

## Module 5

- A1.** Which one of the following is NOT a redox reaction?
- A. Extraction of aluminium from bauxite.
  - B. Reaction of lead (II) oxide with dilute nitric acid.
  - C. Reaction of aluminium and silver nitrate.
  - D. Combustion of sulphur in air.
- A2** In which one of the following pairs of substances does the named element have the same oxidation number (state)?
- A. chlorine in  $\text{Cl}_2$  and  $\text{HCl}$
  - B. iron in  $\text{FeCl}_2$  and  $\text{FeCl}_3$
  - C. nitrogen in  $\text{NH}_3$  and  $\text{NH}_4\text{Cl}$
  - D. manganese in  $\text{MnO}_2$  and  $\text{MnCl}_2$
- A3** The metal rubidium is below potassium in Group I of the Periodic Table. Which statement is most likely to be correct?
- A. Rubidium forms an acidic oxide.
  - B. Rubidium forms a carbonate that is readily decomposed by heat.
  - C. Rubidium displaces metallic francium from aqueous potassium chloride.
  - D. Rubidium reacts more vigorously than potassium with water.
- A4** The table gives information on four metals and some of their compounds.

Metal	G	H	I	J
Action of dilute sulphuric acid	Hydrogen evolved	No reaction	Hydrogen evolved	Hydrogen evolved
Extraction	Heat	Heat	Electricity	Electricity
Action of metal on a solution of the sulphate of J	No reaction	No reaction	J is formed	No reaction

What is the order of reactivity of these metals?

Most reactive  $\longrightarrow$  least reactive

- A. H                      G                      I                      J
- B. J                      I                      G                      H
- C. I                      J                      G                      H
- D. I                      H                      G                      J

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**Module 5: Inorganic Chemistry**

**B1** Describe ONE observation you would see and the name of the product associated with your observation for each of the following reactions.

- (a) Chlorine gas is added to a solution of potassium iodide.
- (b) Potassium iodide is added to a solution of acidified potassium permanganate.

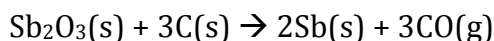
**B2** Chlorine is a group VII element. It generally exists as a diatomic molecule in natural state.

- (a) Explain why all group VII elements have similar chemical properties.
- (b) Explain, with an aid of a diagram, why chlorine always exists as diatomic molecules.
- (c) Chlorine can react with magnesium to form magnesium chloride. Draw the electronic structure **and** state the chemical formula of magnesium chloride in the spaces below.
- (d) It is observed that another compound, sodium chloride conducts electricity only when molten. Explain why this is so.

**B3** Explain each of the following.

- (a) River water can be made safer to drink if a small quantity of chlorine is first bubbled through it.
- (b) Aluminium is more reactive than iron. Why do aluminium cans not corrode in damp air
- (c) A copper(II) sulphate solution, used as wood preservative, should not be stored in a galvanised iron container.

**B4** An element in Group V is extracted from its oxide using carbon. The equation for the reaction is



- (i) Use the Periodic Table to name the compound  $\text{Sb}_2\text{O}_3$ .
- (ii) Which substance is the oxidising agent in this reaction?
- (iii) What is the oxidation state of Sb in  $\text{Sb}_2\text{O}_3$ ?

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**Module 5: Inorganic Chemistry**

- B5** (a) (i) What is an alloy?
- (ii) Draw diagrams in the spaces below to show the structures of a pure metal and an alloy.
- (iii) Use your diagrams to explain why alloys are stronger and harder than pure metals.
- (b) Six different types of metals, A, B, C, D, E and F react with sulfuric acid under the conditions stated in the following table.

<b>Metal</b>	<b>Reaction with sulfuric acid</b>
A	Reacts gradually with cold acid, producing bubbles.
B	Explosive reaction with cold acid.
C	No visible reaction when reacted with diluted acids, but reacts very slowly when boiled with concentrated acid.
D	Dissolves quickly in cold acid, producing a lot of gas.
E	No reaction with cold acid, but reacts quickly in hot acid.
F	Inert

- (i) Place the metals in order of reactivity, starting with the most reactive metal first.
- (ii) Give a reason why metal A cannot be copper.
- (iii) Provide a suitable identity of metal B.

## Module 5 (Solutions)

- A1.** Which one of the following is NOT a redox reaction? **B**
- A2** In which one of the following pairs of substances does the named element have the same oxidation number (state)? **C**
- A3** The metal rubidium is below potassium in Group I of the Periodic Table. Which statement is most likely to be correct? **D**
- A4** The table gives information on four metals and some of their compounds. What is the order of reactivity of these metals? **C**
- B1** Describe ONE observation you would see and the name of the product associated with your observation for each of the following reactions.
- (c) Chlorine gas is added to a solution of potassium iodide.  
**Colourless solution turned into brown solution, iodine**
- (d) Potassium iodide is added to a solution of acidified potassium permanganate.  
**Purple solution turned into brown solution, iodine**
- B2** Chlorine is a group VII element. It generally exists as a diatomic molecule in natural state.
- (e) Explain why all group VII elements have similar chemical properties.  
**All group VII elements have 7 outermost electrons hence each atom of the elements will gain 1 electron to become stable.**
- (f) Explain, with an aid of a diagram, why chlorine always exists as diatomic molecules.  
**Chlorine atom needs 1 more electron to become stable hence each chlorine atom will share electrons with another chlorine atom in order to obtain a stable octet structure.**
- (g) Chlorine can react with magnesium to form magnesium chloride. Draw the electronic structure **and** state the chemical formula of magnesium chloride in the spaces below.
- (h) It is observed that another compound, sodium chloride conducts electricity only when molten. Explain why this is so.  
**Sodium chloride is an ionic compound. Only when it is molten, will there be free ions to conduct electricity.**

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**B3** Explain each of the following.

- (a) River water can be made safer to drink if a small quantity of chlorine is first bubbled through it.

Chlorine gas serves as a **disinfectant** to remove microorganisms present in water.

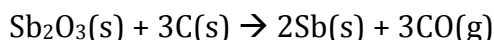
- (b) Aluminium is more reactive than iron. Why do aluminium cans not corrode in damp air?

A **layer of aluminium oxide** is formed around the aluminium to prevent further reaction with the moisture in the air.

- (c) A copper(II) sulphate solution, used as wood preservative, should not be stored in a galvanised iron container.

**Displacement** reaction will take place, as iron is more reactive than copper in the reactivity series. Therefore, copper (II) sulfate will gradually become iron (II) sulfate in this scenario.

**B4** An element in Group V is extracted from its oxide using carbon. The equation for the reaction is

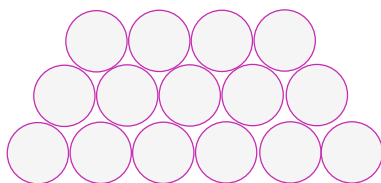


- (i) Use the Periodic Table to name the compound  $\text{Sb}_2\text{O}_3$ .  
**Tin (III) oxide.**
- (ii) Which substance is the oxidising agent in this reaction?  
**C. It oxidises itself to reduce other compounds.**
- (iii) What is the oxidation state of Sb in  $\text{Sb}_2\text{O}_3$ ? **+3**

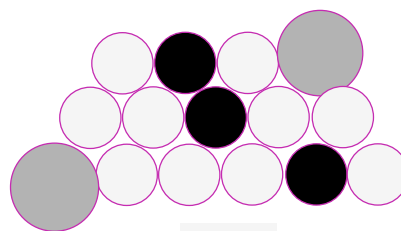
**B5** (a) (i) What is an alloy?

**Alloy is a mixture of metals with multiple elements.**

- (ii) Draw diagrams in the spaces below to show the structures of a pure metal and an alloy.



**Metals**



**Alloys**

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(iii) Use your diagrams to explain why alloys are stronger and harder than pure metals.

- Harder and stronger than metals.
  - Additional of another elements of different size breaks up regular arrangement of atoms.
  - Atoms cannot slide over.

(b) Six different types of metals, A, B, C, D, E and F react with sulfuric acid under the conditions stated in the following table.

<b>Metal</b>	<b>Reaction with sulfuric acid</b>
A	Reacts gradually with cold acid, producing bubbles.
B	Explosive reaction with cold acid.
C	No visible reaction when reacted with diluted acids, but reacts very slowly when boiled with concentrated acid.
D	Dissolves quickly in cold acid, producing a lot of gas.
E	No reaction with cold acid, but reacts quickly in hot acid.
F	Inert

(iv) Place the metals in order of reactivity, starting with the most reactive metal first.

**B>D>A>E>C>F**

(v) Give a reason why metal A cannot be copper.

**Copper is below hydrogen in the reactivity series. This means that it has a (relatively) milder reactivity than H<sup>+</sup>. Therefore, it does not reacts with Copper.**

(vi) Provide a suitable identity of metal B. **Potassium**