1(a). In a neutralisation reaction dilute sulfuric acid, H2SO4, reacts with potassium hydroxide solution, KOH.

H_2SO_4 + 2KOH ✓ K_2SO_4 + $2H_2O$

Calculate the mass of potassium sulfate, K_2SO_4, that could be made from 6.54 g of dilute sulfuric acid, H_2SO_4.

Give your answer to **3** significant figures.

Relative atomic mass (A_r): H = 1.0 K = 39.1 O = 16.0 S = 32.1

Mass of potassium sulfate = ... g **[4]**

(b). The neutralisation reaction between sodium hydroxide solution, NaOH, and dilute hydrochloric acid, HCl, makes a salt and water.

Write the **balanced symbol** equation for the reaction.

---------- **[2]**

2. Complete the **balanced symbol** equation for the **complete** combustion of methane.

CH_4 + 2……. → CO_2 + … H_2O

[2]

3. What is the balanced equation for the reaction of sodium with oxygen?

A Na + O → NaO
B Na + O_2 → NaO_2
C 4Na + O_2 → $2Na_2O$
D Na_2 + 2O → 2NaO

Your answer ☐ **[1]**

4(a). A student investigates the reaction between sodium carbonate, Na_2CO_3, and sulfuric acid, H_2SO_4.

Sodium sulfate, water and carbon dioxide are made.

i. Complete the **balanced symbol** equation for the reaction.

$Na_2CO_3(s)$ + $H_2SO_4(aq)$ → ..... (aq) + $H_2O(l)$ + $CO_2(g)$ **[1]**

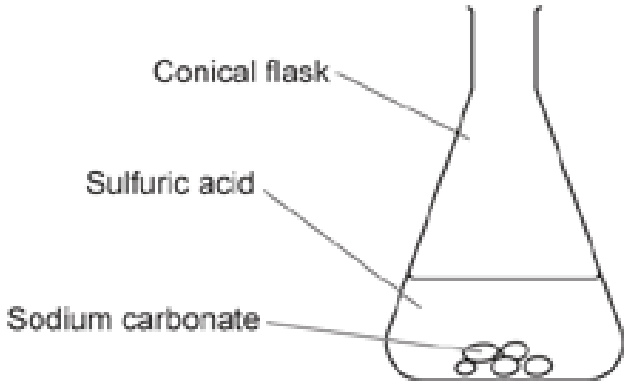
ii. Sulfuric acid has the state symbol (aq).

What does (aq) mean?

---------- **[1]**

iii. One of the products is a gas. The student wants to collect the gas formed.

Complete the diagram to show how they can collect and measure the volume of gas.



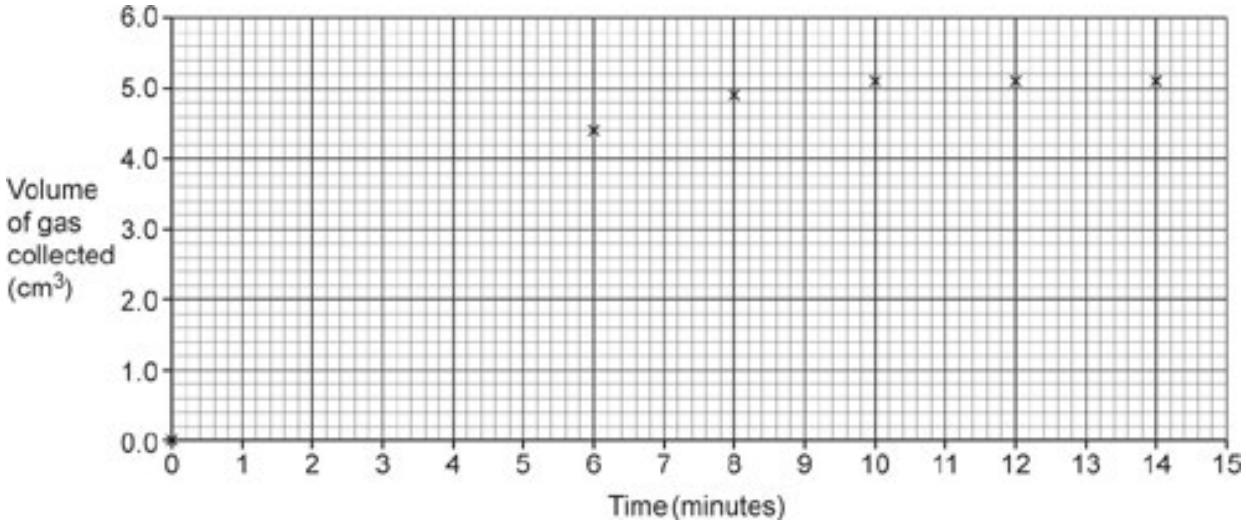
[2]

(b). The table shows the student's results.

Time (minutes)	Volume of gas collected (cm^3)
0	0.0
2	2.0
4	3.5
6	4.4
8	4.9
10	5.1
12	5.1
14	5.1

i. Plot the results from the table on the graph.

Six points have already been plotted.



[1]

ii. Draw a curve of best fit.

[1]

iii. Use the graph to estimate the volume of gas that has been collected at 7.5 minutes.

Volume of gas collected = ... cm^3 **[1]**

iv. The student collects 5.1 cm^3 of gas.

The student wants to collect more gas.

How does the student change the experiment so that more gas is collected?

Tick (✓) **one** box.

- Use a larger conical flask ☐
- Use less sodium carbonate ☐
- Use less sulfuric acid ☐
- Use more sulfuric acid ☐

[1]

5. What is the balanced symbol equation for the reaction of methane with oxygen?

A $CH_4 + O_2 \rightarrow CO_2 + H_2O$
B $CH_4 + O_2 \rightarrow CO_2 + 2H_2O$
C $CH_4 + 2O_2 \rightarrow CO_2 + H_2O$
D $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Your answer ☐ **[1]**

6. 11.0 g of aluminium reacts with 43.4 g of chlorine to make 54.4 g of aluminium chloride.
$2Al + 3Cl_2 \rightarrow 2AlCl_3$

How much **aluminium** is required to make 217.6 g of aluminium chloride?

A 22.0 g
B 44.0 g
C 86.8 g
D 173.6 g

Your answer ☐ **[1]**

7. The melting point of magnesium chloride is 714 °C.

Which state symbols are used for magnesium chloride at these temperatures?

	State symbol at 25 °C	State symbol at 110 °C
A	g	g
B	s	s
C	s	g
D	g	s

Your answer ☐ **[1]**

8. Why can the mass of a reaction in an open conical flask decrease?

A One of the products is a gas.
B One of the products is a solid.
C One of the reactants is a liquid.
D One of the reactants is a solid.

Your answer ☐ **[1]**

9. 63.5 g of copper reacts to make 134.5 g of copper chloride, $CuCl_2$.

$Cu + Cl_2 \rightarrow CuCl_2$

How much copper chloride will be made from 0.635 g of copper?

A 0.01345 g
B 0.1345 g
C 1.345 g
D 13.45 g

Your answer ☐ **[1]**

10. Sodium fluoride has the formula NaF. The formula of the sodium ion is Na^+.

What is the formula of the fluoride ion?

A F^+
B F^-
C F^{2+}
D F^{2-}

Your answer ☐ **[1]**

11. Iron reacts with dilute sulfuric acid, H_2SO_4.

Iron sulfate, $FeSO_4$, and hydrogen gas, H_2, are made.

i. Write the **balanced symbol** equation for this reaction.

---

[1]

ii. A student reacts 2.8 g of iron with dilute sulfuric acid.

The student makes 5.4 g of iron sulfate.

They predicted that they should have made 7.6 g of iron sulfate.

Calculate their **percentage yield**.

Give your answer to **1** decimal place.

Percentage yield of iron sulfate = ... % **[3]**

12. Propane, C_3H_8, is an alkane.

Propane undergoes complete combustion in oxygen. Carbon dioxide and water are made.

Write the **balanced symbol** equation for the complete combustion of propane.

_____ **[2]**

13. Bromine reacts with sodium iodide.

What is the **balanced symbol** equation for the reaction?

A $Br + NaI \rightarrow NaBr + I$
B $Br_2 + NaI \rightarrow NaBr + I_2$
C $Br_2 + 2NaI \rightarrow 2NaBr + I_2$
D $Br_2 + NaI_2 \rightarrow NaBr_2 + I_2$

Your answer ☐ **[1]**

14. Calcium carbonate, $CaCO_3$, thermally decomposes to make calcium oxide, CaO, and carbon dioxide.

$CaCO_3 \rightarrow CaO + CO_2$

5.0 g of calcium carbonate makes 2.8 g of calcium oxide.

How much carbon dioxide is made?

A 2.2 g
B 2.8 g
C 4.4 g
D 7.8 g

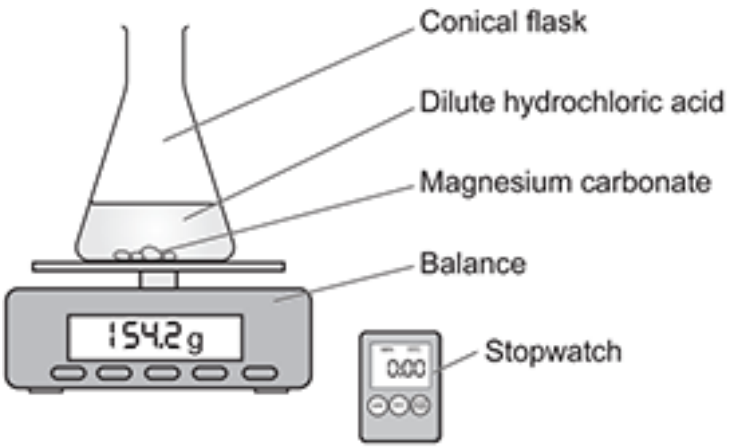
Your answer ☐ **[1]**

15. A student reacts magnesium carbonate with dilute hydrochloric acid. Carbon dioxide gas and a salt are made.

i. What is the name of the salt made?

_____ **[1]**

ii. The diagram shows the apparatus the student uses.



How can the student tell when the reaction is complete?

_____

[1]

iii. The student records the mass on the balance every 2 minutes for 12 minutes.

The student's results are shown in the table.

Time (minutes)	Mass (g)
0	154.2
2	150.5
4	148.2
6	146.5
8	145.3
10	144.0
12	142.9

The mass before the reaction starts is 154.2 g.

How much carbon dioxide gas is made after 8 minutes?

Mass of carbon dioxide = ... g **[2]**

16. Chlorine reacts with aluminium to form aluminium chloride.

- The formula for aluminium chloride is $AlCl_3$.
- The symbol for a chloride ion is Cl^-.

What is the **symbol** for an aluminium ion?

_____ **[1]**

17. The symbol for a calcium ion is Ca^{2+}. The symbol for an iodate ion is IO_3^-.

What is the formula for calcium iodate?

A $CaIO_3$
B $CaIO_{32}$
C $Ca(IO_3)_2$
D Ca_2IO_3

Your answer ☐ **[1]**

18. Which state symbol is used for liquids?

A (aq)
B (g)
C (l)
D (s)

Your answer ☐ **[1]**

END OF QUESTION PAPER