M.Sc. 1st Semester Examination, 2021
CHEMISTRY
Course Title: Inorganic Chemistry
Course Code: CHEM 101C
Course ID: 11451

Time: 2 Hours   **Full Marks: 40**

The figures in the right hand side margin indicate full marks.

Candidates are required to give their answers in their own words as

far as practicable

1. Answer *any five* of the followings: $2 \times 5 = 10$

   (a) Sketch the structures of all possible isomers of $M(AB)_3$ in which AB is a bidentate unsymmetrical ligand.

   (b) Write down the functions of Vitamin B_6.

   (c) What is an enzyme? What do you mean by oxidoreductases?

   (d) Give an example of fluxional complex.

   (e) Why is NO important in biology?

   (f) Give one example for each of water soluble and fat soluble vitamin.

   (g) The electronic spectrum of $[CoF_6]^{3-}$ shows two bands having maxima around 11,500 cm^{-1} and 14,500 cm^{-1}. -Explain

2. Answer *any four* of the followings: $5 \times 4 = 20$

   (a) What is aldehyde oxidase? Write the mechanism of function of aldehyde oxidase.

                                                 $1+4 = 5$

   (b) (i) Derive the relation between stepwise formation constants and overall formation constant.

      (ii) Identify and find the total number of the isomers of $Ma_2b_2c_2$ by Bailar's method.

                                                 $2.5+2.5 = 5$

   (c) (i) Explain why second peak in DTA curve of calcium oxalate monohydrate $(CaC_2O_4.H_2O)$ in air is in the positive side, but that in carbon dioxide atmosphere is in the negative side.

      (ii) The thermogravimetry analysis curve of a sample of $MgC_2O_4 \cdot H_2O$ shows as a function of temperature. The original sample weighing 22.16 mg is heated from room temperature to 1000^oC at a rate of 20^oC per minute. The sample shows two steps: a loss of 3.06 mg from $100 - 250\ ^oC$ and a loss of 12.24 mg from 350 –

550°C. For each step, identify the volatilization product and the solid residue that remains. $\qquad$ 2+3 = 5

(d) What is the difference between cisplatin and transplatin? How does cisplatin work on cancer cells? Why is transplatin not used as an anticancer drug? $\qquad$ 1+2+2 = 5

(e) (i) Given Δ_o for H_2O is 1300 cm^{-1}, what would be the CFSE of $[Cr(H_2O)_6]^{2+}$ in high spin and low spin configurations? (Mean pairing energy P = 23,500 cm^{-1})

(ii) Show that for d^4 high spin metal ions, the relative energy of an octahedral over tetrahedral fields is -6Dq + 4Dq$'$ where 10Dq and 10Dq$'$ are the crystal field splitting in octahedral and tetrahedral fields respectively. $\qquad$ 2.5+2.5 = 5

(f) (i) Distinguish between Fischer carbene and Schrock carbene.

(ii) Write down the structures of A and B.
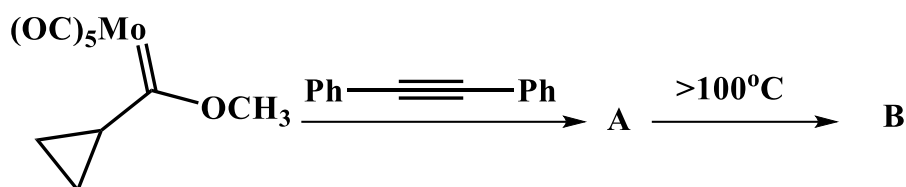
(iii) Write down the structure of first synthesized diene-complex. $\qquad$ 2+2+1 = 5

3. Attempt *any one* of the followings: $\qquad$ 10×1 = 10

(a) (i) In terms of CFT, explain why all six Cu-OH$_2$ distances in Cu(H$_2$O)$_6$ are not equal.

(ii) In a Ni^{2+} complex the absorption bands arising from d-d transition occur at 10750, 17500, 28200 cm^{-1}. Assign the bands from Orgel diagram. Which transition is responsible for the colour of the complex?

(iii) Give one example of optically active pure inorganic complex.

(iv) The potential of a UO^{2+}/U^{4+} half-cell is –0.0190 V relative to a saturated calomel electrode. What is its potential when using a saturated silver/silver chloride electrode or a standard hydrogen electrode? $\qquad$ 2+5+1+2 = 10

(b) (i) What do you mean by controlled-potential coulometry and controlled-current coulometry? Why is Pt wire in auxiliary electrode of the coulometry separated by a salt bridge from the analytical solution? Write down two advantages and two disadvantages of controlled-current coulometry over controlled-potential coulometry. Why is controlled-potential coulometric analysis usually carry out in a small volume electrochemical cell, using an electrode with a large surface area, and with a high stirring rate?

(ii) Draw the structures of corrin and porphyrin. $\qquad$ (1+1+2+2) + (2+2) = 10