BINDURA UNIVERSITY OF SCIENCE EDUCATION

SCIENCE AND MATHEMATICS EDUCATION DEPARTMENT

OCT 2024

DC002/ DCH004: INORGANIC CHEMISTRY

Time: 2Hours

ANSWER QUESTION 1 AND FOUR (4) OTHER QUESTIONS TWO (2) FROM EACH OF THE SECTIONS "A" AND "B". EACH QUESTION CARRIES 20 MARKS

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1. (a) Define the following terms:
   (i) Ionic radius.
   (ii) Electronegativity.
   (iii) Effective nuclear charge.
   (iv) Inert pair effect. [4 × 2 marks]

   (b) Using M to represent group II metals, give the general formulae for each of the following group II compounds:
   (i) Chlorides. [1 mark]
   (ii) Oxides. [1 mark]
   (iii) Carbonates. [1 mark]
   (iv) Hydrides. [1 mark]
   (iv) Nitrates. [1 mark]

   (c) (i) Suggest why d-block elements are better electrical conductors than s-block elements. [4 marks]
   (ii) Give the property of transition metals that makes alloying common. [3 marks]

SECTION A: ANSWER TWO QUESTIONS FROM THIS SECTION

2. Explain the following observations:
   (i) The boiling points of group VII elements increase down the group.

Element	Boiling point / ^0C
Cl_2	-35
Br_2	+59
I_2	+184

[3 marks]

   (ii) Electrical conductivity of period 3 elements increases from Na to Al. [4 marks]

(iii) Aqueous solutions of ionic compounds conduct electricity whilst those of covalent substances do not. [3 marks]

(b) (i) Give the formulae of the chlorides of the period three elements, Na to Si. [4 marks]

(ii) Write equations to show the reactions of the following oxides with water; SO_2, P_4O_6 and P_4O_{10}. [6 marks]

3. (a) Relationship between three oxides that can be formed by Group 1 elements is given below:

$$O^{2-} \xrightarrow{\frac{1}{2}O^2} O_2^{2-} \xrightarrow{O_2} 2O_2^-$$

Give the names and general formulae of the 3 oxides that Group 1 elements can form. [6 marks]

(b) Suggest reasons why the reaction of lithium with water is less vigorous than those of sodium and potassium. [4 marks]

(c) Explain why certain elements in the Periodic Table are classified as s-block, p-block and d-block elements. Illustrate your answer with an example of an element for each block and give its electronic configuration. [6 marks]

(d) The Ne atom and the Mg^{2+} ion have the same number of electrons. Explain why the first ionisation energy of neon is lower than the third ionisation energy of magnesium. [4 marks]

4. (a) State the structure in carbon and lead [4marks]

(b) Compare and contrast the

i. structure and bonding of CO_2 and PbO_2 [4marks]

ii. the relative stability of the lower and higher oxidation states of carbon and lead [4marks]

iii. thermal stability of the tetrachlorides of carbon and lead [4marks]

iv. hydrolysis of tetrachlorides of carbon and lead [2marks]

(c) Sn and Pb show inert pair effect. Explain inert pair effect [2marks]

SECTION B: ANSWER ANY <u>TWO</u> QUESTIONS FROM THIS SECTION

5. (a) Define the term *transition element*. [2 marks]

(b) State **four** general characteristics of a transition element or its compounds. [4 marks]

(c) Give a brief explanation on the origin of colour in transition elements. [4 marks]

(d) Explain why although zinc is a d-block element, it is not considered to be a transition element. [3 marks]

(e) Write electronic configurations of the Cu and Ni^{2+}. [4 marks]

(f) Explain why transition elements can act as catalysts. [3 marks]

6. (a) Describe the variation in group 4 elements' catenation ability. [2 marks]

(b) Outline the differences between

(i) Elemental silicon and carbon. [8 marks]

(ii) Oxides of silicon and carbon [10 marks]

7. (a) Discuss the trends of Group 6 hydrides under the following sub-headings

(i) Reducing character. [3 marks]

(ii) Thermal stability. [3 marks]

(b) Oxygen can be prepared from heating some metallic oxides. Illustrate this with an equation. [2 marks]

(c) Outline the manufacture of sulphuric acid in the Contact process. [12 marks]

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