filtrate**	**solute**
mixture	**solvent**	**solid**	**volume**



A .....

B .....

C .....

D .....

E .....

Exercise 2.1B What is the difference between these terms?

Practice

In this exercise, you will practise explaining the difference between terms.

1 Explain the difference between the terms transparent and opaque.

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2 Explain the difference between the terms dissolving and melting.

.....

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3 Distinguish between the terms solute, solvent and solution.

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Exercise 2.1C Explaining observations

Challenge

In this exercise, you will explain the reasons behind some observations.

When 20 g of salt is added to a beaker containing 100 g of water the salt dissolves and seems to disappear as a solution is formed.

1 What is the mass now? .....

2 Explain your answer.

.....

.....

› 2.2 Solutions and solubility

Exercise 2.2A Using the correct scientific term

Focus

This exercise will help you to use the correct scientific terms.

Use the terms given below to complete the sentences. Each term may be used once, more than once or not at all.

concentrated	solubility	saturated solution
soluble	insoluble	diluted

1 A substance that will not dissolve in water is .....

2 Solution A has more solute particles in it than solution B. Solution A is more ..... than solution B.

3 Sofia has added more and more copper sulfate to a beaker of water until no more will dissolve. She has made a ..... of copper sulfate.

4 Copper sulfate dissolves in water so it is said to be ..... in water.

5 Marcus has added 50 cm^3 water to a solution of sodium chloride. He has ..... the solution.

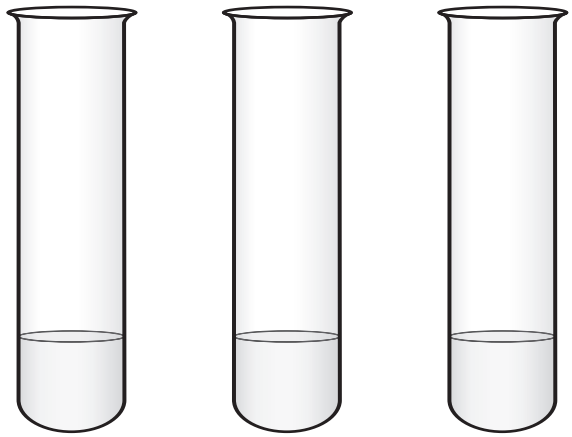
Exercise 2.2B Looking at the solubility of three solutes

Practice

This exercise will help you to interpret results.

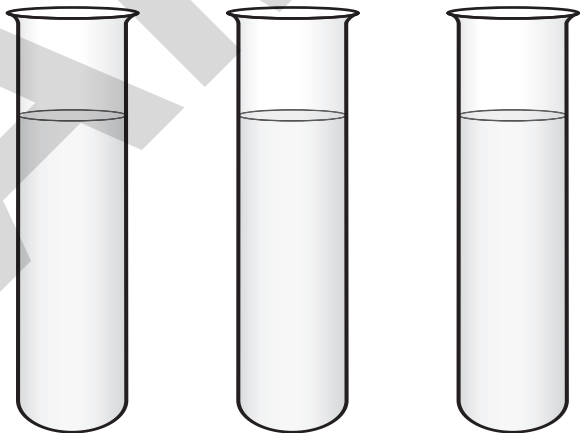
Zara, Arun and Marcus have investigated three solutes, A, B and C to find out how soluble they are. They put water in their test tubes and measured how many spatulas of the solute they could add until no more would dissolve.

Zara has her test tubes ready, with the water added before she starts to add the solutes.



Marcus has his test tubes ready, with the water added before he starts to add the solutes.

Arun has his test tubes ready, with the water added before he starts to add the solutes.



They each use the solutes in the same order and add them to their set of test tubes, working from left to right Here are their results.

Solute used	Number of spatulas of solute used until no more would dissolve		
	Zara	Marcus	Arun
A	3	3	9
B	1	3	3
C	2	3	6

1 Which solute did Zara find was the most soluble? .....

2 Which did she find the least soluble? .....

3 Look carefully at Arun's results. He has a different number of spatulas of solute added compared to Zara but do Arun's results agree with Zara's findings? .....

4 Explain the difference in the reading that Zara and Arun got.

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5 Marcus has the same number of spatulas for all three solutes. Explain why his results are so different from those of Zara and Arun.

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Exercise 2.2C Making up a solution

Challenge

This exercise will help you to work out how to make solutions of the correct concentration.

Arun has a solution of copper sulfate labelled X.

1 Explain how he can make up a 100 cm^3 solution of copper sulfate that is:

a half as concentrated as solution X

.....

.....

b a quarter as concentrated as solution X

.....

.....

c half as concentrated as the solution in part **b**.

.....

.....

2 What steps can Arun take to ensure that his solutions are made up as accurately as possible?

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2.3 Planning a solubility investigation

Exercise 2.3A Dissolving salt

Focus

In this exercise, you will interpret a graph and spot mistakes.

Marcus and Sofia are investigating how much salt they can dissolve in different volumes of water.

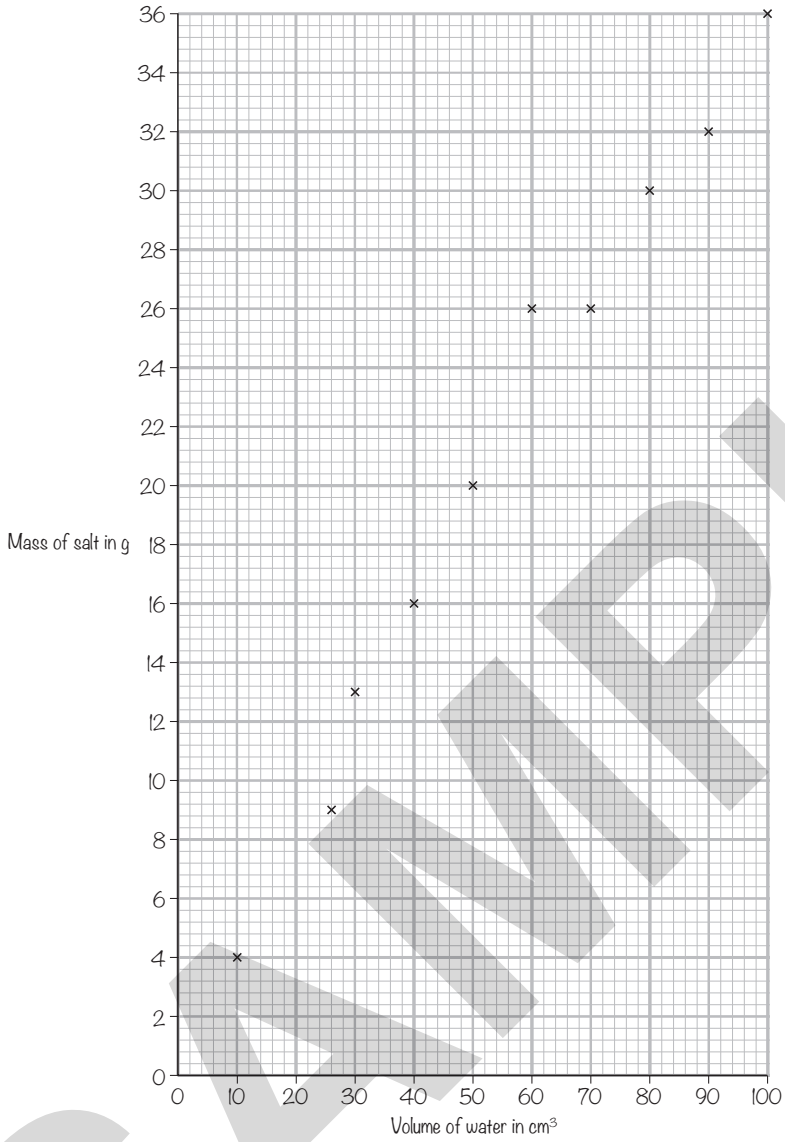
The volume of water they use is the independent variable.

This is what they do. Sofia measures out the volume of water. Marcus places the beaker of water on a top pan balance and adds salt, one spatula at a time, until no more dissolves. He measures the mass of salt added.

Here is their table of results.

Volume of water in cm^3	Mass of salt in g
10	4
20	9
30	13
40	16
50	20
60	26
70	26
80	30
90	32
100	36

Marcus plots this graph from their results.



1 What was Sofia's prediction?

.....

2 Which reading is plotted incorrectly? Draw a **red** circle around it on the graph.

3 Which other point does not fit the pattern of the graph? Draw a **blue** circle around this mass reading in the table, and around the point on the graph.

4 Draw a line of best fit.

5 Describe what the graph shows.

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6 Was Sofia's prediction correct?

.....

Exercise 2.3B Comparing the solubility of two salts: part 1

Practice

In this exercise, you will plan an investigation and interpret some results.

Arun and Marcus are asked to compare the solubility of two salts in water at room temperature. The two salts are labelled X and Y.

1 Name the independent variable in the investigation.

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2 Name the dependent variable in the investigation.

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3 List the control variables in the investigation.

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4 Describe how Arun and Marcus will carry out this investigation. They have access to normal laboratory equipment. You may draw a diagram if this helps your description.

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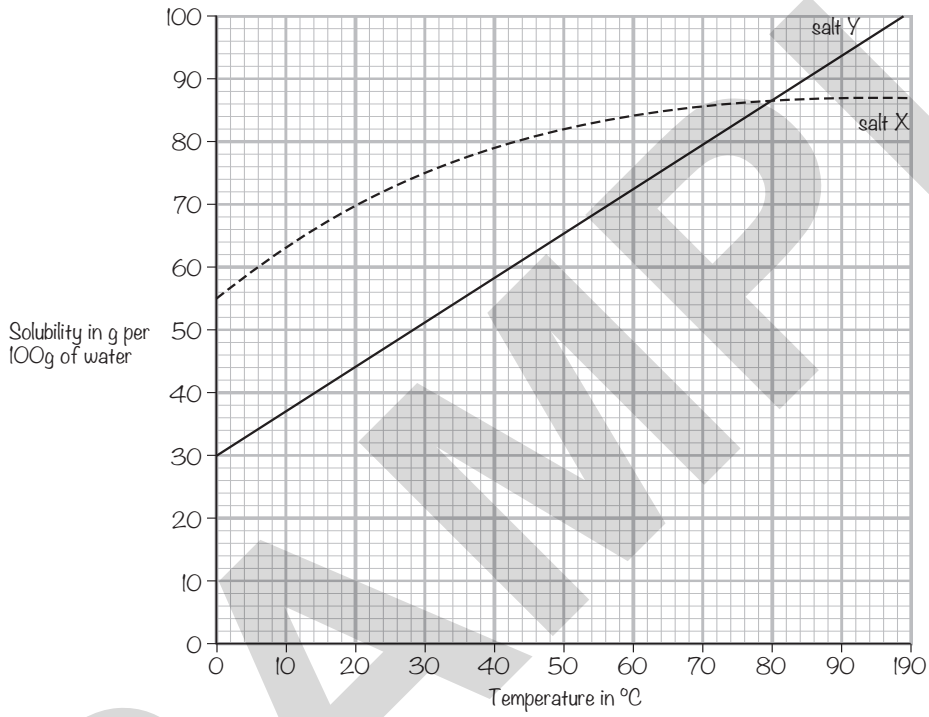
Exercise 2.3C Comparing the solubility of two salts: part 2

Challenge

Arun and Marcus carry out the experiment described in *Comparing the solubility of two salts: part 1*. They find that more of salt X than salt Y can be dissolved in water at room temperature.

The boys then investigate the solubility of these two salts at different temperatures. The graph shows the results of their investigation.



5 At what temperature do the two salts have the same solubility?

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6 Which salt is less soluble at 50 °C? .....

7 Describe what the graph shows about the solubility of salt X.

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8 Describe what the graph shows about the solubility of salt Y.

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2.4 Paper chromatography

Exercise 2.4A Wordsearch

Focus

This wordsearch contains words that are used throughout this unit.

M	O	L	E	N	R	O	C	E	L	O	J	F	L
B	S	O	L	U	T	E	T	S	C	G	W	T	X
S	O	L	A	Y	A	L	K	A	S	L	P	I	E
N	L	C	H	R	O	M	A	T	O	G	R	A	M
I	U	T	I	O	N	G	I	U	L	R	K	C	K
E	T	U	D	E	R	M	O	R	P	A	I	M	T
D	I	L	U	T	E	B	R	A	E	P	A	T	E
S	O	L	V	E	N	T	A	T	M	H	S	E	A
U	N	P	R	Y	R	N	X	E	L	F	K	S	K
V	D	E	M	S	A	W	C	D	S	J	A	S	H
D	I	K	D	I	S	S	O	L	V	E	T	M	T
F	L	O	D	B	I	B	C	A	C	L	H	I	X

Exercise 2.4B Paper chromatography

Practice

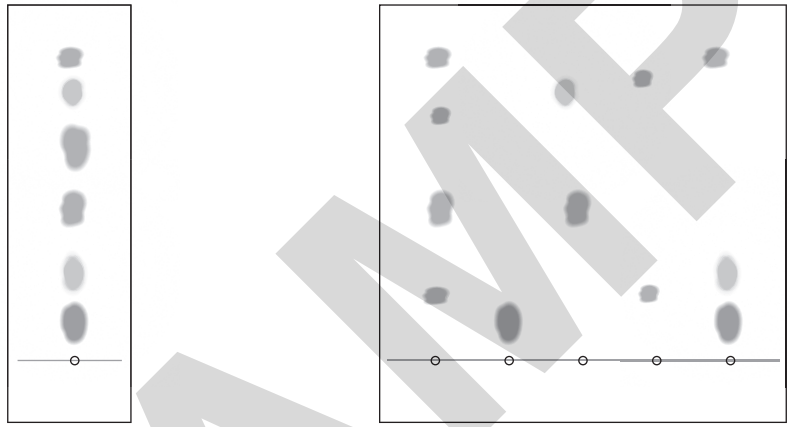
This exercise will give you practice in interpreting a chromatogram.

A food scientist is testing the food colouring used in drinks sold for children. She has to check that any colouring used does not contain any banned chemical.

She places drops of the drink on chromatography paper. She uses water to allow the colouring to separate.

She also makes another chromatogram of all the permitted chemical colourings. If she finds anything that does not match with these colourings, she will have to carry out further tests.

The diagrams show her two chromatograms.



chromatogram from the drink

chromatogram of the permitted chemicals

1 Why is the spot of drink placed above the water line at the start of the process?

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2 How many different colourings has the scientist found in the drink?

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3 Draw a circle around the dye in the drink that is **not** on the permitted list of colourings.

4 Explain why the scientist should carry out further tests on this colouring found in the drink.

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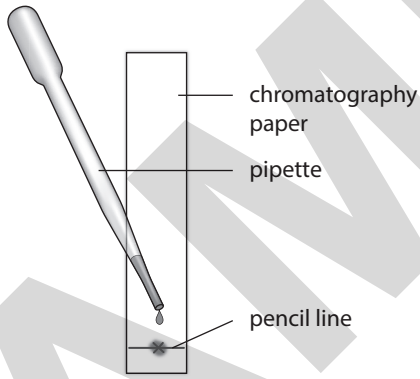
Exercise 2.4C Paper chromatography with plant material

Challenge

This exercise will give you practice in interpreting a chromatogram.

Sofia has been given some liquid that has been extracted from the petals of a flower. She wants to find out if it is a pure substance or if it is a mixture. She places drops of the liquid on a piece of chromatography paper. The diagram shows what she did.



She was careful to allow each drop of liquid to dry before adding another drop. She placed the paper into a beaker containing water and waited to see the result.

After about 15 minutes she saw that the water had moved up the paper but the drop of liquid had not.

1 Explain why this happened.

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2 What should Sofia try now?

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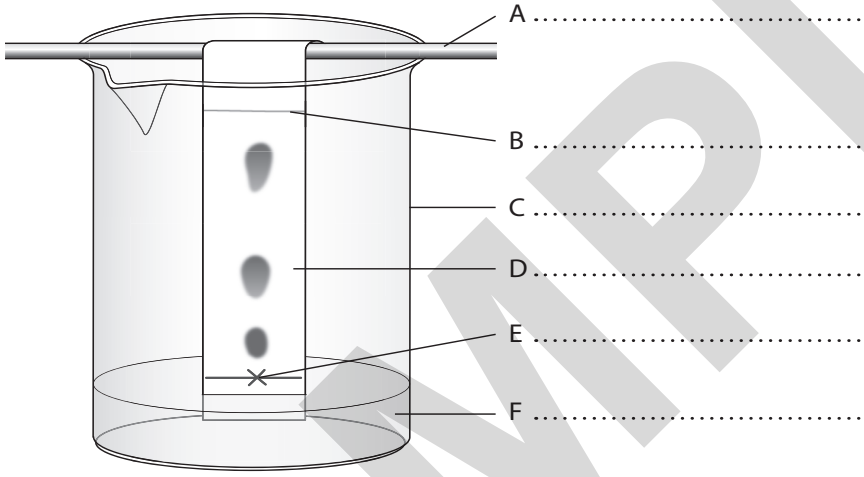
After Sofia changed her investigation, she produced this chromatogram.

3 Label the chromatogram.



4 Why did Sofia dry the drops of liquid before she added more?

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5 Is the colour from the petals pure or a mixture? How do you know this?

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6 Explain how the liquid was separated.

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