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I Semester M.Sc. Degree Examination, June/July - 2022

CHEMISTRY

Inorganic Chemistry - I

(CBCS Scheme New Freshers -2019-20 Onwards)

Paper: CH-101



Time : 3 Hours

Maximum Marks : 70

*Instructions to Candidates:*

Answer question No. 1 and any Five of the following.

Answer any Ten of the following:

(10×2=20)

1. a) What is synergic bonding? Explain with an example.
- b) If z- is the internuclear axis, which linear combinations of s, p and d atomic orbitals will result in the formation of  $\sigma$ ,  $\pi$  and  $\delta$  orbitals?
- c) Based on electronegativity, arrange the following bonds in the order of decreasing polarity: N-O, N-N, N-P and C-N. Justify your answer.
- d) What are Amphiboles? Write their structures.
- e) Give the preparation and structure of  $[Fe(C_2B_9H_{11})_2]^{2-}$
- f) Draw the structure and mention the composition of benitoite.
- g) Give the applications of heteropoly acids.
- h) Write the equation for self-ionization of liq.  $N_2O_4$ . Justify the ionization with any one reaction.
- i) Give the meaning of symbiosis with an example.
- j) Distinguish between  $\beta^-$ -and  $\beta^+$  decay. Give one example in each case.

[P.T.O.]



- k) What are the factors favouring M-M bond?
- l) Calculate the binding energy per nucleon for  $^{27}_{59}\text{Co}$  with a mass of 58.95182 amu. (Mass of H atom = 1.008142 amu and neutron is 1.008982 amu).
2. a) Identify the number of lone-pair of electrons present in the following:  $\text{ClF}_3$ ,  $\text{ICl}_4^-$  and  $\text{I}_3^-$ . Predict their structures using VSEPR theory.
- b) Derive the limiting radius ratio for octahedral arrangement.
- c) Explain Fajan's rules. Based on these rules, explain why  $\text{AlCl}_3$  shows higher melting point than  $\text{AlBr}_3$  and  $\text{AlI}_3$ . (4+3+3=10)
3. a) Discuss the synthesis, structure and bonding in borazine. Why is it called inorganic benzene?
- b) Why do zeolites exhibit molecular sieving property? Explain with examples.
- c) What are carboranes? How are they classified? Give one example for each class. (3+4+3=10)
4. a) Write a short note on MCD.
- b) Discuss the theoretical basis of HSAB concept. What are its limitations?
- c) Predict the bases as hard or soft in the reaction which proceed from left to right
- $$\text{CH}_3\text{Hg}^+ + \text{H}^+ \text{R}_2\text{S} \rightarrow \text{CH}_3\text{HgSR}_2^+ + \text{H}^+$$
- $$\text{CH}_3\text{HgNH}_3^+ + \text{H}^+ \rightarrow \text{NH}_4^+ + \text{CH}_3\text{Hg}^+$$
- (3+4+3=10)
5. a) Explain the structure and bonding involved in a dinuclear  $[\text{Re}_2\text{Cl}_8]^{2-}$
- b) Explain the salient features of shell model of nucleus. Predict the nuclear spin and parity of  $^{33}_{16}\text{S}$  and  $^{43}_{20}\text{Ca}$  nuclides. (5+5=10)
6. a) Write Kapustinskii's equation and define the terms in it. Using this equation calculate the lattice energy of  $\text{KNO}_3$ . (Given radius of  $\text{K}^+ = 1.38 \text{ \AA}$  radius of  $\text{NO}_3^- = 1.89 \text{ \AA}$ ).
- b) Sketch the M.O. Energy level diagram of  $\text{ICl}$  molecule and explain its features.
- c) Discuss the structures of zinc blende and wurtzite. (3+3+4=10)
7. a) Discuss the synthesis, structure and bonding in  $\text{S}_4\text{N}_4$  compounds.
- b) Explain the preparation bonding and structure of  $(\text{PNCl}_2)_3$ .
- c) Give examples of any three isopolymolybdate ions. At what pH, these are stable? (3+4+3=10)



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8. a) Explain cotton effect with an example.
- b) Distinguish between low nuclearity and high nuclearity carbonyl clusters.
- c) Calculate the decay constant, mean life time and half life of a radio nuclide where activity diminished by 10% in 100 days. (3+4+3=10)

