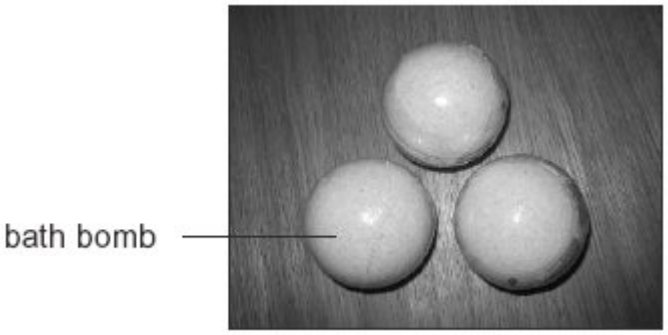
KS3 Science

Word Equations

Question Paper

Time available: 39 minutes
Marks available: 56 marks

1. When bath 'bombs' are dropped into bath water they colour the water and make the water smell of perfume.



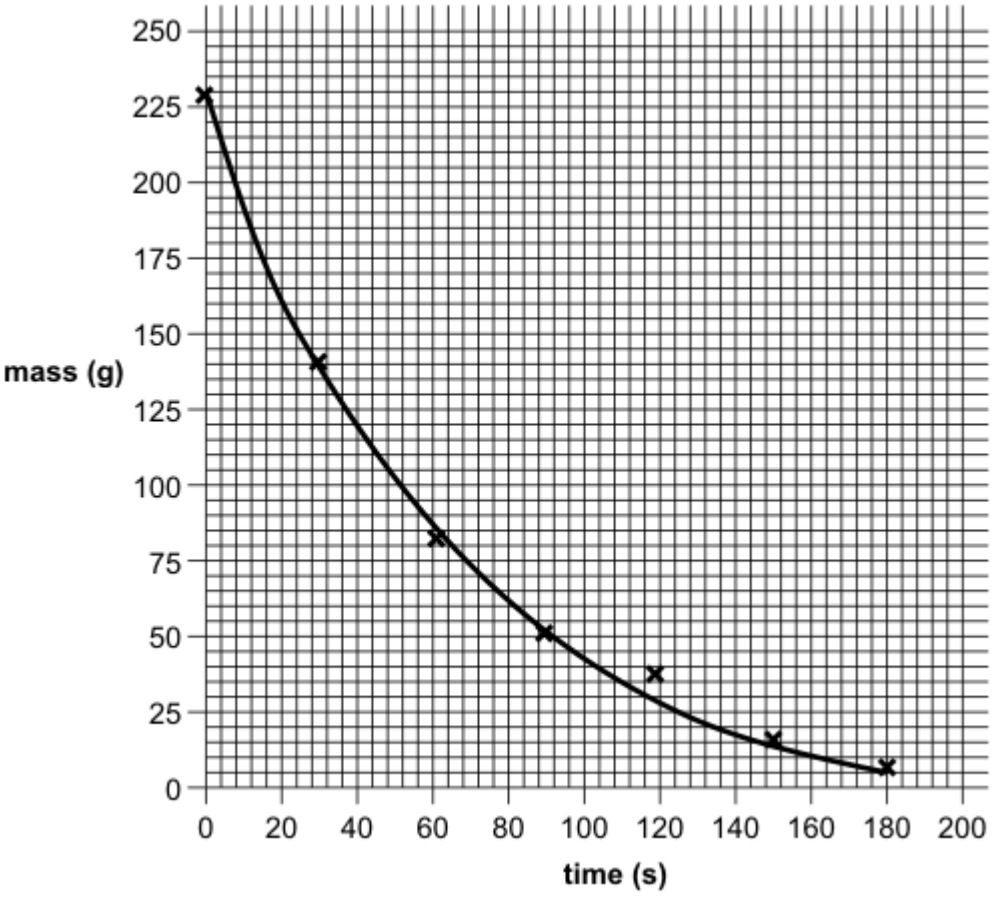
(a) Bath bombs contain citric acid and sodium carbonate. When they react a gas is produced.

Complete the word equation for the reaction that takes place.

citric acid + sodium carbonate → sodium citrate + water + ...

1 mark

(b) A bath bomb was dropped into hot water and its mass was measured every thirty seconds, for three minutes.
The graph below shows the results.



Between which two times on the graph does the mass of the bath bomb decrease fastest?
Tick the correct box.

between 0 s and 30s ☐

between 30 s and 60s ☐

between 90 s and 120s ☐

between 150 s and 180s ☐

1 mark

(c) (i) The bath bomb was 230g at the start.
How long does it take for the mass of the bath bomb to decrease by a half?

..... s

1 mark

(ii) The reactants in a bath bomb were 176g at the start.
129g of sodium citrate and 14g of water are produced in the reaction.
Calculate the mass of gas produced in the reaction.

.....

..... g

1 mark

(d) Some people on cruise ships practise golf. They hit golf balls into the sea.
Turtles can swallow the golf balls. A new type of golf ball has been made from a bath bomb covered in hardened paper to use on cruise ships.

Suggest **one** reason why this type of golf ball might be better for the environment than a normal golf ball.

.....

.....

1 mark

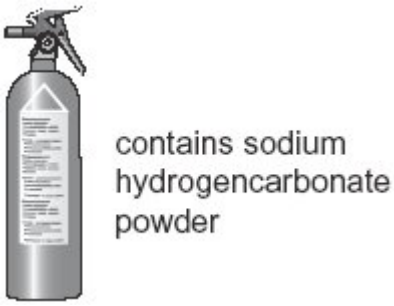
(e) Complete the word equation for the reaction between citric acid and calcium carbonate.
Use the equation in part (a) to help you.

citric acid + calcium carbonate ⟶ water + ... + ...

1 mark

maximum 6 marks

2. (a) The fire extinguisher below contains a compound called sodium hydrogencarbonate.



The formula for sodium hydrogencarbonate is $NaHCO_3$.

When sodium hydrogencarbonate is heated it breaks down to produce carbon dioxide, water and a compound with the formula Na_2CO_3.

This is shown in the equation below.

(i) Complete the word equation below.

sodium hydrogencarbonate $\longrightarrow$ carbon dioxide + water + ... (Na_2CO_3)

1 mark

(ii) Complete the table below to show the mass of water produced when 168 g of sodium hydrogencarbonate breaks down completely.

compound	**reactant or product**	**mass (g)**
sodium hydrogencarbonate	reactant	168
carbon dioxide	product	44
water	product	
Na_2CO_3	product	106

1 mark

(iii) How much carbon dioxide is produced when 336 g of sodium hydrogencarbonate breaks down completely?

..... g

1 mark

(b) The diagram below shows two other types of fire extinguisher.

contains carbon dioxide gas

contains water

To put out a fire, you have to do one or more of the following:

- keep oxygen away from the fire
- take the heat away from the fire
- take the fuel away from the fire.

The density of carbon dioxide is about 1.8 g per 1000 cm^3.
The density of air is about 1.2 g per 1000 cm^3.

(i) Use the information above to explain why carbon dioxide is used to put out fires.

.....

.....

.....

2 marks

(ii) When water from the fire extinguisher is sprayed over a fire, the water evaporates.

Why does evaporation cool the fire down?

.....

.....

1 mark
maximum 6 marks

3. (a) The chemical formula for hydrochloric acid is HCl.
The chemical formula for sodium hydroxide is NaOH.

When they react together, two products are formed.
The chemical formula for one product is NaCl.

(i) Complete the word equation below with the **names** of both products.

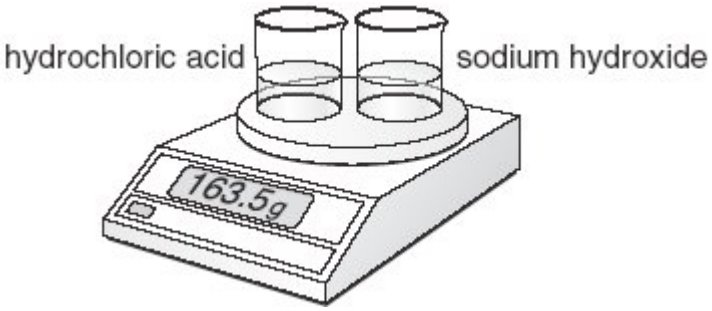
1 mark

(ii) **On the dotted line**, give the chemical formula of the other product.

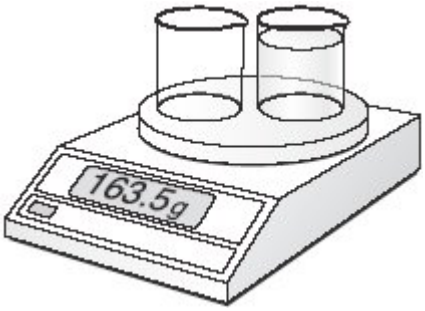
sodium hydroxide	+	hydrochloric acid	⟶	_____	+	_____
NaOH		HCl		NaCl		.....

2 marks

(b) In experiment 1, Molly put two beakers on a balance.
One contained 20 cm^3 of hydrochloric acid.
The other contained 20 cm^3 of sodium hydroxide solution.
The total mass was 163.5 g.



She poured the acid onto the sodium hydroxide. They reacted.



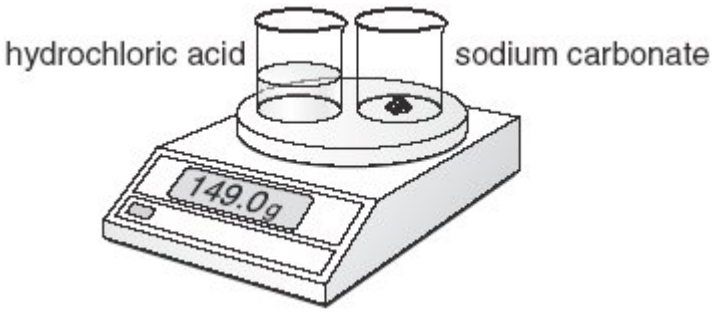
Why did the reading on the balance **not** change?

.....

.....

1 mark

(c) In experiment 2, Molly put two beakers on a balance.
One contained 20 cm^3 of hydrochloric acid.
The other contained 5 g of sodium carbonate.



She poured the acid onto the sodium carbonate. They reacted.
Two of the products are the same as in experiment 1.

(i) Complete the word equation with the names of the **three** products.

sodium carbonate + hydrochloric acid → ..... + ... + ...

1 mark

(ii) The total mass at the start was 149.0 g.
When the reaction stopped, the reading on the balance was 147.0 g.

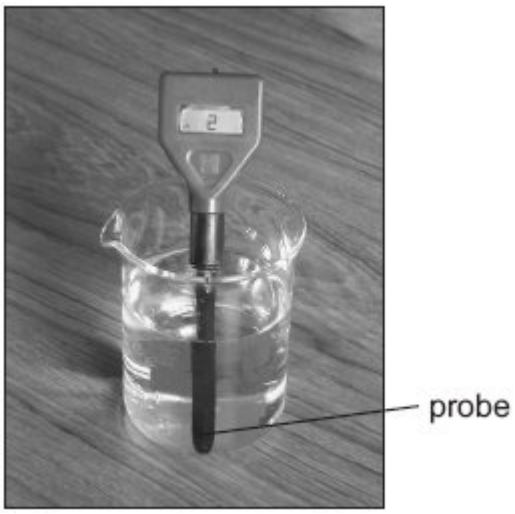
Why was there a loss of mass in this reaction?

.....

.....

1 mark
maximum 6 marks

4. Molly used a pH sensor to test different liquids. She dipped the probe of the sensor into each liquid and recorded the pH value in a table.



(a) In the table below, tick **one** box for each liquid to show whether it is **acidic**, **neutral** or **alkaline**. One has been done for you.

liquid	pH value	acidic	neutral	alkaline
alcohol	7			
dilute hydrochloric acid	2	✓		
distilled water	7			
vinegar	3			
sodium hydroxide solution	11			

2 marks

(b) Between each test Molly dipped the probe into distilled water.

(i) Why did she do this?

.....

.....

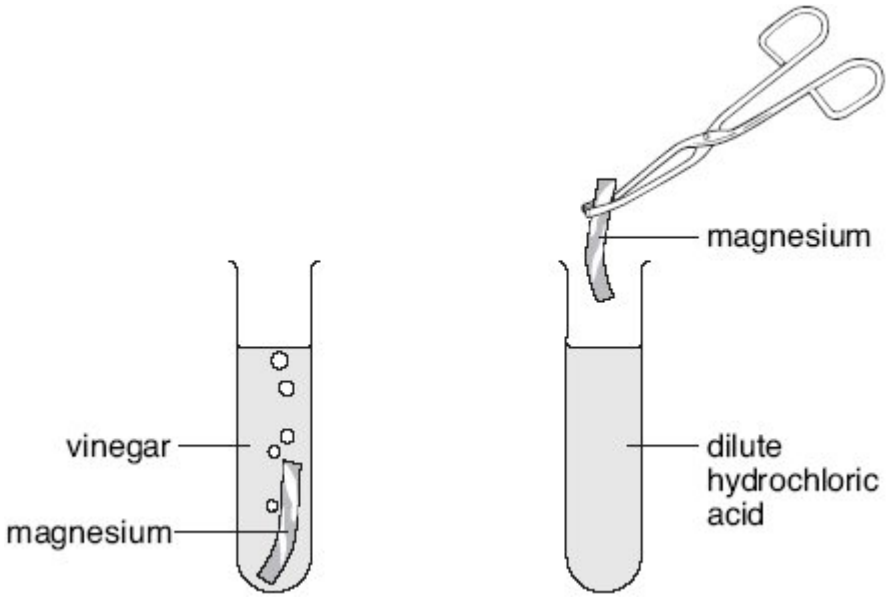
1 mark

(ii) Which other liquid in the table could Molly use between tests to have the same effect as distilled water?

.....

1 mark

(c) Molly put a piece of magnesium into a test-tube containing 20 cm^3 of vinegar. She put another piece of magnesium into a test-tube containing 20 cm^3 of dilute hydrochloric acid.



(i) Molly thought that magnesium would react more vigorously with hydrochloric acid than with vinegar.
What information in the table made Molly think this?

.....

.....

1 mark

(ii) How would Molly be able to tell if a more vigorous reaction took place with hydrochloric acid than with vinegar?

.....

.....

1 mark

(d) (i) Complete the word equation for the reaction between magnesium and hydrochloric acid.

magnesium + hydrochloric → ..... + ...
acid

2 marks

(ii) After some time this reaction stopped. Why did the reaction stop?

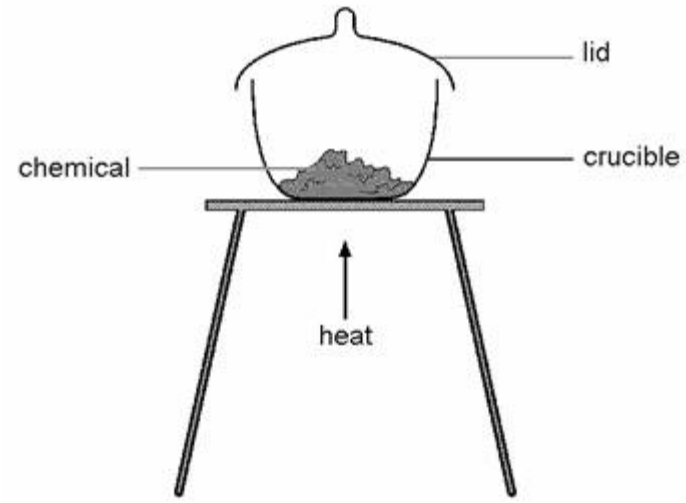
.....

.....

1 mark
maximum 9 marks

5. Shuli investigated differences between physical and chemical changes.

She put three chemicals in separate crucibles and weighed each one.
She heated each crucible as shown below.
She weighed each crucible again when it had cooled down.



She recorded her observations in a table as shown below.

experiment	name of chemical	observations	change in mass
A	magnesium (a silvery solid)	The silvery magnesium burned brightly in air. A white powder was formed.	increase
B	potassium permanganate (purple crystals)	The purple crystals crackled and turned black. A colourless gas was given off.	decrease
C	zinc oxide (a white powder)	The white powder turned pale yellow on heating. It turned white again on cooling.	no change

(a) (i) In experiment A, magnesium reacts with a gas in the air.

Complete the word equation for the reaction in experiment A.

magnesium + ... → .....

2 marks

(ii) Explain the increase in mass in experiment A. Use your word equation to help you.

.....

.....

1 mark

(b) The gas given off in experiment B re-lit a glowing splint.
Give the name of this gas.

.....

1 mark

(c) Name the white powder left at the end of experiment C.

.....

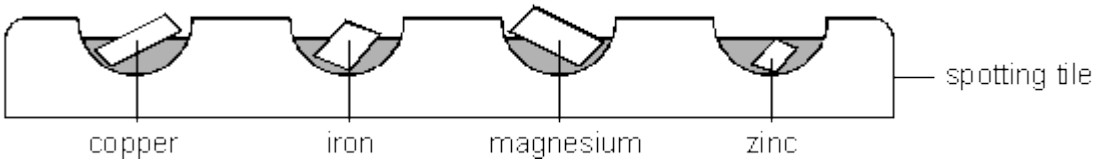
1 mark

(d) In each experiment, did a chemical change or a physical change take place?
Tick **one** box for each experiment.

experiment	chemical change	physical change
A		
B		
C		

1 mark
Maximum 6 marks

6. Aisha placed small samples off four different metals on a spotting tile.
She added drops of copper sulphate solution to each metal.



Aisha repeated the experiment with fresh samples of the four metals and solutions of different salts. She recorded some of her results in a table.

✓ shows that a reaction took place

X shows that no reaction took place.

metals / solutions	copper	iron	magnesium	zinc
copper sulphate	×	✓	✓	
iron sulphate	×	×	✓	✓
magnesium sulphate	×		×	
zinc sulphate	×	×	✓	×

(a) The four metals have different reactivities.

(i) Use the information in the table to put the four metals in a reactivity series.

most reactive metal .....

.....

.....

least reactive metal .....

1 mark

(ii) Use the reactivity series to complete the table by writing in ✓ or **X** in the **three** empty boxes.

2 marks

(b) Copper reacts with silver nitrate solution.

(i) Complete the word equation for the reaction:

copper + silver nitrate → ..... + ...

2 marks

(ii) Platinum does **not** react with silver nitrate.
Put the metals platinum, copper and silver in the correct order according to their reactivity.

most reactive .....

.....

least reactive .....

1 mark

(c) In many houses the hot water pipes are made from copper and the boiler is made from iron.
Which of these metals will corrode first? Explain your answer.

.....

.....

1 mark

Maximum 7 marks

7. Two pupils heated some copper carbonate in a crucible. They recorded the mass of the crucible and contents before and after heating.

(a) The word equation for this reaction is:

copper carbonate → copper oxide + carbon dioxide

(i) What mass of carbon dioxide is given off in this reaction?
Give the unit.

.....

1 mark

(ii) What is the name of this type of chemical reaction?
Tick the correct box.

combustion ☐

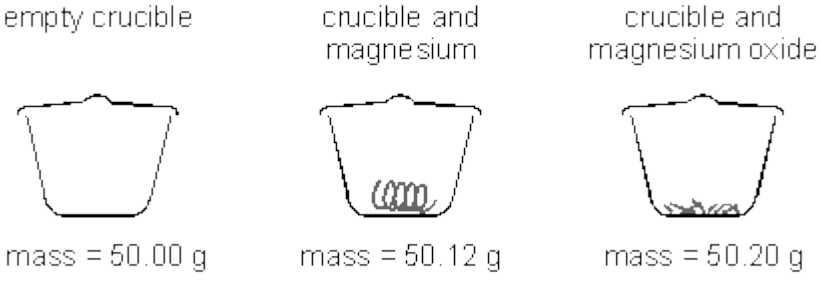
oxidation ☐

reduction ☐

thermal decomposition ☐

1 mark

(b) The pupils then heated some magnesium in another crucible. They worked carefully and did not lose any of the magnesium oxide which formed.
They recorded the mass of the crucible and contents before and after heating.



(i) Write a word equation for the reaction.

.....

1 mark

(ii) Why does the mass of the contents of the crucible increase in this reaction?

.....

.....

1 mark

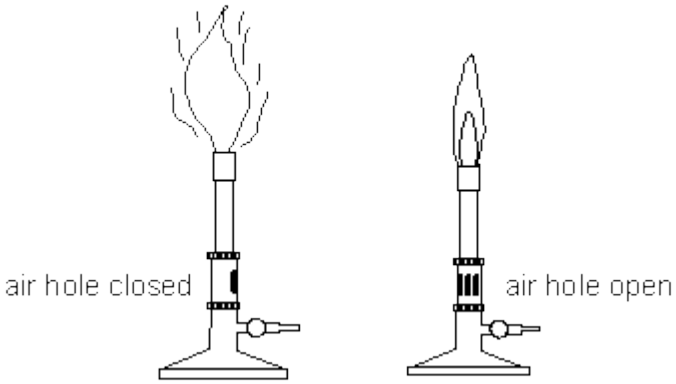
(iii) What is this type of chemical reaction called?

.....

1 mark

Maximum 5 marks

8. The diagrams show two Bunsen burners. One burner has the air hole closed, and the other has the air hole open.



(a) Explain why opening the air hole of a Bunsen burner makes the flame hotter.

.....

.....

1 mark

(b) Natural gas is methane, CH_4. It is burned in a Bunsen burner.
Complete the word equation for the chemical reaction in the clear blue flame.

methane + ... → ..... + ...

2 marks

Maximum 3 marks

9. Sodium hydrogencarbonate is present in indigestion powders.
It is often called bicarbonate of soda. Sodium hydrogencarbonate:

is a white solid;

does not smell;

forms a solution with a pH of about 8.5;

is very soluble in water;

is not poisonous.

(a) (i) Is sodium hydrogencarbonate solution acidic, alkaline, or neutral?

.....

1 mark

(ii) Indigestion can be caused by too much acid in the stomach.

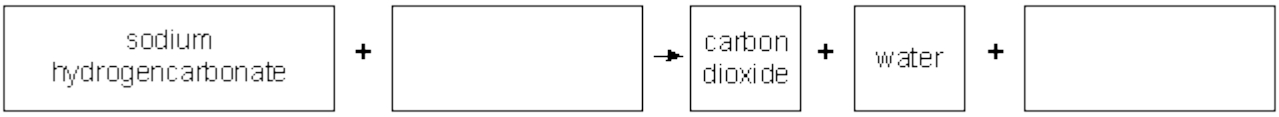
Which **two** pieces of information in the list are the most important reasons why sodium hydrogencarbonate can be used as an indigestion powder?

1 .....

2 .....

2 marks

(b) Nitric acid reacts with sodium hydrogencarbonate. The salt formed is a nitrate. Fill in the boxes to complete the word equation.



1 mark

(c) An indigestion powder contains sodium hydrogencarbonate and a small amount of citric acid. The powder starts to fizz when it is added to water.

What gas is given off when the mixture fizzes?

.....

1 mark
Maximum 5 marks

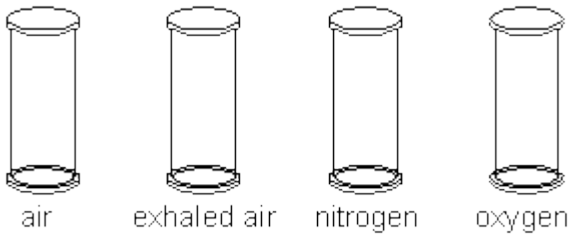
10. Magnesium burns in air giving a very bright light.

(a) Complete the word equation below to show this reaction.

magnesium + ... → .....

1 mark

The diagram shows four gas-jars. Each contains a different gas. Burning magnesium is put into each jar.



(b) In **one** of the gas-jars, the magnesium goes out immediately.
Name the gas in this jar.

.....

1 mark

Explain your answer.

.....

.....

1 mark
Maximum 3 marks