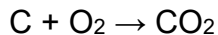


## Introducing Chemical Reactions (F)

1. Oxygen reacts with 1.20 g of carbon. 4.40 g of carbon dioxide forms.



What mass of oxygen is used in this reaction?

- A 0.80 g
- B 1.60 g
- C 3.20 g
- D 5.60 g

Your answer

[1]

2. The symbol of an aluminium ion is  $\text{Al}^{3+}$ .

The symbol of an oxide ion is  $\text{O}^{2-}$ .

What is the formula of aluminium oxide?

- A  $\text{AlO}$
- B  $\text{Al}_2\text{O}$
- C  $\text{Al}_3\text{O}_2$
- D  $\text{Al}_2\text{O}_3$

Your answer

[1]

3. Ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , burns in oxygen. Carbon dioxide and water are made.

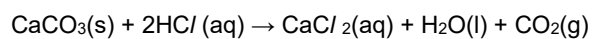
Which equation for this reaction is correctly balanced?

- A  $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- B  $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$
- C  $\text{C}_2\text{H}_5\text{OH} + 2\text{O}_2 \rightarrow 3\text{CO}_2 + 2\text{H}_2\text{O}$
- D  $2\text{C}_2\text{H}_5\text{OH} + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$

Your answer

[1]

4. Look at the balanced symbol equation.



What does the symbol **(s)** represent in the balanced symbol equation?

- A Solid
- B Solute
- C Solution
- D Substance

Your answer

[1]

5. The formula of a magnesium ion is  $\text{Mg}^{2+}$ .

The formula of a nitrate ion is  $\text{NO}_3^-$ .

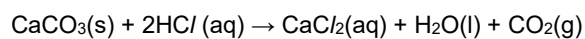
What is the formula of **magnesium nitrate**?

- A  $\text{MgNO}_3$
- B  $\text{Mg}_2\text{NO}_3$
- C  $\text{Mg}(\text{NO}_3)_2$
- D  $\text{Mg}_2(\text{NO}_3)_3$

Your answer

[1]

6. A student reacts calcium carbonate with hydrochloric acid.



What physical state does **(g)** represent in the balanced symbol equation?

- A Aqueous
- B Gas
- C Liquid
- D Solid

Your answer

[1]

7. This question is about elements in the Periodic Table.

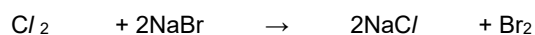
Look at the table. It shows some properties of Group 7 elements.

Element	Molecular formula	State at room temperature	Radius of an atom (nm)	Order of reactivity
Fluorine	F <sub>2</sub>	.....	0.072	most reactive ↑ ↓ least reactive
Chlorine	Cl <sub>2</sub>	gas	0.099	
Bromine	Br <sub>2</sub>	liquid	0.114	
Iodine	I <sub>2</sub>	solid	0.133	
Astatine	At <sub>2</sub>	solid	.....	

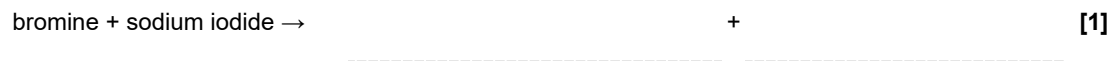
In the table, the Group 7 elements are listed in order of reactivity.

The equations show a displacement reaction of Group 7 elements.

chlorine + sodium bromide → sodium chloride + bromine



i. Complete the word equation.



ii. There is no reaction between iodine and sodium bromide.

Explain why.

----- [1]

iii. Chlorine reacts with sodium iodide. Sodium chloride and iodine are made.

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

----- [2]

8. A student reacts some metals with different salt solutions.

Table 17.2 shows her results.

	<b>Magnesium</b>	<b>Zinc</b>	<b>Iron</b>	<b>Copper</b>
<b>Copper sulfate</b>	blue solution becomes colourless	blue solution becomes colourless	blue solution becomes green	no reaction
<b>Iron sulfate</b>	green solution becomes colourless	green solution becomes colourless	no reaction	no reaction
<b>Magnesium sulfate</b>	no reaction	no reaction	no reaction	no reaction
<b>Zinc sulfate</b>	black coating on magnesium	no reaction	no reaction	no reaction

**Table 17.2**

- i. What colour is **iron sulfate** solution?

----- [1]

- ii. Write down the order of reactivity of the four metals copper, iron, magnesium and zinc. Use **Table 17.2** to help you.

..... **most reactive**

.....

.....

..... **least reactive**

[2]

- iii. Magnesium reacts with copper sulfate,  $\text{CuSO}_4$ .  
Magnesium sulfate,  $\text{MgSO}_4$ , and copper are made.  
Write the **balanced symbol** equation for this reaction.

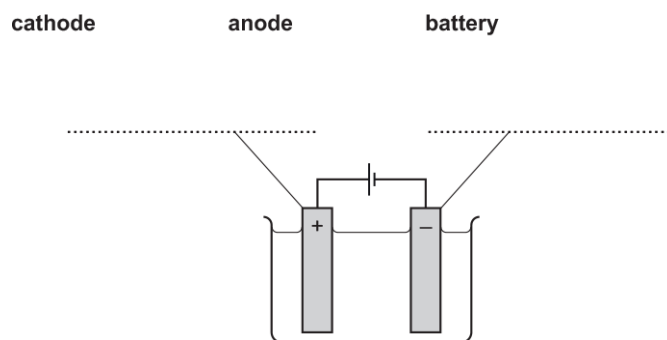
----- [1]

9 (a). Electrolysis can be used to separate the elements in some compounds using electricity.

i. Look at the diagram of an electrolysis experiment.

Complete the diagram using the words in the list.

You may use each word once, more than once or not at all.



[2]

ii. A teacher demonstrates the electrolysis of molten lead bromide.

Predict the products made at each electrode.

Positive electrode

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Negative electrode

-----

[2]

iii. Molten lead bromide contains lead ions,  $\text{Pb}^{2+}$ , and bromide ions,  $\text{Br}^-$ .

What is the formula for lead bromide?

Tick (✓) **one** box.

PbBr

PbBr<sub>2</sub>

Pb<sub>2</sub>Br

Pb<sub>2</sub>Br<sub>2</sub>

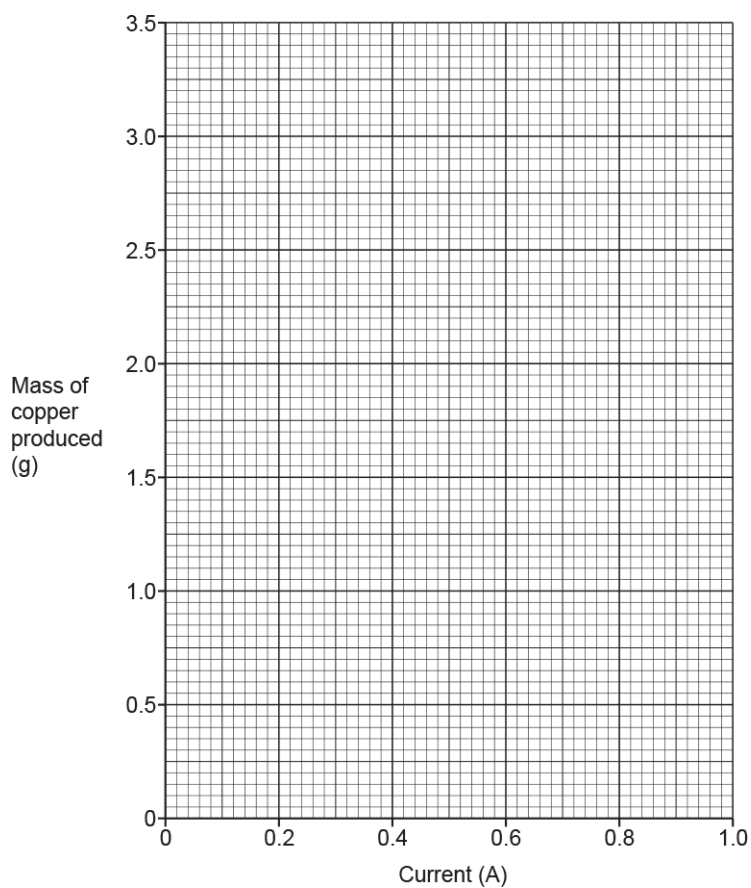
[1]

(b). The student investigates the mass of copper made during the electrolysis of aqueous copper chloride.

The student varies the electric current and passes the current for the same time in each experiment. Here is a table of their results.

Current (A)	Mass of copper produced (g)
0.2	0.6
0.4	1.3
0.6	1.8
0.8	2.5
1.0	3.1

i. Plot a graph of the student's results and draw a line of best fit.



[3]

ii. Use your graph to **estimate** the current needed to make 2.25 g of copper.

Current = ..... A [1]

iii. Use your graph, and a calculation, to find the mass of copper that would be produced using 15 A.

Give your answer to **2** significant figures.

Mass of copper produced = ..... g **[2]**

**10.** The burning of methane gas is an exothermic reaction.

When methane, CH<sub>4</sub>, burns in oxygen, O<sub>2</sub>, carbon dioxide, CO<sub>2</sub>, and water, H<sub>2</sub>O, are made.

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

..... **[2]**

**11.** Acids are substances that turn universal indicator paper red.

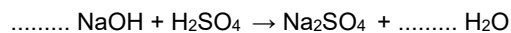
i. What makes a substance acidic?

..... **[1]**

ii. Sodium hydroxide, NaOH, is an alkali.

Sodium hydroxide neutralises sulfuric acid, H<sub>2</sub>SO<sub>4</sub>. The reaction makes a salt called sodium sulfate, Na<sub>2</sub>SO<sub>4</sub>. Water is also made.

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



**[2]**

**12.** Pentane, C<sub>5</sub>H<sub>12</sub>, is an alkane found in petrol.

Pentane undergoes **complete combustion** in excess oxygen, O<sub>2</sub>.

Carbon dioxide and water are made.

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

..... **[2]**

13.

- a. Nanoparticles are used as catalysts.

Describe a property of nanoparticles that make them useful as catalysts.

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----- [2]

- b. David is synthesising a new titanium dioxide nanoparticle for use as a catalyst.

One  $\text{TiO}_2$  nanoparticle has a mass of  $5.0 \times 10^{-3}$  mg.

Calculate how many  $\text{TiO}_2$  nanoparticles are in 80.0 mg of  $\text{TiO}_2$ .

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

Name	Number of carbon atoms in molecule	Molecular formula	Boiling point (°C)
ethane	2	$\text{C}_2\text{H}_6$	-88
propane	3	$\text{C}_3\text{H}_8$	-42
pentane	5	$\text{C}_5\text{H}_{12}$	36
hexane	6	$\text{C}_6\text{H}_{14}$	69

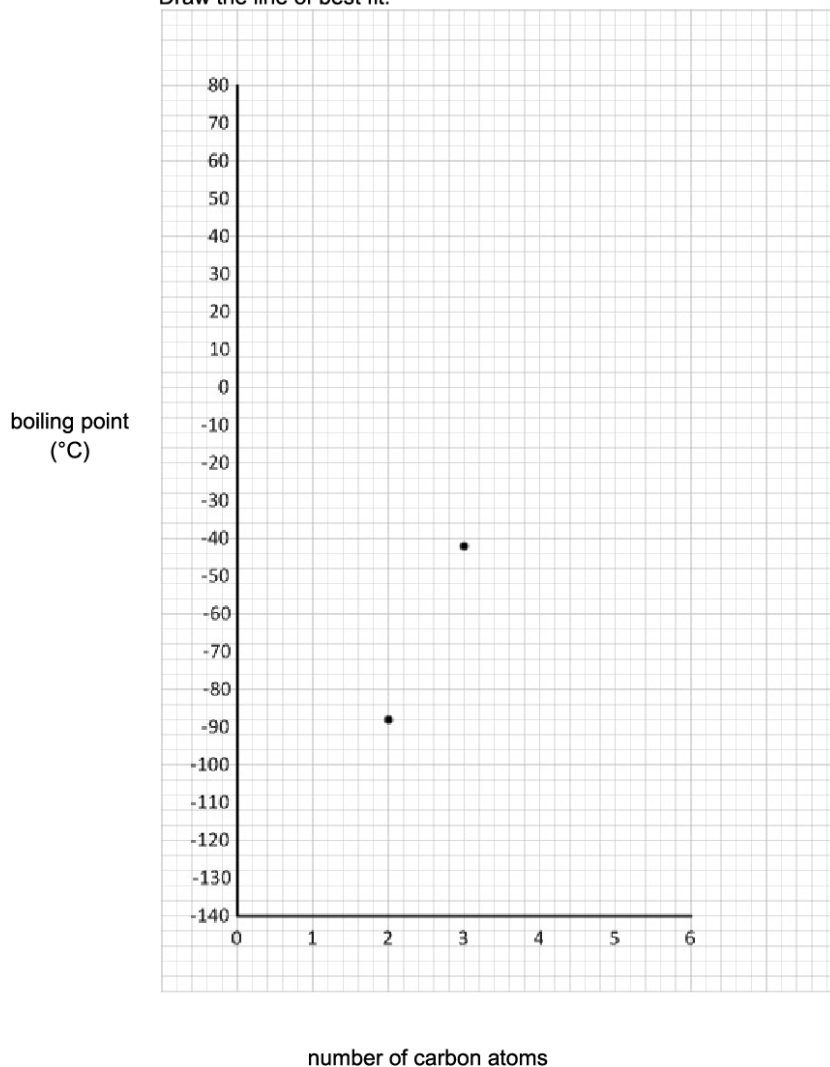


14 (a). Look at the data about some hydrocarbons.

The data for ethane and propane have been plotted on the grid.

- i. Plot the data for pentane and hexane on the grid.

Draw the line of best fit.



[2]

- ii. Use your graph to estimate the boiling point of butane.

answer:..... °C

[1]

- iii. Describe the relationship between the number of carbon atoms in the molecule and its boiling point.

Use ideas about forces between molecules to explain your answer.

-----

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[2]

(b). **Propane** burns in oxygen,  $O_2$ .

Carbon dioxide and water are made.

Write a **balanced symbol** equation for this reaction.

----- [2]

15. Paul and Orla want to make some solid zinc sulfate.

They make some predictions.

You can react sulfuric acid with zinc metal or zinc carbonate to make zinc sulfate. Both reactions make hydrogen.

Paul says

You can react hydrochloric acid with zinc metal or zinc carbonate to make zinc sulfate. The reaction with zinc metal makes hydrogen and the reaction with zinc carbonate makes carbon dioxide.

Orla says

Comment on how correct **both** statements are.

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-----  
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-----  
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-----  
----- [4]



17. The size of a nanoparticle is similar to the size of a molecule.

Which of these best describes the size of a nanoparticle?

- A. 0.01 nm
- B. 50 nm
- C. 1000 nm
- D. 10,000 nm

Your answer

[1]

18. The Group 7 elements are known as the halogens.

The halogens have similar chemical properties.

Their physical properties vary with increasing atomic number.

All halogens react with alkali metals to make a salt.

- i. All halogens have similar chemical reactions.

Explain why in terms of electronic structure.

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-----  
[1]

- ii. Sodium reacts with bromine to make sodium bromide, NaBr.

Construct the **balanced symbol** equation for this reaction.

-----  
[2]

- iii. What is the formula of the product of the reaction between astatine and potassium?

-----  
[1]

**19(a).** Ammonium sulphate,  $(\text{NH}_4)_2\text{SO}_4$ , is a fertiliser.

Ammonium sulphate can be manufactured from ammonia and sulfuric acid.

Sulfuric acid is manufactured in a series of steps.

**Step 1:**

Sulphur is burnt in oxygen to produce sulphur dioxide.

**Step 2, The Contact Process:**

Sulphur dioxide is reacted with oxygen to produce sulphur trioxide. This takes place in the presence of vanadium(V) oxide at a pressure of 2 atmospheres and at about  $450^\circ\text{C}$ .

**Step 3:**

Sulphur trioxide is reacted with water to produce sulfuric acid.

Write balanced symbol equations for each stage of this process.

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----- [4]

**(b).** A sample containing 17.0 g of ammonia completely reacts with sulfuric acid.

A mass of 66.0 g of ammonium sulphate is made.

Show that the maximum mass of ammonium sulphate that can be made from 51.0 g of ammonia is 198.0 g.

[1]

**20.** The alkane,  $\text{C}_{15}\text{H}_{32}$ , is cracked to make an alkene,  $\text{C}_6\text{H}_{12}$  and an alkane,  $\text{C}_3\text{H}_8$ .

Construct the **balanced symbol** equation for this reaction.

----- [1]

**END OF QUESTION PAPER**