Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

This question is about metals and their compounds.

(a) State why the atomic radius of calcium is greater than the atomic radius of magnesium.

_____

_____

_____

(1)

(b) Magnesium reacts with steam.

Give an equation, including state symbols, for this reaction.

_____

(1)

(c) Similar-sized pieces of barium and magnesium are added to separate 100 cm^3 samples of dilute sulfuric acid. In each case the sulfuric acid is in excess.

The barium reacts quickly at first. After a few minutes the reaction stops, even though there is still some unreacted barium in the flask.

The magnesium reacts more slowly than the barium, but the reaction continues until all the magnesium has reacted.

Explain why

- the barium initially reacts more quickly than the magnesium
- the barium reaction stops before all the barium has reacted.

_____

_____

_____

_____

_____

_____

(3)

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(d) A metal nitrate **X**$(NO_3)_2$ completely decomposes when heated.

$$2\ \mathbf{X}(NO_3)_2(s) \rightarrow 2\ \mathbf{X}O(s) + 4\ NO_2(g) + O_2(g)$$

A 0.832 g sample of **X**$(NO_3)_2$ decomposes on heating to produce a total of 348 cm^3 of gas at 298 K and 100 kPa

Deduce the identity of metal **X**.

The ideal gas constant, R = 8.31 J K^{-1} mol^{-1}

Identity of metal **X** _____

(6)

(e) Sodium reacts with aluminium and hydrogen to form solid $NaAlH_4$

Give an equation for this reaction.

Suggest why $NaAlH_4$ has a high melting point.

Equation

_____

Suggestion _____

_____

_____

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_____

(3)

(f) Give the equation for the reaction between H_3PO_4 and an excess of NaOH

_____

(1)

Lithium is an important metal used in cells to power mobile phones.

(g) In a lithium cell, a lithium cobalt oxide electrode and a lithium electrode are used.

Give the equation for the reaction that occurs at the positive electrode.

_____

(1)

(h) Commercial electrochemical cells can be rechargeable or non-rechargeable.

State why lithium cells can be recharged.

_____

_____

(1)

(Total 17 marks)

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