

CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN,

Semester End Examination, January 2021

Semester: V

Inorganic Chemistry - CHC106

Total marks: 80

Duration: 2 Hours

- Instructions:** 1. The two sections are to be answered on separate answer books
2. All questions are compulsory.

SECTION A

Q1. Answer ANY FOUR of the following

4 × 4 = 16 Marks

- i) State, giving reasons, which of the following has a smaller radius
a) Mg, Mg²⁺
b) Br, Cl
- ii) What is effective nuclear charge? What are the factors that influence ionization potential?
iii) Give reasons
a) Among halogens, iodine alone forms heptafluoride
b) Fluorides of iodine are most stable in comparison to other interhalogen compounds.
- iv) Explain decrease in acidity of the following oxyacids
 $\text{HClO}_4 > \text{HClO}_3 > \text{HClO}_2 > \text{HOCl}$
- v) Explain the hybridization of Xenon tetrafluoride and draw the structure. Identify the number of bond pairs and lone pairs present.
- vi) Explain Schottky defect in crystals (with a diagram). What are the consequences of the presence of Schottky defect in 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 4s electron in Chromium. **3 Marks**
- ii) Discuss the band structure of n-type semiconductors. **3 Marks**

OR

Q2 A) Answer the following questions

- i) 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**
- ii) Discuss the band structure of metals and insulators. **3 Marks**

Q2 B) Answer the following questions

i) Give reasons

4 Marks

- a) The electron affinity of nitrogen is lower than that of carbon and oxygen
- b) The electron affinity of Chlorine is less than that of Fluorine.

ii) What are clathrates? Why helium does not form clathrates?

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) Thiocyanogen
- b) Azidocarbonyl disulphide

ii) Why are defects present in a crystal.

3 Marks

OR

Q3 A) Answer the following questions

iii) Discuss the geometry and hybridization of IF_5 .

3 Marks

iv) Discuss the classification of defects.

3 Marks

Q3 B) i) Answer the following questions

4 Marks

a) Discuss the structure of the triiodide ions.

b) Write the reactions for the preparation of XeF_6 and XeF_2 .

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

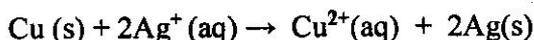
i) Draw a labelled molecular orbital diagram showing proper distribution of electrons for $[FeF_6]^{3-}$ considering only sigma bonding.

ii) With suitable examples explain the possible structures of coordination compound with coordination number 4.

iii) From the given reduction potential values answer the following

a) Predict whether Fe(s) will oxidise to Fe^{2+} by the reaction with 0.1N HCl

- b) Will Cu metal displace Mg from a solution of MgSO₄?
 c) Predict whether Fe metal will liberate hydrogen gas from a solution of dil HCl.
 d) Will the redox reaction occur?



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

- iv) Two electrodes, silver and copper were taken to construct an electrochemical cell. Set up the cell, identify the anode and the cathode and write the reactions taking place at the respective half cells. Give the overall cell reaction and the cell representation. Calculate the EMF of the cell. ($E^{\circ}\text{Cu}^{2+}|\text{Cu} = +0.34 \text{ V}$, $E^{\circ}\text{Ag}^+|\text{Ag} = +0.80 \text{ V}$)
- v) Discuss the properties of nanomaterials with respect to
- Colour
 - Boiling Point
- vi) Draw and explain the structure of oxy and deoxy hemoglobin.

Q5 A) Answer the following

- i) With a labelled molecular orbital diagram explain L→Mπ interaction in octahedral complexes. **3 Marks**
- ii) Differentiate between primary and secondary valencies. **3 Marks**

OR

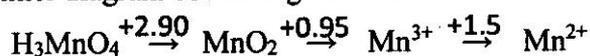
- iii) $[\text{FeF}_6]^{3-}$ is a spin free complex whereas $[\text{Co}(\text{NH}_3)_6]^{3+}$ is spin paired. Explain. **3 Marks**
- iv) Explain the calcination and roasting process involved in the metallurgical extraction of ores. **3 Marks**

Q5 B) Answer the following

- i) Discuss the properties and applications of Carbon Nanotubes. **4 Marks**
- ii) Write a note on the biological importance of calcium and magnesium **2 Marks**

Q6 A) Answer the following

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

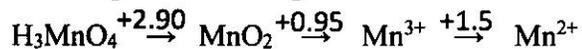


Calculate the reduction potential for the reduction of H₃MnO₄ to Mn²⁺.

- ii) Draw the molecular orbital diagram showing the distribution of electrons for $[\text{Co}(\text{NH}_3)_6]^{3+}$ considering only sigma bonds. **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) Explain three factors affecting the stability of coordination compounds with examples.

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 biological importance of sodium potassium pump.

3 Marks

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