EO BOOKLET : PERIODIC TABLE

ANSWERS

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1. Use the Periodic Table on page 2 to help you answer this question.

(a) Identify the most reactive metallic element in the Periodic Table.

Fr / Francium

(1)

(b) Give the formula of the compound formed between sodium and the most reactive element in Group 7.

NaF

(1)

(c) All of the metals in Group 1 react with water. There are similarities between the reactions. Put a cross (☒) in **three** boxes to show which statements apply to the reactions of **all** Group 1 metals with water.

a flame is seen	☐
a solution of the metal hydroxide is formed	☒
a solution of the metal oxide is formed	☐
carbon dioxide is formed	☐
hydrogen is formed	☒
the metal sinks	☐
the solution formed is acidic	☐
the solution formed is alkaline	☒

(3)

2. Lithium and sodium are metals in Group 1 of the Periodic Table. They react in a similar way with water, producing hydrogen gas and an alkaline solution.

(a) A piece of sodium is added to another trough of water.

(i) Give two observations, other than the sodium floating, that you could make during the reaction.

any 2

(1) melts / becomes a ball

(2) moves (on the surface)

(3) fizzes / bubbles / effervescence

(4) Disappears / becomes smaller

(2)

(ii) Write a chemical equation for the reaction.

$2Na + 2H_2O \rightarrow 2NaOH + H_2$

(2)

Leave blank

(b) Rubidium is another Group 1 metal. A piece of rubidium is added to a different trough of water.

(i) Predict one observation that would be different using rubidium instead of sodium.

flame / explosion

(accept any more extreme observation e.g. moves more quickly / bubbles faster etc) (1)

(ii) Predict a possible pH value for the solution formed in the reaction between rubidium and water.

10 – 14 (any value within this range)

(1) **Q6**

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3. Calcium and sodium are both reactive metals.
A small piece of each metal is added to separate troughs of water.
The metals react with water as shown in these equations:

calcium + water → compound **A** + gas **X**

sodium + water → compound **B** + gas **X**

(a) (i) State one observation that would be the same during both reactions.

bubbles / fizzes / effervescence / metal gets smaller

(1)

(b) (i) What is the **name** of compound **A**?

calcium hydroxide

(1)

(ii) What is the **formula** of compound **B**?

NaOH

(1)

(c) Identify gas **X** and describe a test, and the result, for this gas.

Identity of **X** hydrogen / H_2

Test (squeaky) pop with a burning splint.

(2)

Leave blank

(d) (i) State the colour of universal indicator in a solution of compound **B**.
Which ion causes universal indicator to turn this colour?

Colour of universal indicator ..... blue / purple .....

Acids Topic

Ion ..... OH^- .....

(2)

(ii) What colour does compound **B** give in a flame test?

Analysis Topic

..... yellow / orange .....

(1) **Q1**

4 (a) When chlorine gas is bubbled into colourless sodium bromide solution a reaction takes place. The solution becomes brown.

(i) Write a word equation for the reaction which takes place.

chlorine + sodium bromide → bromine + sodium chloride

(2)

(ii) What name is given to this type of reaction?

..... displacement .....

(1)

(iii) What does this reaction indicate about the reactivity of chlorine compared to bromine?

chlorine more reactive (than bromine) **(1)**

5 (a) Some chlorine gas is bubbled into a solution containing potassium iodide.
A displacement reaction occurs.

(i) Write an ionic equation for the reaction.

$Cl_2 + 2I^- \longrightarrow 2Cl^- + I_2$

(1)

(ii) What colour is the solution at the end of the reaction?

brown / red / orange (NOT yellow) **(1)**

(iii) Explain why no displacement reaction occurs when iodine is added to a solution of potassium chloride.

chlorine is more reactive than iodine/
iodine less reactive than chlorine

(1)

(c) Hydrogen chloride can be made using the reaction

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

Describe the colour change seen during this reaction.

- (yellow) - green
- to colourless / (misty / steamy fumes)

(2)

6 Three of the elements in Group 7 of the Periodic Table are chlorine, bromine and iodine.

(a) Give the electronic configuration of chlorine.

2, 8, 7

(1)

(b) How many electrons are there in the outer shell of an atom of iodine?

7

(1)

(c) Bromine reacts with hydrogen to form hydrogen bromide. The chemical equation for the reaction is

$$Br_2(g) + H_2(g) \rightarrow 2HBr(g)$$

Describe the colour change occurring during the reaction.

Colour change
- brown / orange
- to colourless

(2)

7 (a) A teacher prepares a gas jar of oxygen.
She then lights a piece of magnesium ribbon and places it in the gas jar.
A vigorous reaction occurs.

Give two observations she could make during the reaction between magnesium and oxygen.

1 bright / brilliant / dazzling / white flame

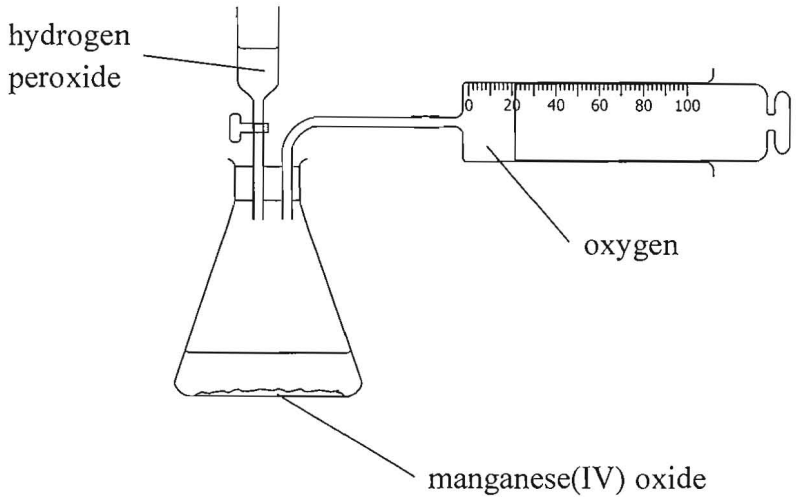
2 white solid forms

(2)

Leave blank

SECTION A

8 Oxygen gas can be prepared and collected in the laboratory using the apparatus shown in the diagram.



(a) Hydrogen peroxide decomposes very slowly to form water and oxygen.

(i) Write a word equation for this reaction.

hydrogen peroxide → water + oxygen

(1)

(ii) The reaction is much faster if a small amount of manganese(IV) oxide is added. What type of substance is manganese(IV) oxide in this reaction?

(Rates Topic)

catalyst

(1)

(b) The diagram shows oxygen gas being collected in a syringe.
Suggest one other way to collect the gas.

over water / displacement of air with downward delivery of gas.

(1)

(c) Describe the test for oxygen.

relights a glowing splint.

(1)

9 (a) Some sulphur is burned in a gas jar of oxygen. The gas formed is sulphur dioxide.

(i) Write a chemical equation for the reaction between sulphur and oxygen.

$S + O_2 \rightarrow SO_2$

(1)

(ii) The damp litmus paper turns red when placed in the sulphur dioxide.
What does this indicate about sulphur dioxide?

acidic / forms H^+ ions

(1)

10 (f) Two reactions involving copper compounds are shown in this sequence:

copper(II) carbonate $\xrightarrow{\text{Reaction 1}}$ copper(II) oxide $\xrightarrow{\text{Reaction 2}}$ copper(II) chloride

(i) Reaction **1** occurs when copper(II) carbonate is heated. Carbon dioxide is the other product of this reaction.

Describe the colour change seen and write a chemical equation for the reaction. Include state symbols in the equation.

Colour change from green to black

Chemical equation

$CuCO_{3(s)} \rightarrow CuO_{(s)} + CO_{2(g)}$

(4)

(ii) The other substance needed for Reaction **2** is dilute hydrochloric acid. Write the chemical equation for Reaction **2**.

ACIDS TOPIC

$CuO + 2HCl \rightarrow CuCl_2 + H_2O$

(3)

① reactants
②① products
① balancing BUT only if all formula correct

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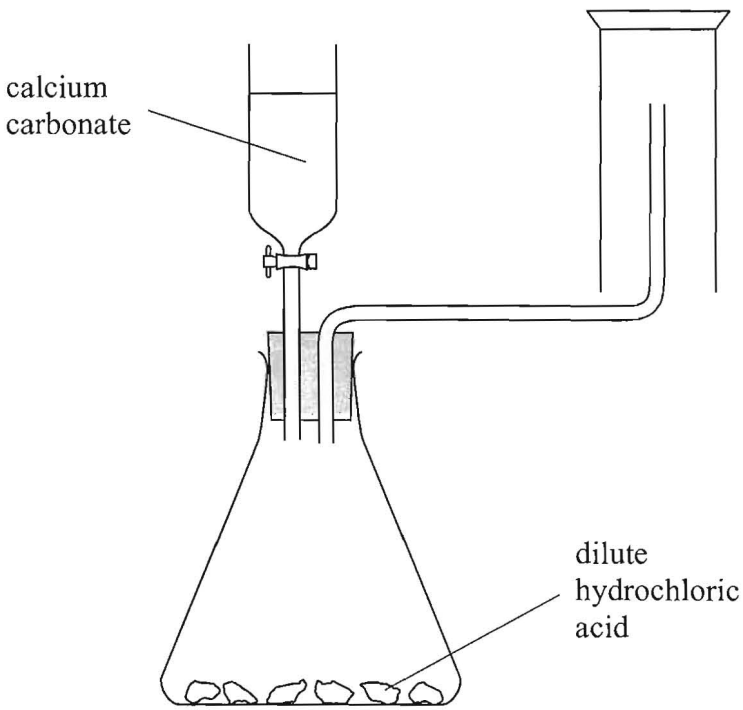
17. (a) A student was asked to draw a diagram to show apparatus he would use to prepare carbon dioxide gas in the laboratory. This is the diagram he drew.



(i) State how the diagram is labelled incorrectly.

reagents the wrong way round

(1)

(ii) Why is the method of collection of carbon dioxide unsuitable?
How could the carbon dioxide be collected?

- CO_2 is heavier/denser than air
- Collect over water or in a gas syringe or by downward delivery of gas.

(2)

(iii) Write a chemical equation, including state symbols, for the reaction that occurs in the conical flask.

$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$

(3)

1) formula
1) balancing (dependant on formula)
1) state.

7.

Leave blank

12 Zinc carbonate decomposes when heated to form zinc oxide and carbon dioxide.

$$ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$$

A student investigated this reaction using the following method.

1. Weigh a clean dry crucible.
2. Add some zinc carbonate powder and reweigh the crucible and contents.
3. Heat the crucible and contents for five minutes.
4. Allow the crucible and contents to cool and then reweigh.
5. Repeat steps 3 and 4 until the mass of the crucible and contents is unchanged.

The student did the experiment four times, starting with different masses of zinc carbonate, and recorded her results in a table.

	Mass in grams recorded in each experiment			
	1	**2**	**3**	**4**
Mass of empty crucible	19.3	20.1	20.4	19.8
Mass of crucible and zinc carbonate before heating	25.2	25.9	26.5	25.4
Mass of crucible and contents after heating for five minutes	24.8	24.1	24.9	23.4
Mass of crucible and contents after heating for a total of ten minutes	23.9	23.9	24.4	23.4
Mass of crucible and contents after heating for a total of fifteen minutes	23.5	23.9	24.4	23.4

(a) Why does the mass of the crucible and contents decrease during heating?

• carbon dioxide / CO_2 / gas

AND

• given off / lost / released / formed / produced

(1)

8

Leave blank

(b) The reason for Step 5 in the method is to check whether the decomposition of zinc carbonate is complete.

(i) In which experiment was it not necessary to heat for a third period of five minutes? Explain your choice.

• 4

• mass unchanged after 2nd heating / OR mass unchanged after 5/10 mins **(2)**

(ii) In which experiment should the student have heated for a fourth period of five minutes? Explain your choice.

• 1

• mass still changing / not constant OR mass changed when heated 3 times **(2)** / after 15 min

(c) Use the results from Experiment 3 in the table to calculate the following masses.

(i) The mass, in grams, of zinc carbonate used.

6.1

(1)

(ii) The mass, in grams, of zinc oxide obtained.

4.0

(1) **Q2**

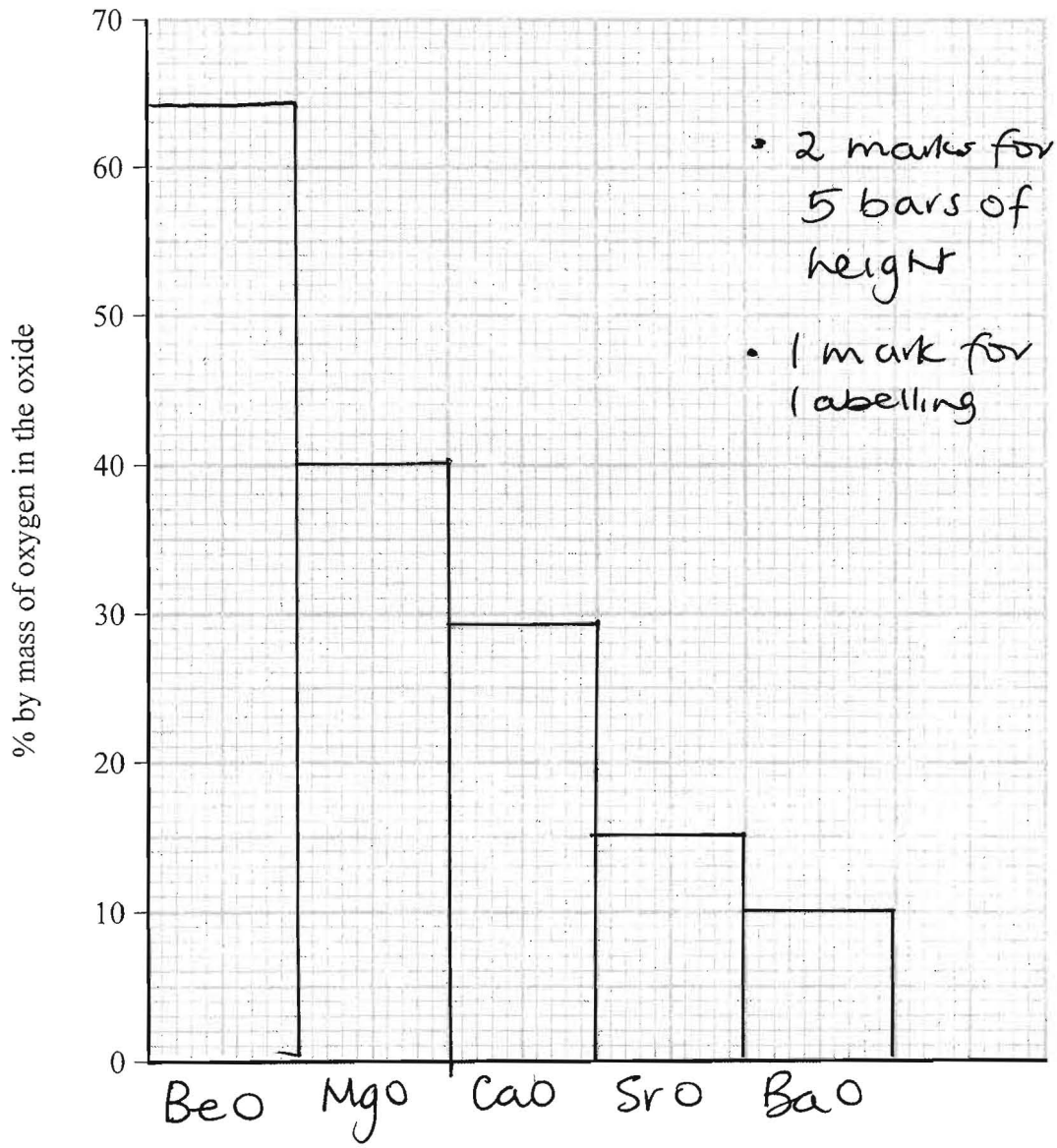
(Total 7 marks)

9.

13 As part of his project on oxides, a student used information from the Periodic Table to calculate the percentage of oxygen by mass in the first five Group 2 metal oxides.
He presented his results in a table.

Formula of oxide	Relative formula mass	% by mass of oxygen
BeO	25	64
MgO	40	40
CaO	56	29
SrO	104	15
BaO	153	10

(a) Draw a bar chart to show the % by mass of oxygen for the five oxides.



(3)

10

Leave blank

(b) The teacher asked the student some questions.
Suggest a suitable answer to each question.

(i) Why is a line graph of % by mass of oxygen against relative formula mass not a valid way to present the data?

• data / Mr is not continuous / no intermediate values / only certain Mr values possible

(1)

(ii) What is the relationship between the % by mass of oxygen in the oxide and the relative formula mass of the oxide?

% of oxygen decreases as relative formula mass increases

(or vice-versa)

(1)

(c) The teacher told the student that he should have done some experimental work for this part of the project.
The teacher suggested that a suitable experiment to determine the % by mass of oxygen in an oxide would be the combustion of magnesium.

Outline the procedure, including measurements and calculations, that you could use to obtain a value for the % by mass of oxygen in magnesium oxide.

- Weigh magnesium
- heat / burn / ignite magnesium
- weigh magnesium oxide / contents of tube or crucible
- heat and reweigh to constant mass
- mass of MgO minus mass Mg (gives mass of oxygen)
- % oxygen = $\frac{\text{mass oxygen}}{\text{mass of MgO}} \times 100$

(5) **Q4**

(Total 10 marks)

TOTAL FOR PAPER: 50 MARKS

END