MCH502-03

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULT OF SCIENCE EDUCATION

DEPARTMENT OF CHEMISTRY

JAN 2025

MAIN EXAMINATION PAPER

PROGRAMME:	MSc EDUCATION (CHEMISTRY)
COURSE:	INORGANIC CHEMISTRY 5
CODE:	MCH502
DURATION:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions.
2. Each question should start on a **fresh page** and marks will be allocated as indicated.
3. Each question carries **20 marks.**

REQUIRED MATERIAL

Non- programmable calculator

Question 1

(a) Applying the eighteen-electron rule, find the value of x and y.

(i) $Fe_x(CO)_6(\eta^3\text{-}C_3H_5)_6$ **[3 marks]**

(ii) $Cr(CO)_4(\eta^3\text{-}C_3H_6)_y$ **[3 marks]**

(b) Classify the following as closo, nido, or arachno.

(i) $C_2B_3H_7$ **[1 mark]**

(ii) $NCB_{10}H_{11}$ **[1 mark]**

(c) Determine the number of framework electron pairs predicted by the mno rule for the following.

(i) $(\eta^5\text{-}C^2B_9H_{11})_2Fe^{2-}$ **[2 marks]**

(ii) $(\eta^5\text{-}C_5H_5)CoB_4H_{10}$ **[2 marks]**

(d) Explain the bonding in diborane. **[5 marks]**

(e) Discuss the role of hemoglobin in transporting oxygen, carbon dioxide, and hydrogen ions in biological systems. **[3 marks]**

Question 2

Describe the importance of transition elements in biological storage, transport and redox processes. **20 marks]**

Question 3

Discuss the modern challenges and discussions regarding the periodic table. **[20 marks]**

Question 4

Discuss the role of inorganic chemistry in the development of catalytic processes for industrial applications. Provide examples of specific catalysts and their applications.

[20 marks]

Question 5

A reaction between the terpyridine ligand (L) and iron salt resulted in the formation of an organometallic FeL_2 complex. Outline how you can characterize the formed complex using different analytical techniques. **[15 marks]**

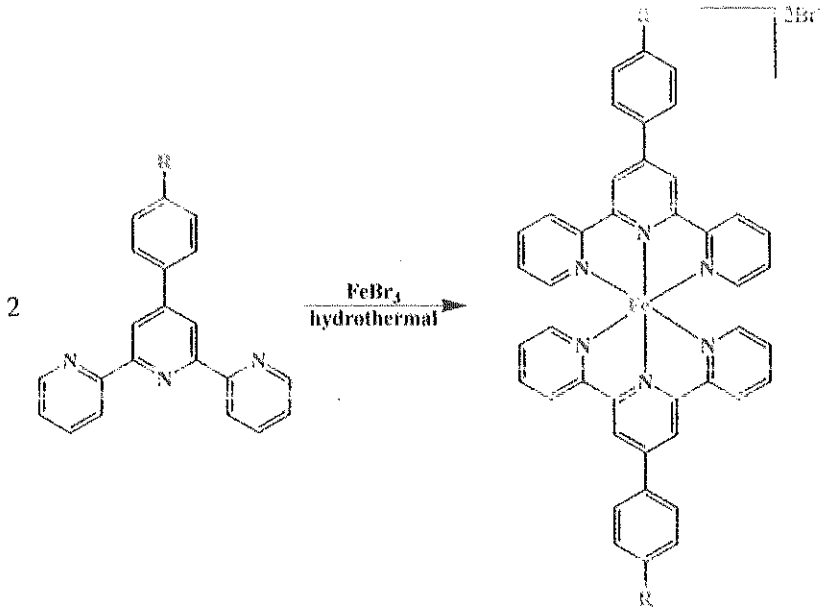

Figure 1

(b) Define the concept of the isolobal analogy and explain how it is applied in understanding the bonding and reactivity of organometallic fragments. **[5 marks]**