

B.Sc. 5th Semester (Honours) Examination, 2020-2021

CHEMISTRY

Course ID: 51411

Course Title: UG/CHEM/501/C-11

Course Title: Inorganic Chemistry IV

Time: 1 Hour 15 Minutes

Full Marks: 25

*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 following questions: 1×5 = 5
- (a) Give an example of each for MLCT and LLCT transition.
 - (b) What will be the Russell Saunders symbol of cobalt (II) ion?
 - (c) A complex registers a magnetic moment of 5.0 BM. How many unpaired electrons does it have?
 - (d) Draw the splitting pattern of the d-orbitals in square planar crystal field.
 - (e) Which one among $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Os}(\text{CN})_6]^{4-}$, possesses greater $10 Dq$ value? -Explain.
 - (f) Why does Zr and Hf form close pair?
 - (g) Write down the electronic configuration of uranium mentioning its most prominent oxidation state.
 - (h) What happens when Th-232 is bombarded with neutron?
2. Answer *any two* of the following questions: 5×2 = 10
- (a) (i) “[NiCl_4] $^{2-}$ is paramagnetic while [NiCN_4] $^{2-}$ is diamagnetic” – Explain and comment on their geometry.
 - (ii) Arrange the following species in the order of increasing Jahn Teller distortion in an octahedral environment: high spin cobalt (III), low spin cobalt (II), copper (II) and Ti (III) 3+2 = 5
 - (b) (i) Why lanthanide elements show the common and stable oxidation state of +3?

(ii) "Tc(VII) and Re(VII) are less oxidising whereas Mn(VII) is highly oxidising" – Explain.

2+3 = 5

(c) (i) Bis(dimethylglyoximato) nickel (II) is experimentally known to be diamagnetic. How do you interpret on CF model?

(ii) Explain spin crossover region and give an example of a complex exhibiting high spin and low spin equilibrium.

2+3 = 5

(d) (i) What will be the CFSE for tetrahedral $[\text{CoCl}_4]^{2-}$ if the CFSE of octahedral $[\text{CoCl}_6]^{4-}$ is 18000 cm^{-1} .

(ii) Briefly discuss the principle of separation of lanthanides by ion-exchange method.

2+3 = 5

3. Answer any one of the following questions:

10×1 = 10

(a) (i) Mention the effect of pH on chromate-dichromate equilibrium.

(ii) $10 Dq$ of $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$ is known from electronic spectrum to be $21,000 \text{ cm}^{-1}$.

The pairing energy of Mn (III) is $28,800 \text{ cm}^{-1}$. Predict whether the complex is high-spin or low spin

(iii) Find out the geometry and $\mu_{s.o.}$ value of the complex $\text{K}_3[\text{MnCN}_6]$ and indicate the hybridization of central metal ion.

(iv) "Pentavalent uranium has a strong tendency to disproportionate" – Comment.

2+3+3+2 = 10

(b) (i) Explain why the orbital moment is quenched in most of the first transition series complexes?

(ii) Why does $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ have pale colour as compared to the complexes of other oxidation states of these metals?

(iii) What is nephelauxetic effect and what is the empirical formula to calculate the Racah parameter for different metal ions in complexation?

3+3+2+2 = 10