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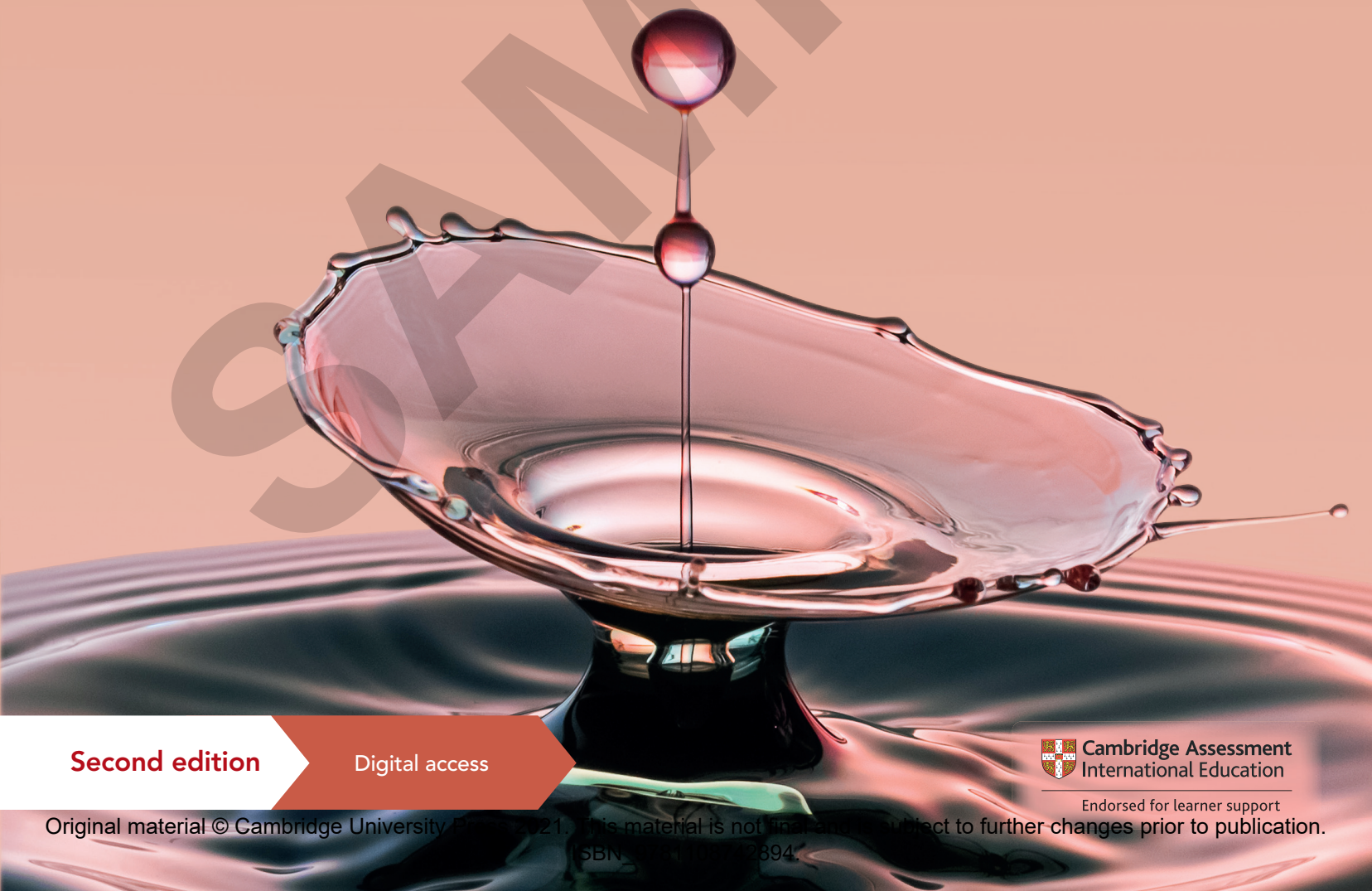
Cambridge Lower Secondary Science

WORKBOOK 9

Mary Jones, Diane Fellowes-Freeman & Michael Smyth



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Science

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Contents

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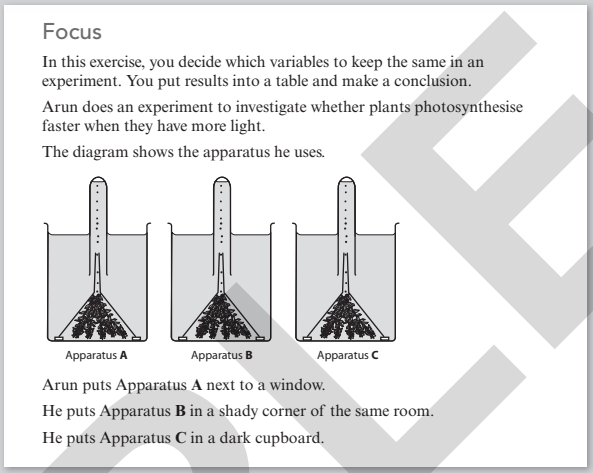
How to use this book

This workbook provides questions for you to practise what you have learned in class. There is a topic to match each topic in your Learner's Book. Each topic contains the following sections:

Focus: these questions help you to master the basics



Focus

In this exercise, you decide which variables to keep the same in an experiment. You put results into a table and make a conclusion.

Arun does an experiment to investigate whether plants photosynthesise faster when they have more light.

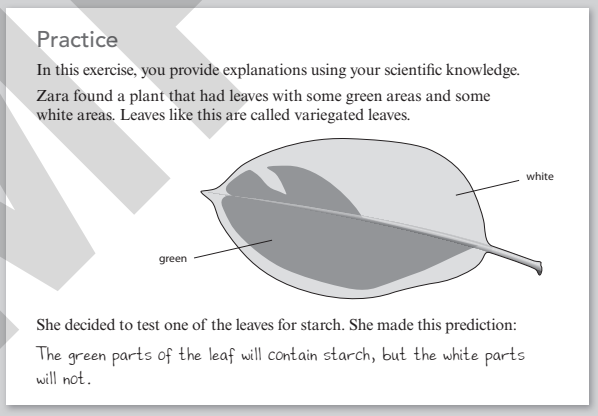
The diagram shows the apparatus he uses.

Arun puts Apparatus **A** next to a window.

He puts Apparatus **B** in a shady corner of the same room.

He puts Apparatus **C** in a dark cupboard.

Practice: these questions help you to become more confident in using what you have learned



Practice

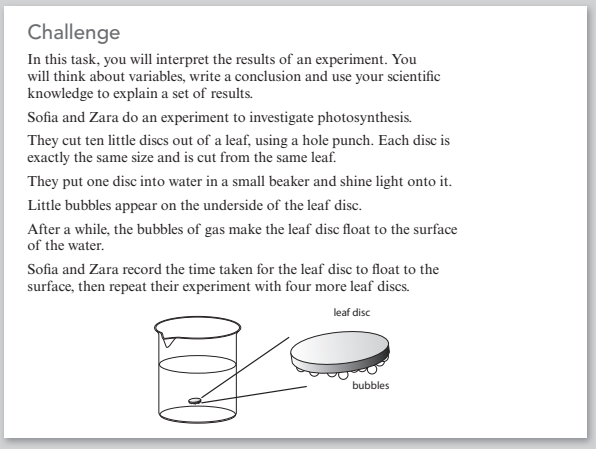
In this exercise, you provide explanations using your scientific knowledge.

Zara found a plant that had leaves with some green areas and some white areas. Leaves like this are called variegated leaves.

She decided to test one of the leaves for starch. She made this prediction:

The green parts of the leaf will contain starch, but the white parts will not.

Challenge: these questions will make you think very hard



Challenge

In this task, you will interpret the results of an experiment. You will think about variables, write a conclusion and use your scientific knowledge to explain a set of results.

Sofia and Zara do an experiment to investigate photosynthesis.

They cut ten little discs out of a leaf, using a hole punch. Each disc is exactly the same size and is cut from the same leaf.

They put one disc into water in a small beaker and shine light onto it.

Little bubbles appear on the underside of the leaf disc.

After a while, the bubbles of gas make the leaf disc float to the surface of the water.

Sofia and Zara record the time taken for the leaf disc to float to the surface, then repeat their experiment with four more leaf discs.

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1 Photosynthesis and the carbon cycle

1.1 Photosynthesis

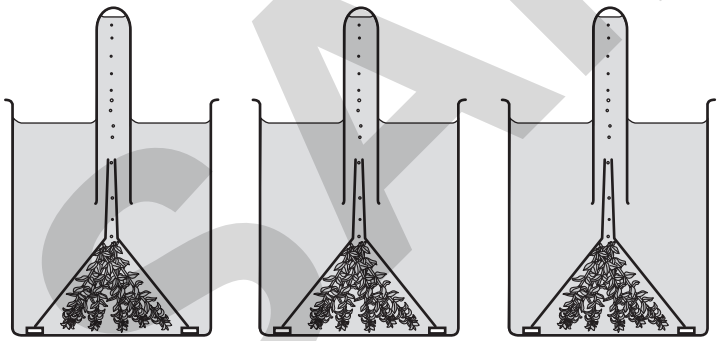
1.1A How light level affects photosynthesis

Focus

In this exercise, you decide which variables to keep the same in an experiment. You put results into a table and make a conclusion.

Arun does an experiment to investigate whether plants photosynthesise faster when they have more light.

The diagram shows the apparatus he uses.



Apparatus **A** Apparatus **B** Apparatus **C**

Arun puts Apparatus **A** next to a window.

He puts Apparatus **B** in a shady corner of the same room.

He puts Apparatus **C** in a dark cupboard.

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1 What should Arun keep the same for all three sets of apparatus?

Tick (✓) **three** boxes.

the amount of light ☐

the type of plant ☐

the mass of the plant ☐

the number of bubbles ☐

the temperature ☐

Arun leaves his three sets of apparatus for two days. Then he measures the volume of gas collected in each test tube.

This is what he writes down.

A 18.3 cm^3

B 7.2 cm^3

C 0,5 cm^3

2 Complete Arun's results table.

Apparatus	Amount of light	
A		
B		
C		

3 What conclusion can Arun make from his results?

Tick (✓) **one** box.

Plants need chlorophyll for photosynthesis. ☐

Plants that live in water photosynthesise more slowly than plants that live on land. ☐

Plants photosynthesise faster when they have more light. ☐

Plants use water for photosynthesis. ☐

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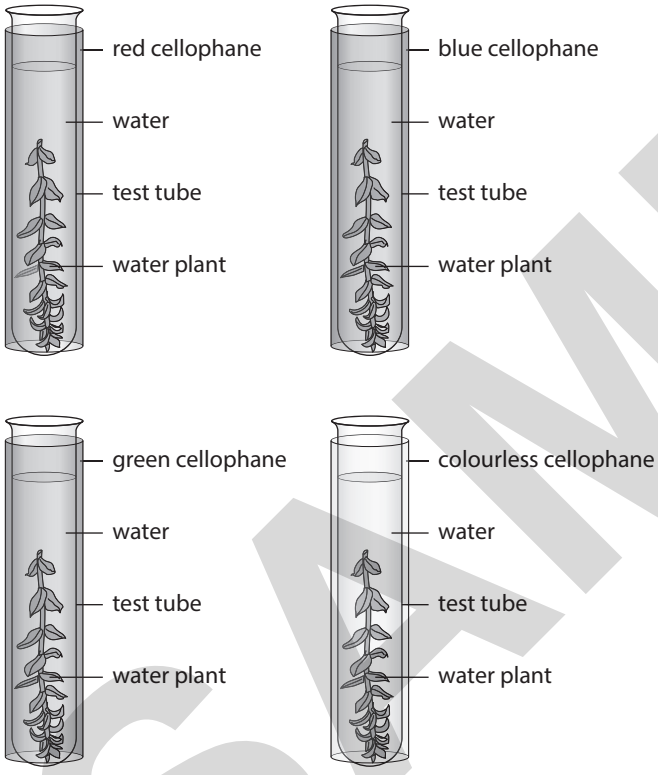
1.1B The effect of different colours of light on the rate of photosynthesis

Practice

This exercise gives you practice in recording results, and also thinking about variables in an experiment.

Marcus wanted to find out which colour of light would make a plant photosynthesise fastest.

The diagram shows the apparatus that he set up.



Marcus shone a light onto each tube. He counted the number of bubbles that the water plant gave off in one minute. He did this three times for each piece of pondweed.

These are his results.

red – 10, 12, 11

blue – 8, 12, 10

green – 4, 5, 6

colourless – 11, 13, 12

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1 What was the variable that Marcus changed in his experiment?

.....

2 What was the variable that Marcus measured in his experiment?

.....

.....

3 List three variables that Marcus should have kept the same in his experiment.

first variable .....

second variable .....

third variable .....

4 Draw a results table in the space below, and fill in Marcus's results so that they are easy to understand. Remember to include a column where you can write in the mean value for each set of results.

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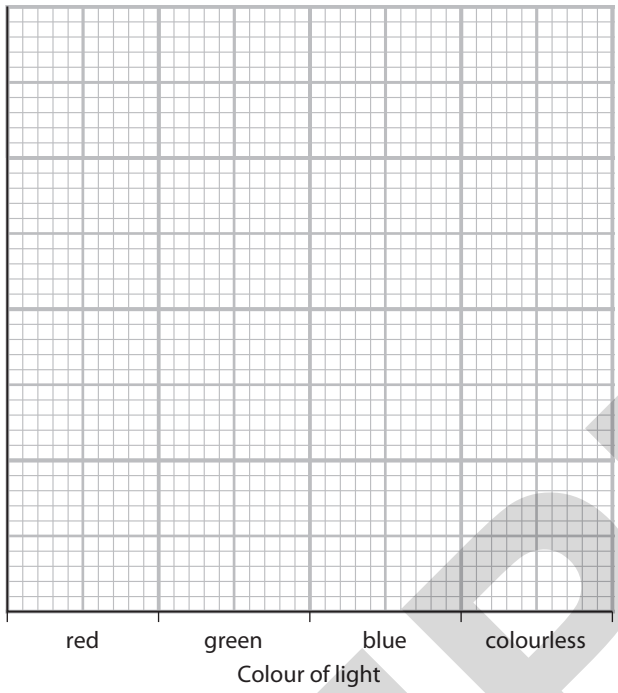
5 Complete the bar chart to show Marcus's results.



6 Write down a conclusion that Marcus can make from his results.

.....

.....

.....

1.1C Turning an idea into a hypothesis that can be tested

Challenge

In this challenging task you will choose an idea and then turn it into a hypothesis that can be tested by scientific experiment. Then you will write a plan for the experiment.

Here is an idea about water plants and photosynthesis.

Idea: Carbon dioxide is one of the raw materials for photosynthesis. We can provide extra carbon dioxide to a water plant by bubbling carbon dioxide gas into the water. This could allow the water plant to photosynthesise faster.

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1 Use the idea to write down a hypothesis that you could test by doing an experiment.

Check your hypothesis with your teacher before you move on to question 2.

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2 Use the next two pages to write a plan for an experiment you could do, to test your hypothesis.

- Try to make your plan really clear and detailed, so that someone else could follow it to do your experiment.
- Include a labelled diagram of the apparatus you would use.
- Draw a results chart, with headings.
- Predict what you think the results might be, giving a reason for your prediction.
- Remember to state your independent variable, dependent variable, and the variables that you will try to keep the same.

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1.2 More about photosynthesis

1.2A Duckweed experiment

Focus

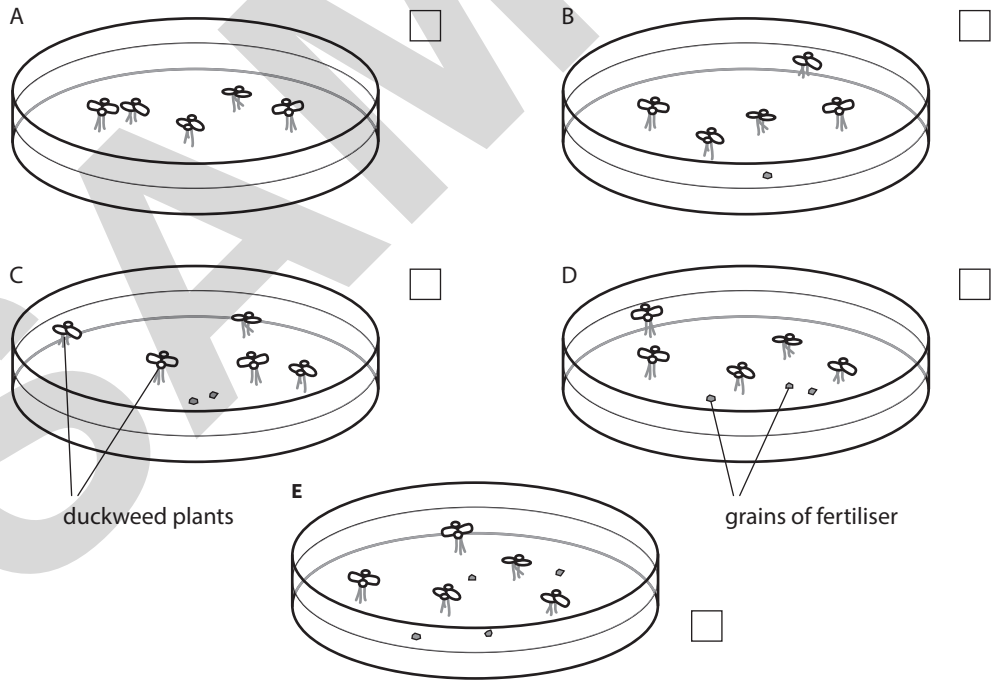
In this exercise, you practise planning experiments, recording results and making conclusions.

Sofia does an experiment to find out if extra nitrate fertiliser helps duckweed plants to grow faster.

She takes five dishes and puts the same amount of distilled water into each of them. She labels the dishes **A**, **B**, **C**, **D** and **E**.

She adds one grain of fertiliser to dish **B**, two grains to dish **C**, three grains to dish **D** and four grains to dish **E**.

She puts five duckweed plants into each dish.



1 Write the number of grains of fertiliser that Sofia puts into each dish in the boxes next to each diagram.

2 Which variable does Sofia change in her experiment? Tick (✓) the correct answer.

number of duckweed plants ☐

volume of water ☐

quantity of fertiliser ☐

3 Which variables should Sofia keep the same in her experiment? Tick (✓) all the correct answers.

number of duckweed plants ☐

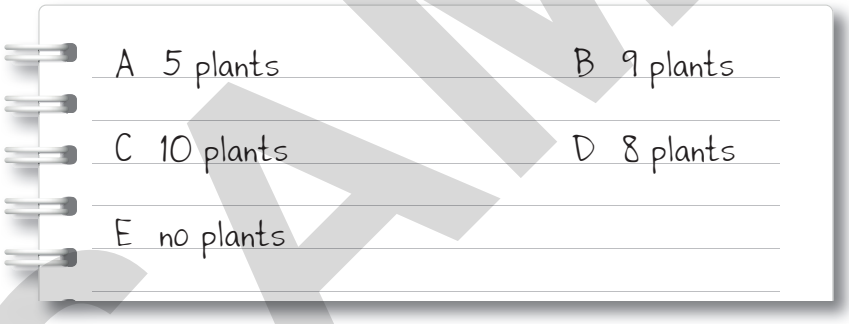
quantity of fertiliser ☐

light intensity ☐

volume of water ☐

temperature ☐

After two weeks, Sofia counts the number of duckweed plants in each dish. She writes the results in her notebook.



4 Complete the results chart.

Dish	Number of grains of fertiliser	Number of plants at end of experiment
A	0	5

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5 Draw a bar chart to display Sofia's results.

Put 'number of grains of fertiliser' on the horizontal axis.

Put 'number of plants at end of experiment' on the vertical axis.

Sofia says:

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6 Explain how Sofia's results support her conclusion.

.....

.....

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.....

7 How can Sofia improve her experiment?
Tick (✓) the correct answer.

Use three sets of dishes for each quantity of fertiliser. ☐

Use a different kind of water plant in each dish. ☐

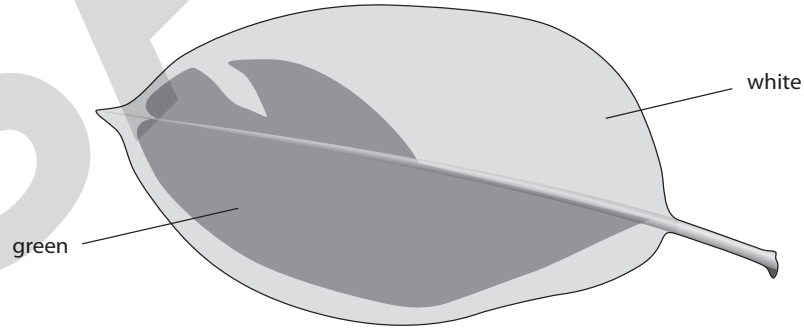
Put each dish in a different temperature. ☐

1.2B Testing a variegated leaf for starch

Practice

In this exercise, you provide explanations using your scientific knowledge.

Zara found a plant that had leaves with some green areas and some white areas. Leaves like this are called variegated leaves.



She decided to test one of the leaves for starch. She made this prediction:

The green parts of the leaf will contain starch, but the white parts will not.

1 What is the substance that makes leaves green?

.....

2 Explain why Zara's prediction is likely to be correct.

.....

.....

3 First, Zara put the leaf into boiling water, and left it there for 5 minutes.

Explain why she did this.

.....

.....

4 Next, she took the leaf out of the water and put it into some hot alcohol.

Explain why she did this.

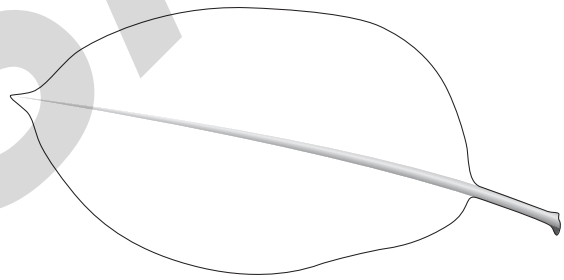
.....

.....

5 Lastly, Zara dipped the leaf into water and spread it out on a white tile. The leaf looked white.

She added iodine solution to the leaf. Some parts of the leaf went orange-brown, and some went blue-black.

On the diagram below, shade in the parts of the leaf that would go blue-black, if Zara's prediction was correct.



6 What substance causes the iodine to turn blue-black?

.....

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1.2C Floating discs experiment

Challenge

In this task, you will interpret the results of an experiment. You will think about variables, write a conclusion and use your scientific knowledge to explain a set of results.

Sofia and Zara do an experiment to investigate photosynthesis.

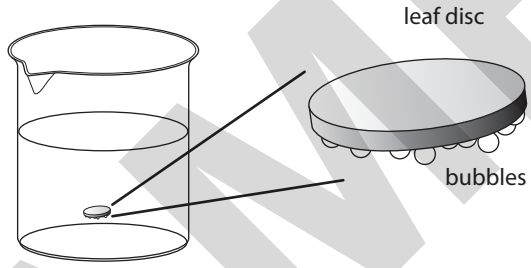
They cut ten little discs out of a leaf, using a hole punch. Each disc is exactly the same size and is cut from the same leaf.

They put one disc into water in a small beaker and shine light onto it.

Little bubbles appear on the underside of the leaf disc.

After a while, the bubbles of gas make the leaf disc float to the surface of the water.

Sofia and Zara record the time taken for the leaf disc to float to the surface, then repeat their experiment with four more leaf discs.



1 Name the gas that the leaf disc produced when it photosynthesised.

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2 Explain why the bubbles of gas formed on the underside of the leaf, not on the top.

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3 In what way does the time taken for the leaf disc to rise depend on the bubbles of gas? Explain your answer.

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Sofia and Zara do the investigation again, but this time they put the beaker and the leaf discs in a room with only dim lighting.

Here are the girls' results from both tests.

	Time taken for leaf disc to rise to the surface, in seconds					
Conditions	Try 1	Try 2	Try 3	Try 4	Try 5	Mean
bright light	14	3	12	14	11	
dim light	44	66	69	77	71	

4 Suggest the hypothesis that the girls were testing.

.....

.....

5 What was the independent variable in the girls' experiment?

.....

.....

6 Sofia thought that there was one anomalous result in each row of their results table.

Draw circles around the two anomalous results in the table.

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7 Calculate the mean times taken for each row in the results table. Write your answers in the last column.

Remember not to include the anomalous results when you calculate the mean.

8 Suggest why the times taken for the five leaf discs to rise in each of the lighting conditions were not all the same.

.....

.....

9 Write a conclusion for the girls' experiment.

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10 Suggest an explanation for the difference between the mean times for the leaf discs to rise in bright light and in dim light

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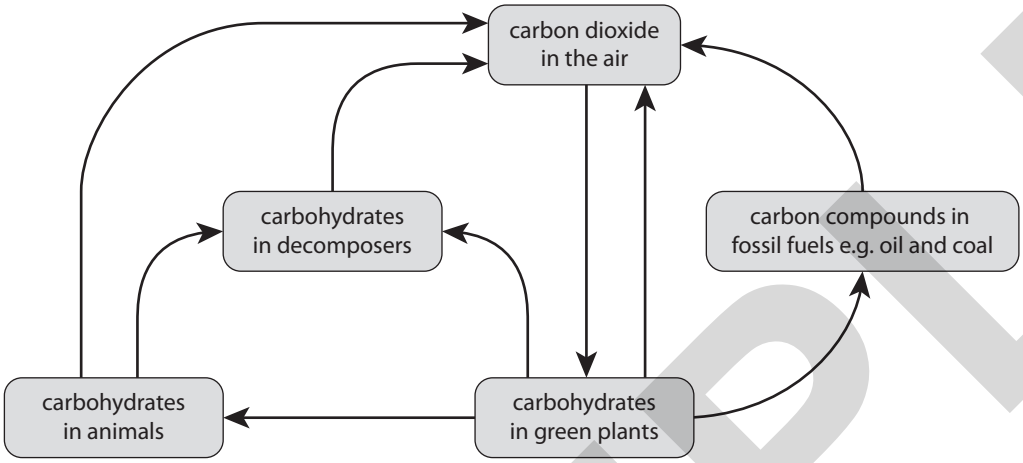
1.3 The carbon cycle

1.3 Completing a carbon cycle diagram

The diagram shows part of the carbon cycle.



Focus

1 On the diagram, write these labels next to the correct arrows:

R next to three arrows that show respiration

P next to one arrow that shows photosynthesis

C next to one arrow that shows fossil fuels being formed

D next to two arrows that show decomposition

F next to one arrow that shows feeding

Practice

Hydrogencarbonate indicator changes colour according to how much carbon dioxide there is in it.

- The indicator is purple when there is no carbon dioxide.
- The indicator is red when there is a low concentration of carbon dioxide.
- The indicator is yellow when there is a high concentration of carbon dioxide.

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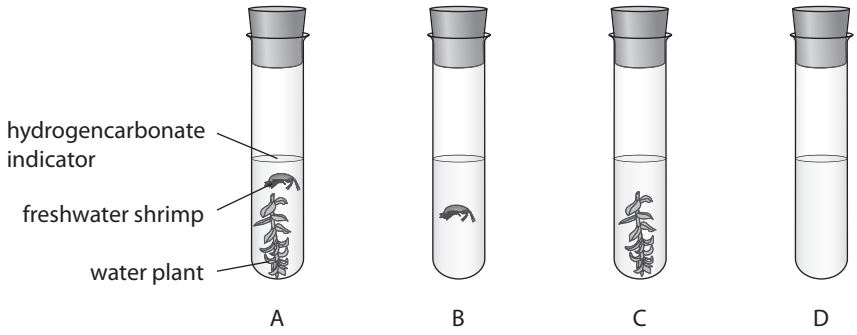
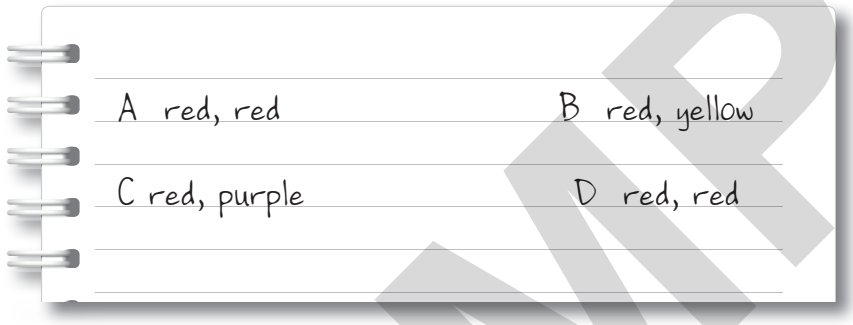
Arun set up four boiling tubes like this:



Arun recorded the colour of the indicator in each tube at the start of his experiment. Then he left the tubes in the laboratory for two hours, and recorded the colour again.

This is what he wrote down.



2 Suggest why Arun put a bung in each tube.

.....

.....

3 Describe two variables that Arun kept the same in his experiment.

.....

.....

4 Construct a results table in the space below, and complete it to show Arun's results.

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5 Explain Arun's results.

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Challenge

6 Use Arun's results, and the diagram of the carbon cycle, to explain the importance of plants in maintaining a stable concentration of carbon dioxide in the atmosphere.

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1.4 Climate change

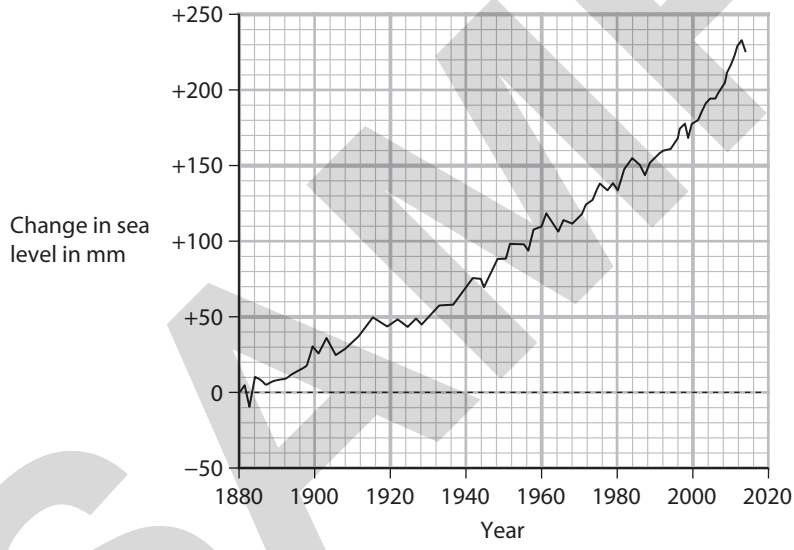
1.4 Interpreting graphs about climate change

In this exercise, you look at graphs displaying data collected by NASA (the USA's National Aeronatutics and Space Adminstration) and NOAA (the USA's National Oceanic and Atmosphere Adminstration). You will need to study the graphs carefully to answer the questions, and also use your own knowledge about photosynthesis, the carbon cycle and climate change.

Focus

Here are three graphs about climate change.

Graph A



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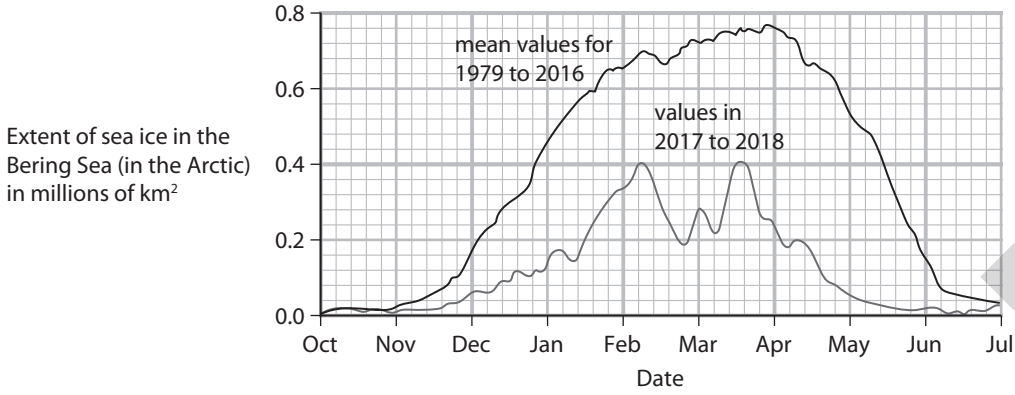
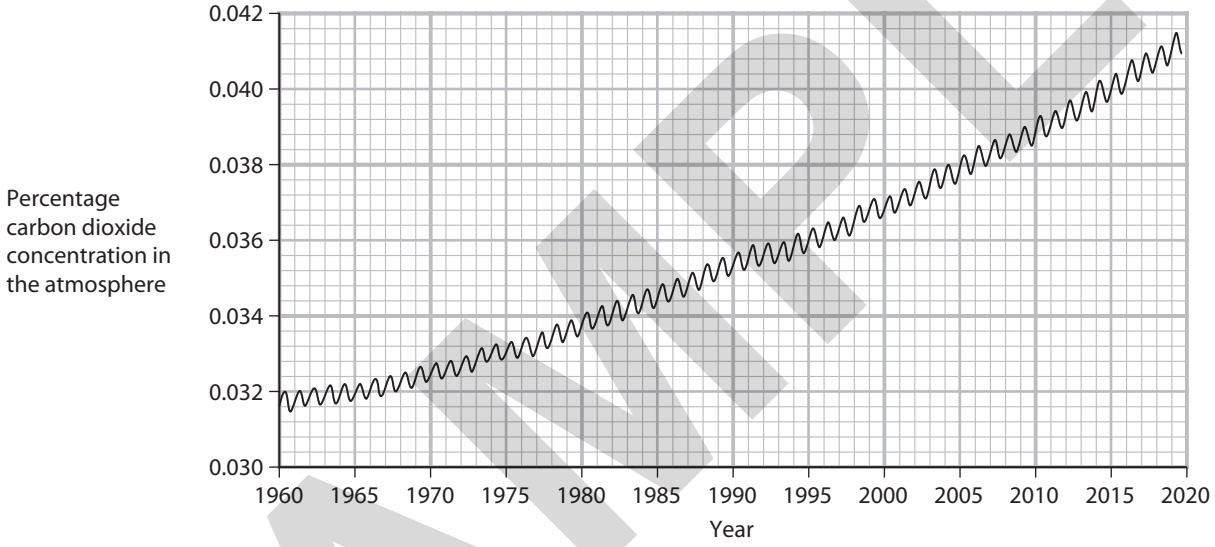
Graph B



Graph C



1 Write the **letter** of the graph that matches each of these statements.

There is more carbon dioxide in the atmosphere now than there used to be. .....

Sea level is steadily rising. .....

Sea ice in the Arctic is present for fewer months in the year now, and there is less of it. .....

Practice

2 Look at graph **A**.

Describe in words what is shown on the graph. Include some figures in your answer, for example by stating the change in sea level since 1880.

.....

.....

.....

.....

.....

3 Look at graph **B**.

Describe **two** ways in which the extent of sea ice in the Bering Sea in 2017 to 2018 differed from the mean extent from 1979 to 2016.

1st way .....

.....

2nd way .....

.....

Challenge

4 Look at graph B again.

What extra data would you want to collect, in order to be certain that the extent of sea ice really is changing? Explain your answer.

.....

.....

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5 Look at graph **C**.

Most scientists think that human activities are contributing to the changes in carbon dioxide concentration shown in the graph.

Use your own knowledge to explain why they think this.

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6 Look at graph **C** again.

The measurements of carbon dioxide concentration were made in Hawaii, which is in the northern hemisphere.

Thinking about plants and photosynthesis, suggest why the line wiggles up and down each year.

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