Predicting chemical reaction – 2021/20 GCSE Gateway Chemistry A

1. Nov/2021/Paper_J248/02/No.8

Transition metals have properties that are different from other metals in the Periodic Table.

Copper is a transition metal.

Which of the following describes copper?

A A metal which forms blue compounds.

B A metal which reacts violently with water.

C A metal with a low density that floats on water.

D A metal with a low melting point.

Your answer ☐ **[1]**

2. Nov/2021/Paper_J248/02/No.16

This question is about the elements in Group 1 of the Periodic Table.

(a) Group 1 elements all react in a similar way.

Explain why.

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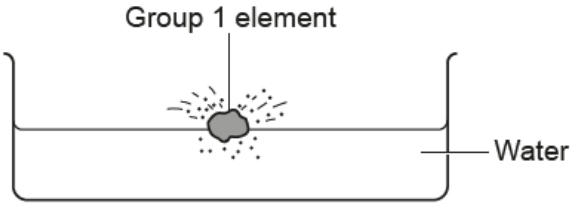
..... **[1]**

(b) Lithium, sodium and potassium are Group 1 elements.

They react with water.



Look at the table.

Group 1 element	Time for element to react completely (s)	Observations
Lithium	24	fizzes moves slowly on the surface of the water makes an alkaline solution
Potassium	6	fizzes vigorously and gas catches fire melts moves very quickly on the surface of the water makes an alkaline solution
Sodium	14	fizzes vigorously melts moves quickly on the surface of the water makes an alkaline solution

All three elements make the same gas when they react with water.

(i) What is the name of this gas?

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

(ii) How would you test for this gas?

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

(iii)* Rubidium is another Group 1 element. It is below potassium in Group 1 of the Periodic Table.

Predict what you will **see** and the **reaction time** when rubidium reacts with water.

Include an **equation** for the reaction.

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..... **[6]**

3. Nov/2020/Paper_J248/02/No.16

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_2	.....	0.072	most reactive
Chlorine	Cl_2	gas	0.099	↕
Bromine	Br_2	liquid	0.114	↕
Iodine	I_2	solid	0.133	↕
Astatine	At_2	solid	.....	least reactive

(a) Complete the table. Use ideas about trends down a Group to help you. **[2]**

(b) 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

$$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$$

(i) Complete the word equation.

bromine + sodium iodide → ..... + ... **[1]**

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

Explain why.

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

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

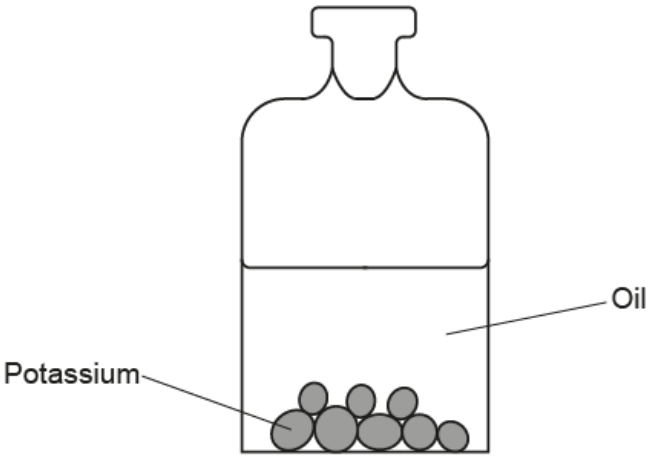
Write the **balanced symbol** equation for this reaction.

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

(c) Group 1 is another group of elements in the Periodic Table.

(i) Potassium is a Group 1 metal.

Potassium is stored under oil because it is very reactive.



What does the oil stop the potassium reacting with?

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

(ii) Sodium is another Group 1 metal.

Sodium reacts in a similar way to potassium.

Explain why.

Use ideas about atomic structure in your answer.

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

4. Nov/2020/Paper_J248/02/No.17(c)

(c) The student reacts some metals with different salt solutions.

Table 17.2 shows her results.

	Magnesium	**Zinc**	**Iron**	**Copper**
Copper sulfate	blue solution becomes colourless	blue solution becomes colourless	blue solution becomes green	no reaction
Iron sulfate	green solution becomes colourless	green solution becomes colourless	no reaction	no reaction
Magnesium sulfate	no reaction	no reaction	no reaction	no reaction
Zinc sulfate	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, $CuSO_4$.

Magnesium sulfate, $MgSO_4$, and copper are made.

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

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

5. Nov/2021/Paper_J248/03/No.19(a_ c)

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

The table shows some properties of Group 7 elements.

Element	Molecular formula	Melting point (°C)	Boiling point (°C)	Order of reactivity
Fluorine	F_2	–220	.....	most reactive
Chlorine	Cl_2	–101	–34	
Bromine	Br_2	–7	59	
Iodine	I_2	114	184	
Astatine	At_2	.....	337	least reactive

(a) Complete the table. Use ideas about trends down Group 7. **[2]**

(b) Chlorine reacts with sodium bromide, NaBr, in a displacement reaction.

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

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

(c) Explain, in terms of the arrangement of electrons, the **decrease** in reactivity from fluorine to astatine.

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..... **[3]**

6. Nov/2020/Paper_J248/04/No.18(c)

(c) Rubidium is another element in Group 1.

Rubidium reacts much faster than sodium does.

Explain why.

Use ideas about electrons in your answer.

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

7. Nov/2020/Paper_J248/04/No.22

A student investigates the reactivity of four metals, **A**, **B**, **C** and **D**.

He adds a small piece of each metal to cold water.

He then adds a small piece of each metal to dilute hydrochloric acid.

Look at his results.

Metal	Observations in water	Observations in dilute hydrochloric acid
A	slow bubbling	very fast bubbling
B	no reaction	no reaction
C	fast bubbling	very fast bubbling
D	no change	slow bubbling

(a) Write down the order of reactivity of the four metals **A**, **B**, **C** and **D**.

..... **most reactive**

.....

.....

..... **least reactive** **[2]**

(b) The piece of metal **C** used by the student produces 30 cm^3 of hydrogen gas when it reacts with the dilute hydrochloric acid at room temperature and pressure.

(i) Calculate the number of **moles** of hydrogen gas produced.

One mole of any gas occupies 24 dm^3 at room temperature and pressure.

Moles of hydrogen gas = ... **[2]**

(ii) Use your answer from **(b)(i)** to calculate the **mass** of hydrogen gas produced.

Mass of hydrogen gas = ... g **[1]**

(c) Chromium metal, Cr, reacts with nickel sulfate solution, $NiSO_4$. Solid nickel is made.

Two possible equations for this reaction are:

Equation 1 $Cr + NiSO_4 \rightarrow CrSO_4 + Ni$

Equation 2 $2Cr + 3NiSO_4 \rightarrow Cr_2(SO_4)_3 + 3Ni$

10.40 g of chromium metal reacts with excess nickel sulfate solution to make 17.61 g of nickel.

Deduce which equation, **1** or **2**, represents the reaction which takes place.

A_r: Cr = 52.0, Ni = 58.7

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..... **[3]**

(d) Bioleaching is one method used to extract copper from ores.

Reactions involving bacteria slowly convert copper sulfide to a mixture of copper sulfate solution and sulfuric acid.

(i) Describe **two advantages** of extracting copper using bioleaching instead of traditional mining.

1 .....

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2 .....

.....

[2]

(ii) Suggest **one** reason why the sulfuric acid produced during bioleaching may be harmful to the environment.

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