

CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN,

B.Sc. CBCS Semester V (Regular) Examination, January 2022

Subject Code: CHC 106

Subject Name: Inorganic Chemistry

Total marks: 80

Duration: 2 Hours

Total No. of Pages: 05

Instructions: 1. *The two sections are to be answered on separate answer books*

2. *All questions are compulsory.*

3. *Figures to the right indicate full marks*

SECTION A

Q1. Answer ANY FOUR of the following

4 × 4 = 16 Marks

- i) State, giving reasons, which of the following will have a smaller radius
 - a) Ca or Ca^{2+}
 - b) Na or K
- ii) What is effective nuclear charge? How does ionization potential vary in a group and a period of the periodic table?
- iii) The acidity of the oxyacids of chlorine decrease in the following order
 $\text{HClO}_4 > \text{HClO}_3 > \text{HClO}_2 > \text{HOCl}$. Explain
- iv) Discuss the geometry and hybridization of ICl_4^- ion and the IF_7 molecule.
- v) Explain the chemistry of XeF_4 with respect to method of preparation, reaction with water, bonding and structure
- vi) Explain Schottky defect in crystals (with a diagram). What consequences will the presence of Schottky defect have on a crystal?

Q2 A) Answer the following questions

- i) On the basis of Slater's rules, calculate the value of effective nuclear charge for a 3d electron in Chromium. **3 Marks**
- ii) Discuss Stacking fault defect. **3 Marks**

OR

Q2 A) Answer the following questions

- iii) The bond angles of the hydrides of group VIA decrease in the order $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se}$. Give reason for this trend. **3 Marks**
- iv) Discuss grain boundary defect in crystalline solids. **3 Marks**

Q2 B) Answer the following questions

i) Give reasons **4 Marks**

a) Which of the following electronic configurations would you expect to have the lowest ionization energy? Explain

- a) $1s^2 2s^2 2p^6$ b) $1s^2 2s^2 2p^5$ c) $1s^2 2s^2 2p^6 3s^1$ d) $1s^2 2s^2 2p^4$

b) Which of the following ions is isoelectronic with C?

- a) N^{2-} b) N^{2+} c) B^- d) B^+ e) Be^+ f) O^{2+}

ii) What are clathrates? Explain with a suitable example. **2 Marks**

Q3 A) Answer the following questions

i) Give an account of the following pseudohalogens with reference to preparation and structure. **3 Marks**

- a) Cyanogen
b) Seleno Cyanogen

ii) On the basis of 'band theory' explain the 'p'-type of semiconductor. **3 Marks**

OR

Q3 A) Answer the following questions

iii) Give only the structure for **3 Marks**

- a) Triiodide ion b) Iodine pentafluoride
c) Heptaiodide ion d) Dimesoperiodic acid
e) Paraperiodic acid f) Dimeric iodine trichloride molecule

iv) Explain the electrical conductivity of a metal on the basis of MOT. Why does the conductivity in metals usually decrease with increase in temperature? **3 Marks**

Q3 B) i) Answer the following questions

4 Marks

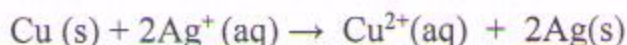
- a) Among halogens, iodine alone heptafluoride. Explain.
 - b) XeF_6 cannot be stored in a glass vessel or quartz jar. Give equations to support your answer..
- ii) What are the factors that affect the magnitude of electronegativity? 2 Marks

SECTION B

Q4. Answer ANY FOUR of the following

4 × 4 = 16 Marks

- i) Explain how the ESR spectra and nephelauxetic effect indicate covalent bonding in complexes.
- ii) Considering only sigma interactions, draw a labelled molecular orbital diagram showing the distribution of electrons for $[\text{Fe}(\text{CN})_6]^{3-}$.
- iii) From the given reduction potential values answer the following
 - a) Predict whether $\text{Fe}(\text{s})$ will oxidise to Fe^{2+} by the reaction with 0.1N HCl
 - b) Will Cu metal displace Mg from a solution of MgSO_4 ?
 - c) Predict whether Fe metal will liberate hydrogen gas from a solution of dil HCl.
 - d) Will the redox reaction occur?



($E^0\text{Fe}^{2+}|\text{Fe} = -0.44 \text{ V}$, $E^0\text{Cu}^{2+}|\text{Cu} = +0.34 \text{ V}$, $E^0\text{Ag}^+|\text{Ag} = +0.80 \text{ V}$, $E^0\text{Mg}^{2+}|\text{Mg} = -2.38 \text{ V}$, $E^02\text{H}^+|\text{H}_2 = 0.00 \text{ V}$)

- iv) Consider the reaction $\text{Cu (s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag(s)}$. The standard reduction potential of the Ag^+/Ag and Cu^{2+}/Cu couples are +0.80V and 0.34V, respectively. What is the standard potential for the reaction? Will a cell set up with this reaction be feasible? Give the representation of this cell and calculate its EMF.
- v) Discuss the properties of nanomaterials with respect to
 - a) Colour
 - b) Surface area
- vi) Draw and explain the structure of oxy and deoxy hemoglobin.

Q5 A) Answer the following

i) With suitable examples show the geometric isomers of octahedral complexes having coordination number six. **3 Marks**

ii) Explain how Chelate effect and steric effect affect the stability of complexes. **3 Marks**

OR

iii) Compare the CFT and MOT (Any six points). **3 Marks**

iv) Write a short note on Pourbaix diagrams. **3 Marks**

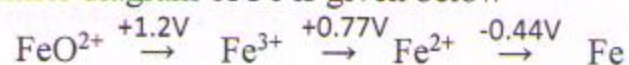
Q5 B) Answer the following

i) Discuss the classification and applications (any two) of Carbon Nanotubes. **4 Marks**

ii) Discuss the use of model systems in bioinorganic chemistry. **2 Marks**

Q6 A) Answer the following

i) A portion of the Latimer diagram of Fe is given below **3 Marks**

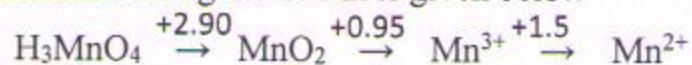


Calculate the reduction potential for the reduction of FeO^{2+} to Fe.

ii) Draw a labelled molecular orbital diagram showing $\text{L} \rightarrow \text{M}\pi$ interactions. **3 Marks**

OR

iii) A portion of the Latimer diagram of Mn is given below **3 Marks**



Determine the species that are susceptible to disproportionation. Also mention the oxidizing and reducing agents in the diagram.

iv) Draw a labelled molecular orbital diagram showing $\text{M} \rightarrow \text{L}\pi$ interactions.

3 Marks

Q6 B) Answer the following questions

i) Explain the Bottom up approach to synthesize nanomaterial. Name some methods that come under this technique. **3 Marks**

ii) With the help of diagram explain the working of the sodium potassium pump. **3 Marks**

*****All The Best*****