BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF SCIENCE AND TECHNOLOGY

PROGRAMME: BACHELOR OF SCIENCE EDUCATION HONOURS DEGREE IN CHEMISTRY (HBScEdCh)

COURSE: INORGANIC CHEMISTRY 1 (CHT101)

DURATION 2 HOURS

INSTRUCTIONS JAN 2025

1. Answer Question 1 and Two questions from Section A and any 2 question from section B.
2. Each question should start on a free page and marks will be allocated as indicated

SECTION A: ANSWER ANY TWO QUESTIONS

Question 1

(a) Explain in detail the significance of the Schrodinger equation. [4 marks]

(b) Calculate energy of one mole of photons of radiation whose frequency is 5×10^{14} Hz.

[4 marks]

(i) Sketch a graph showing and explain briefly the transitions of the electron in the hydrogen atom with three series of transmissions. [6 marks].

(ii) What are the frequency and wavelength of a photon emitted during a transition from n = 5 state to the n = 2 state in the hydrogen atom? [4 marks]

(iii) Explain any two limitations of Bohr's Model. [2 marks]

[TOTAL: 20]

Question 2

a) Explain briefly with aid of an equation the dual character of the electromagnetic radiation.

[4 marks]

(b) Describe how the photoelectric effect works. [6 marks]

(c) Explain with the aid of an equation the application of the Schrodinger equation. [10 marks]

Question 3

(a) Define the term trace metal. [2 mark]

(b) State any four trace metals. [4 marks]

(c) Explain three sources of the following trace metals are stored;

(i) Copper. [4 marks]

(ii) Iron. [3 marks]

(b) Explain four media for the transportation of trace metals from their sources to the surrounding environment. [4 marks]

(c) Write any three balanced chemical equations the oxidation of trace metals. [3 marks]

[TOTAL: 20]

Question 4

(a) Explain two assumptions of Dalton on the existence of an atom. [4 marks]

(b) Draw the electronic configuration of the following elements.

(c) (i) Potasium. [2 marks ×2]

(ii) Chronium

(d) Explain using examples the following as applied in Chemistry.

(i) Pauli Exclusion Principle. [4 marks]

(ii) Hund `s rule. [4 marks]

(iii) Aufbau principle. [4 marks]

[TOTAL: 20]

SECTION B: ANSWER ANY TWO QUESTIONS

Question 5

(a) State and explain the effect of a catalyst on the rate and on the equilibrium yield in the Haber Process.

[2 marks]

(b) In the Haber Process for the manufacture of ammonia, the following equilibrium is established in the presence of a heterogeneous catalyst.

(i) Identify heterogeneous catalyst used in this process. [4 marks]

(ii) Describe the production of ammonia in the Haber and explain the role of the catalyst.

[6 marks]

(iii) Explain how any three substances can poisons the heterogeneous catalyst used in the Haber Process and explain how this substance poisons the catalyst. [6 marks]

(iv) Explain any two ways of reducing the poison posed by the catalyst in Haber process.

[2 marks]

[TOTAL: 20]

Question 6

The periodic table has been criticized for been subject to be redesigned. Justify your answer. **[20 marks]**

Question 7

(a) Draw and label the valence molecular orbital energy level diagram for O_2. [10 marks]

(b) Write the valency orbital occupancy (i.e electronic configuration) for O_2. [2 marks]

(c) Draw a Lewis structure for O_2. [2 marks]

(d) What property of oxygen is clearly shown by the molecular orbital level diagram but not by Lewis diagram? [1mark]

(e) Explain why when O_2 reacts with sodium metal, the peroxide anion is generated (O_2^2).

[5 marks]

[TOTAL:20]