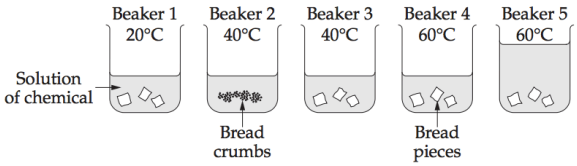
The diagram is a model of a chemical substance.

What does the model represent?

(A) An atom of a compound
(B) An atom of an element
(C) A molecule of a compound
(D) A molecule of an element

A class had to test the effect of temperature on the speed with which a chemical reacts with bread.

They were given a set of beakers with solutions of equal concentration of the chemical to choose from.



Which combination of beakers should they use to ensure it was a fair test?

(A) Beakers 1, 2 and 5
(B) Beakers 3, 4 and 5
(C) Beakers 1, 2 and 4
(D) Beakers 1, 3 and 4

The table shows the number of protons and neutrons in four atoms, *W*, *X*, *Y* and *Z*.

Atom	*Number of protons*	*Number of neutrons*
W	6	6
X	6	7
Y	7	7
Z	7	6

Which of the following correctly identifies atoms that are from different elements, and the evidence for this?

	These atoms are from different elements	*Evidence*
(A)	*W* and *X*	neutrons
(B)	*Y* and *Z*	protons
(C)	*W* and *Y*	neutrons
(D)	*X* and *Z*	protons

During the electrolysis of water the gases hydrogen and oxygen are produced.

The equation for this reaction is shown.

$$2H_2O \rightarrow 2H_2 + O_2$$

What type of reaction is this?

(A) Oxidation
(B) Combustion
(C) Neutralisation
(D) Decomposition

A neutralisation reaction will produce a salt and what other substance?

(A) A base
(B) Hydrogen
(C) Oxygen
(D) Water

Blue litmus paper turns red when placed in an acid. Red litmus paper turns blue when placed in a base.

What do we call chemicals like litmus paper?

Indicators

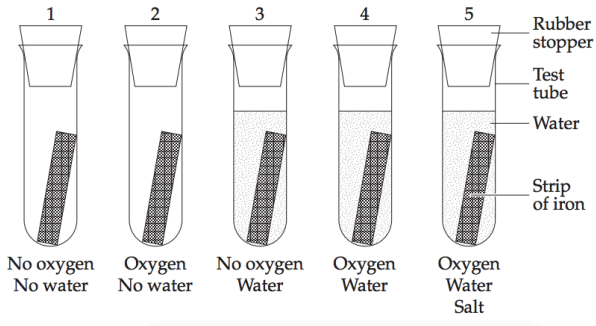
Six steps are involved in applying a scientific process to a problem. In the box below, each step has been given a number, but the steps are not in the correct sequence.

1 Gather experimental results
2 Draw a conclusion
3 Make a hypothesis
4 Compare experimental results with the hypothesis
5 Ask a question
6 Design and carry out an experiment

What is the correct sequence of steps?

(A) 1, 3, 6, 5, 4, 2
(B) 5, 3, 6, 1, 4, 2
(C) 5, 6, 3, 1, 2, 4
(D) 3, 5, 1, 6, 4, 2

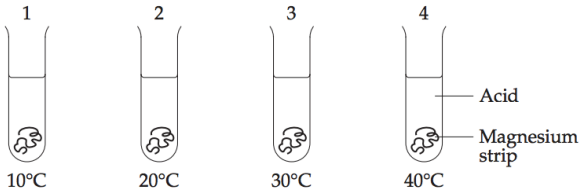
Some students carried out an experiment to determine what causes iron to rust. The students placed iron into test tubes with different conditions and then sealed them. The amount of rust formed was measured.



Identify the following, based on the investigation above:

a) Purpose
b) Independent variable
c) Dependent variables
d) Controls
e) Risk assessment

Students set up an experiment to see how temperature affects a chemical reaction. Four 2 cm strips of magnesium were placed into four test tubes of acid at different temperatures as shown.



The students timed in seconds how long it took for the magnesium to dissolve. The results are shown in the table.

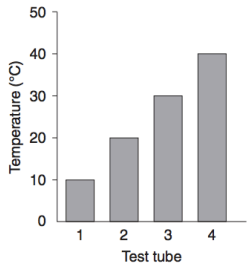
Test tube	1	2	3	4
Temperature (°C)	10	20	30	40
Time (s)	40	30	20	10

Which alternative correctly identifies the independent and dependent variables in the experiment?

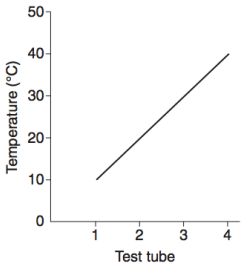
	Independent variable	*Dependent variable*
(A)	Time	Temperature
(B)	Amount of magnesium	Time
(C)	Temperature	Time
(D)	Temperature	Amount of magnesium

Which graph best represents the results of the experiment?

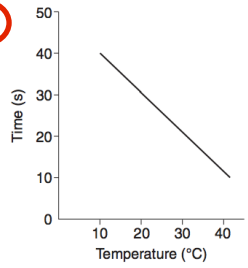
(A)



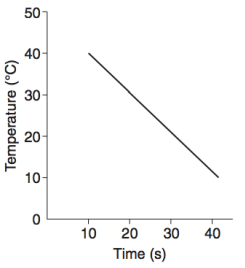
(B)



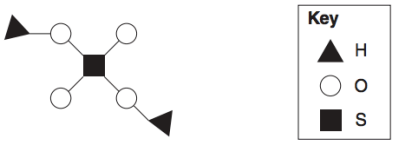
(C)



(D)



The diagram shows a chemical compound.



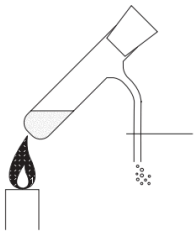
What is the chemical formula of the compound?

(A) S_2OH
(B) H_4OS_2
(C) H_2SO_4
(D) OH_2S_4

Which element is represented by the symbol ▲?

(A) Halogen
(B) Helium
(C) Hydrogen
(D) Hydroxide

A student heated some copper carbonate in a test tube as shown.



The student wrote the following notes in their note book.

1 The solid changed colour from green to black.
2 Carbonates release carbon dioxide gas when heated.
3 The gas collected turned limewater a milky colour.
4 The black solid must be carbon.

Which statement about the notes is correct?

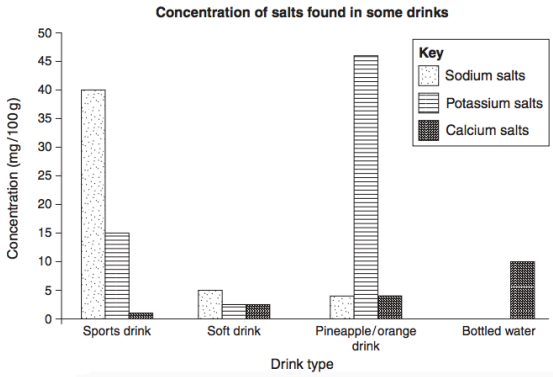
(A) Note 2 is a hypothesis.
(B) Note 4 is an observation.
(C) Notes 1 and 4 are conclusions.
(D) Notes 1, 2 and 3 are observations.

Why is the reaction called a decomposition reaction?

(A) Heat is required.
(B) Carbon dioxide is produced.
(C) Two substances combine to form a larger molecule.
(D) One reactant breaks down into two or more products.

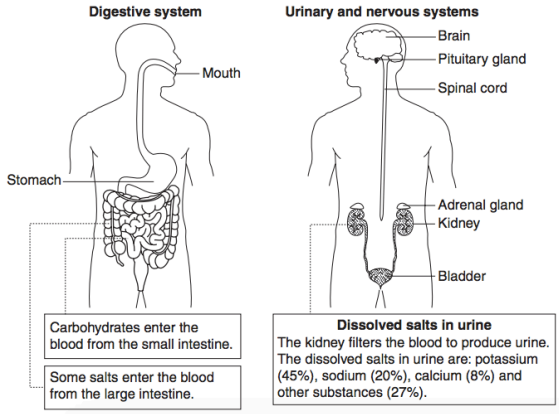
Source *B* – Sports Drinks

Many people believe that sports drinks can improve their athletic performance. The main components of these drinks are carbohydrates and salts (sodium, potassium and calcium). The graph shows the concentration of salts found in some drinks.



What happens to sports drinks in the body

Sports drinks are absorbed by the digestive system and excess salts are removed by the urinary system.



(a) Name ONE variable that was held constant in the students' experiment.

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(b) Outline TWO features of the scientists' experiment that show they have followed correct experimental method.

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(c) What conclusion can be drawn from the scientists' experiment?

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(d) How can the processes used in science help us make informed judgments about claims made in the mass media?

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The burning of coal in power stations produces carbon dioxide.

Which chemical reaction produces the carbon dioxide?

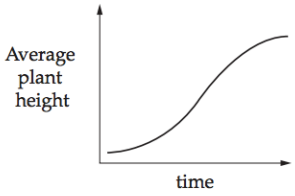
(A) Acidification
(B) Combustion
(C) Decomposition
(D) Neutralisation

The human stomach contains acid. Sodium bicarbonate ($NaHCO_3$) is often found as a component of antacids, which are used to settle upset stomachs. It reacts in a similar way to normal carbonates, causing people to burp.

Why does sodium bicarbonate make people burp?

(A) It produces hydrogen gas.
(B) It solidifies in the stomach.
(C) It produces carbon dioxide gas.
(D) It settles on top of the stomach contents.

Students studied the growth of 100 corn seeds and graphed the results.



Which alternative correctly identifies the independent and dependent variables in their investigation?

	Independent variable	*Dependent variable*
(A)	time	height
(B)	height	time
(C)	time	number
(D)	height	number

This label appeared on a bottle of zinc acetate.

zinc acetate
$Zn(CH_3COO)_2.2H_2O$

Harmful if swallowed.
Avoid contact with eyes.
Irritating to respiratory system.

Which elements make up zinc acetate?

(A) zinc and acetate
(B) zinc, acetate and water
(C) zinc, carbon, hydrogen and oxygen
(D) zinc, carbon, helium, oxygen and water

Which of the following safety equipment is the most important when using zinc acetate in a laboratory?

(A) Gloves
(B) Lab coat
(C) Fire blanket
(D) Safety goggles

What is an example of a neutralisation reaction?

(A) Sodium hydroxide + hydrochloric acid ⟶ sodium chloride + water
(B) Calcium carbonate ⟶ calcium oxide + carbon dioxide
(C) Lead nitrate + potassium iodide ⟶ lead iodide + potassium nitrate
(D) Methane + oxygen ⟶ carbon dioxide + water

A student was studying chemicals found in the kitchen and noted that tea and coffee are both clear brown fluids. If lemon juice is added to both, the tea turns an orange colour but the coffee does not.

Based on these results, which conclusion is correct?

(A) Tea acts as an indicator.
(B) Coffee acts as an indicator.
(C) Both tea and coffee act as indicators.
(D) Neither tea nor coffee acts as an indicator.

Four groups of students (*A*, *B*, *C* and *D*) carried out identical experiments to test reaction time. The results of their experiments are shown.

	Reaction time (seconds)		
Student results	*Trial 1*	*Trial 2*	*Trial 3*
Group A	20	22	21
Group B	22	25	21
Group C	21	23	29
Group D	20	25	25

59 Which group has the least reliable set of results?

60 Calculate the average reaction time for *Group A*.

During your course you carried out first-hand investigations (experiments) to answer scientific questions. You have been asked to present a report on one of these investigations to your class.

(a) State the problem, hypothesis or question that you tested.

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(b) Identify what you measured or observed.

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(c) Briefly describe the features of your investigation that are examples of good experimental design.

In your answer, include:

- how you carried out your investigation to obtain reliable results
- safety considerations
- how you recorded and analysed your results
- your conclusion

The word equations below show two important processes which are part of the global carbon cycle.

Process	*Word Equation*
Photosynthesis	carbon dioxide + water ⟶ glucose + oxygen + water
Respiration	glucose + oxygen ⟶ carbon dioxide + water

Which process will tend to reduce the amount of carbon dioxide in the atmosphere?

The table shows information about four atoms, but some of the information is missing.

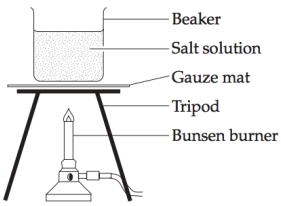
	Protons	*Neutrons*	*Electrons*
W	6	7	___
X	7	7	___
Y	___	8	6
Z	___	8	8

___ missing information

Which two atoms are of the same element?

(A) *W* and *Y*
(B) *W* and *X*
(C) *Y* and *Z*
(D) *Y* and *X*

The diagram shows some apparatus used to measure the boiling point of a salt solution.



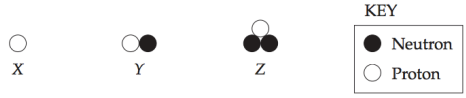
Where should the end of a thermometer be placed to accurately measure the temperature of the salt solution?

Held in middle of salt solution (hand/retort stand & clamp)

Which laboratory equipment would you use to measure the quantity of water and the quantity of salt?

	Equipment to measure quantity of water	*Equipment to measure quantity of salt*
(A)	200 mL beaker	mass balance
(B)	measuring cylinder	mass balance
(C)	measuring cylinder	150 mL beaker
(D)	250 mL beaker	measuring cylinder

The diagram represents models of the nucleus of three atoms.



20 Which statement about models *X*, *Y* and *Z* is correct?

(A) Model *X* is not a nucleus because it does not have any neutrons.
(B) None of the models of the nuclei is correct because none includes electrons.
(C) Models *X*, *Y* and *Z* represent three different elements because they have different numbers of neutrons.
(D) Models *X*, *Y* and *Z* represent nuclei of the same element because they have the same number of protons.

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sulfuric acid + calcium hydroxide → X + water

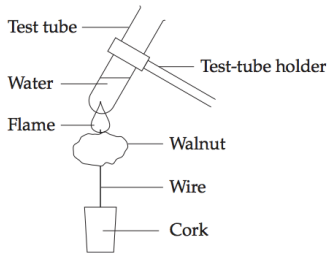
What does X represent in this equation?

(A) carbon dioxide
(B) calcium sulfate
(C) hydrogen
(D) sulfuric hydroxide

What is the name of this type of chemical reaction?

(A) Combustion
(B) Corrosion
(C) Decomposition
(D) Neutralisation

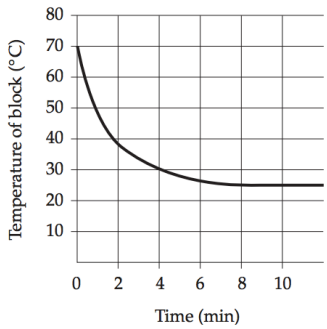
Nathan wanted to investigate how much energy is contained in a walnut. He burned one 3 gram walnut to heat a test tube containing 20 mL of water, and measured the change in temperature.



Which of these would improve Nathan's procedure so that his results will be more reliable?

(A) Use heavier walnuts
(B) Use more than one thermometer
(C) Repeat the investigation under the same conditions
(D) Use cold water at the beginning of the investigation

Mary heated a copper block to 70°C and then cooled it in a waterbath to 25°C. She measured the temperature of the block every minute as it cooled. Mary's results are shown in the graph.



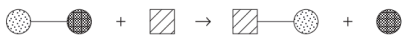
How long did it take for the block to cool to 25°C?

(A) 6 minutes
(B) 8 minutes
(C) 10 minutes
(D) 11 minutes

Under certain conditions, when copper oxide is heated with carbon, the copper oxide will lose oxygen and copper will be formed. The oxygen will combine with the carbon to form carbon monoxide.

= Oxygen = Carbon = Copper

Which set of diagrams represents this reaction?

(A) 
(B) 
(C) 
(D)

Four students investigated whether plants need light to survive. They each set up identical plants in different conditions.

Each student's experiment is shown in the diagram.

Jake

All plants in the dark all the time

Kim

All plants in normal daylight

Mitchell

Half the plants in the dark all the time

Half the plants in normal daylight

Ruby

Half the plants in normal daylight

Half the plants in artificial light

Which student has used a suitable control?

(A) Jake
(B) Kim
(C) Mitchell
(D) Ruby

Which piece of equipment would you use to accurately measure 50 mL of water?

(A) *O*
(B) *P*
(C) *S*
(D) *T*

A reaction occurs when a piece of zinc is added to hydrochloric acid.

Which of the following is a product of this reaction?

(A) Carbon dioxide
(B) Hydrogen
(C) Oxygen
(D) Water

When sodium chloride solution is added to potassium nitrate solution, no solid products are formed. However, when lead nitrate solution is added to sodium iodide solution, a yellow solid forms.

What is the name of the type of chemical reaction that produces the yellow solid?

(A) Corrosion
(B) Decomposition
(C) Neutralisation
(D) Precipitation

What is the yellow solid formed?

(A) Lead iodide
(B) Potassium chloride
(C) Sodium nitrate
(D) Sulfur

Source *A* – Laboratory equipment

The diagram below shows some equipment available in a laboratory.

Which piece of equipment would you use to accurately measure 50 mL of water?

(A) *O*
(B) *P*
(C) *S*
(D) *T*

In an investigation to heat a liquid, the pieces of equipment labelled *M*, *P* and *Q* were selected.

What other piece of equipment is also required?

(A) Gauze mat
(B) Test-tube holder
(C) Thermometer
(D) Watch glass

In the investigation of the decomposition of a solid compound, Alex selected the equipment labelled *M*, *R* and *Q*.

What other piece of equipment should Alex also select?

(A) *N*
(B) *O*
(C) *P*
(D) *T*

Melissa suggested that coffee in plastic cups stays hot longer than thick tomato soup in plastic cups.

Plan a safe experiment to test this idea.

Brendan conducted an investigation in which he:

- mixed two solutions
- filtered the precipitate which formed
- placed some of the solid into a crucible (labelled *N*)
- heated the crucible with a Bunsen burner (labelled *M*) to dry the solid.

Explain why the crucible (labelled *N*) is a more appropriate choice than a beaker (labelled *P*) to dry the solid.

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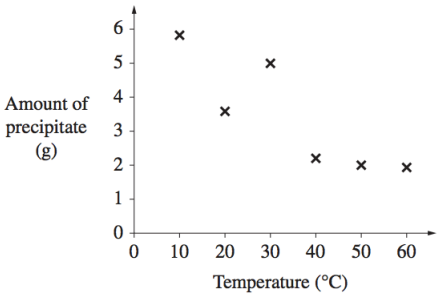
Brendan then wanted to know if the temperature at which the two solutions were mixed affected the amount of precipitate produced.

(i) In the table, list the variable(s) he should keep the same and those that he should change, in order to conduct the investigation.

Variables	
Keep the same	*Change*
.....	.....
.....	.....

(ii) Brendan produced a graph of results from his investigation.



State a conclusion that Brendan could draw from the results of his investigation.

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(c) Brendan explained to another student that he was concerned about the accuracy of his data at 30°C.

State a possible cause for the result at 30°C.

.....

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(d) Brendan's teacher said that the precipitate was not to be washed down the sink when he cleaned up after conducting his investigations.

Suggest a reason for the teacher's instruction.

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