BOWEN UNIVERSITY IWO, OSUN STATE
COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE
INDUSTRIAL CHEMISTRY PROGRAMME
2022/2023 B.SC DEGREE FIRST SEMESTER EXAMINATION

Course Code: CHM 331 **Course Title:** Inorganic Chemistry II **Credit unit:** 3
Date: Friday, 10/02/2023 **Time Allowed:** $2^{1/2}$ hours

INSTRUCTIONS: (a) SECTION A is Compulsory, answer all (30 marks).
(b) Answer only ONE (1) question each from SECTIONS B and C, (20 marks each).
(c) Answer each complete questions on a fresh page of your booklet.

SECTION A (30 marks)

Question 1

a. Explain the principle of back bonding with a simple illustration **5 marks**

b. State the major differences between the crystal and ligand field theories **4 marks**

c. Compare briefly any two of the following:
   i. Alpha rays
   ii. Beta rays
   iii. Gamma rays **5 marks**

d. The discovery of the ziese salt and similar compounds proved there was no intrinsic difference between organic and inorganic chemistry.
   i. State the general name for these types of compounds **1 mark**
   ii. State one chemical reaction the ziese salt undergoes, as well as the product **2 marks**

e. Calculate the spin-only magnetic value for V^{4+}, hence predict its probable magnetic property. **3 marks**

f. Write the electronic configuration of the following noble gases:
   i. $_{54}Xe$
   ii. $_{36}Kr$
   iii. $_{18}Ar$ **3 marks**

g. State the reason(s) why noble gases have very low boiling and melting points compared to elements of other groups. **2 marks**

h. Give/name four different compounds of Xenon you know. **4 marks**

i. Identify the first member of group 3 elements and write its electronic configuration. **1 mark**

SECTION B

Question 2

a. Briefly explain three distinctive properties of transition metals. **6 marks**

b. Write briefly on the role of any two important transition metal in living organisms. **4 marks**

c. Name the following complexes, calculate the primary and secondary oxidation numbers

i. $[Co(NH_3)_4Cl(NO_2)]^+$

ii. $[Cu(H_2O)_2(NH_3)_4]SO_4$ **10 marks**

Question 3

a. Bridget put his small generating machine at the corner of his room, as he watched the just concluded world cup. He dozed off, before the generator went off and was found dead the following morning. Give an account of what could have happened as a chemistry student. **5 marks**

b. The chemistry of such compounds as $[(\eta^x - C_5H_5)_2Fe]$ is well known

i. Write the common name of the above compound

ii. State the value of x in $[(\eta^x - C_5H_5)_2Fe]$

iii. Draw the structure of the compound $[(\eta^x - C_5H_5)_2Fe]$ and state the IUPAC name **5 marks**

c. State the major difference between double salts and complex salts with an example for each. **6 marks**

d. i. While working with an Fe^{2+} compound in the laboratory, the metal can easily get oxidized to Fe^{3+}. Answer True or False with reason(s). **3 marks**

ii. Name the complex $[Pt(NH_3)_2Cl_4]$ **1 marks**

SECTION C

Question 4

Noble gases are often referred to as inert gases that do not normally react with other elements to form compounds, but there are some exceptions like Xenon which formed various compounds when reacts with some elements or formed from certain reactions. Hence, explain concisely any **three (3)** of the named compounds under the following headings:

a. Reaction formation with condition(s) **4 marks**

b. Structure/geometry/shape of the compound with name **6 marks**

c. One major property of the compound **3 marks**

d. Hybridization determination **4 marks**

e. Reaction with water **3 marks**

Question 5

a. i. Boron forms an extensive and interesting series of hydrides, called boranes (B_xH_y). The simplest of these is not BH_3 as expected but its dimer. Hence, give the name, molecular formula and structure of this dimer. **3 marks**

ii. Identify three most important structure categories of boranes? **3 marks**

b. Give reason(s) for the following observations in Group 18 elements?

i. The ionization potential decreases with an increasing radius. **2 marks**

ii. They have little tendency to gain or lose electrons. **2 marks**

iii. Fluorine is the only element that reacts with xenon. **2 marks**

iv. Helium is used as a component of breathing gases for divers. **2 marks**

v. Krypton is similar to Argon, but it is chosen over Argon for insulation and higher coloured temperature performance bulbs. **2 marks**

c. State the specific application/uses of each of the following Noble gases?

i. Argon in electronics **2 marks**

ii. Radon in medicine **2 marks**