

U.G. 4th Semester Examination - 2022

CHEMISTRY

[HONOURS]

Course Code : CHEM-H-CC-T-9

(Inorganic)

Full Marks : 40

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **five** questions: 2×5=10
- Explain the mode of decay of the radio-nuclei ^{14}C and ^{13}N .
 - Define packing fraction.
 - Write the structure of tetrakis (ethylene diamine)- μ -amido- μ -hydroxy dicobalt(III) sulphate.
 - What do you mean by 'fissile nucleus'? Name two such nuclei with their atomic and mass numbers.

- Potash alum is a double salt but potassium ferricyanide is a complex salt. Explain it.
- Why boron nitride is called inorganic graphite?
- Borazine is more reactive than benzene. Explain it.
- Give example of an optically active carbon free co-ordination compound.

2. Answer any **two** questions: 5×2=10

- What is 'Radio-carbon dating'?
 - 1g (one gram) radium-226 is placed in a sealed tube. How much helium will be evolved in 60 days? ($t_{1/2}=1590$ yrs.).
2+3
- What is the basic structural unit of all silicates?
 - Write the name of a noble gas which is formed due to radioactive decay.
 - Write the structural formula of Caro's acid.
 - What is Freon-12?
 - What happens when Boron trichloride is treated with lithium aluminium hydride in ether?
1+1+1+1+1

- c) i) On the basis of EAN (Effective atomic number rule) identify the first row transition metal ions in the following: $[M(CO)_6]$ and $[(H_3C)M(CO)_5]$.
- ii) Define step-wise and overall stability constant and establish a relation between them for ML_6 type of co-ordination compound. 2+3
- d) i) Draw all the isomers of $[Co(NH_3)_2Cl_2(en)]^+$.
- ii) What are ambidentate ligands? How are these involved in linkage isomerism in coordination compounds? Answer with an example. 2+3

3. Answer any **two** questions: 10×2=20

- a) i) Briefly discuss the hazards of radioactivity.
- ii) Distinguish between nuclear fission and nuclear fusion reaction.
- iii) What are phosphazenes? Describe their structural types.
- iv) "Chelate effect is an entropy effect". Explain it. 2+2+4+2

- b) i) What are half-life and mean-life of a radio-element? Using radioactive disintegration law, find mathematical expression for each of them. From their relation find which one is greater.
- ii) A piece of wood was found to have $^{14}C/^{12}C$ ratio 0.7 times that in a living plant. Calculate the period when the plant died ($t_{1/2}$ of $^{14}C = 5760$ yrs).
- iii) Which are used as a control rod and coolant in nuclear reactor? 5+3+2
- c) i) How is XeF_4 prepared? What happens when it is hydrolysed?
- ii) Discuss the structure and bonding of B_2H_6 (diborane).
- iii) Which member in the halogen family exhibits cationic properties and why?
- iv) What is meant by pseudohalogens? Why thiocyanogen is called a pseudohalogen? 2+3+2+3
- d) i) "An inner metallic ligand is essentially a chelating ligand". Elucidate it.

- ii) Chromium (III) chloride forms three different hydrates of some composition $\text{Cr} : \text{Cl} : \text{H}_2\text{O} = 1 : 3 : 6$. The violet salt does not lose water over conc. H_2SO_4 and gives three equivalents of AgCl on treatment with AgNO_3 . The two hydrates, both being green, loses 1 and 2 mol of H_2O over conc. H_2SO_4 and respectively gives 2 and 1 equivalents of AgCl on treatment with AgNO_3 . Write down the coordination structures of the three isomeric Cr(III) complexes and explain the type of isomerism involved.
- iii) Determine the primary and secondary valency of platinum in $\text{K}_2[\text{PtCl}_6]$.
- iv) Write down the IUPAC name of $[\text{Cr(en)}_2(\text{H}_2\text{O})_2]\text{Br}_3$ and $\text{Na}[\text{Pt}(\text{Cl})(\text{Br})(\text{NO}_2)(\text{H}_2\text{O})]$. $2+4+2+2$
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