Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

A student does an experiment to determine the percentage of copper in an alloy.

The student

- reacts 985 mg of the alloy with concentrated nitric acid to form a solution (all of the copper in the alloy reacts to form aqueous copper(II) ions)
- pours the solution into a volumetric flask and makes the volume up to 250 cm^3 with distilled water
- shakes the flask thoroughly
- transfers 25.0 cm^3 of the solution into a conical flask and adds an excess of potassium iodide
- uses exactly 9.00 cm^3 of 0.0800 mol dm^{-3} sodium thiosulfate ($Na_2S_2O_3$) solution to react with all the iodine produced.

The equations for the reactions are

$$2\ Cu^{2+} + 4\ I^- \rightarrow 2\ CuI + I_2$$

$$2\ S_2O_3^{2-} + I_2 \rightarrow 2\ I^- + S_4O_6^{2-}$$

(a) Calculate the percentage of copper by mass in the alloy.

Give your answer to the appropriate number of significant figures.

% copper _____

(6)

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(b) Suggest **two** ways that the student could reduce the percentage uncertainty in the measurement of the volume of sodium thiosulfate solution, using the same apparatus as this experiment.

1 _____

_____

2 _____

_____

3 _____

_____

(2)

(c) State the role of iodine in the reaction with sodium thiosulfate.

_____

(1)

(d) Give the full electron configuration of a copper(II) ion.

_____

(1)

(e) Copper(I) iodide is a white solid.

Explain why copper(I) iodide is white.

_____

_____

_____

_____

_____

_____

(2)

(f) Iodine vaporises easily.

Calculate the volume, in cm^3, that 5.00 g of iodine vapour occupies at 185 °C and 100 kPa

The gas constant $R = 8.31\ J\ K^{-1}\ mol^{-1}$

Give your answer to 3 significant figures.

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Volume _____ cm^3

(4)

(Total 16 marks)

Q2.

This question is about periodicity, the Period 4 elements and their compounds.

(a) State the meaning of the term periodicity.

_____

_____

_____

(1)

(b) Identify the element in Period 4 with the highest electronegativity value.

_____

(1)

(c) Identify the element in Period 4 with the largest atomic radius.

Explain your answer.

Element _____

Explanation _____

_____

_____

_____

(3)

(d) The equations for two reactions of arsenic(III) oxide are shown.

$$As_2O_3 + 6\ HCl \rightarrow 2\ AsCl_3 + 3\ H_2O$$

$$As_2O_3 + 6\ NaOH \rightarrow 2\ Na_3AsO_3 + 3\ H_2O$$

Name the property of arsenic(III) oxide that describes its ability to react in these two ways.

_____

(1)

(e) Complete the equation for the formation of arsenic hydride.

As_2O_3 + Zn + $HNO_3 \rightarrow$ AsH_3 + $Zn(NO_3)_2$ + H_2O

(1)

(Total 7 marks)

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