

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, JUNE 2022

THIRD YEAR [BATCH 2019-22]

CHEMISTRY (HONOURS)

Paper : XIV [CC14]

Date : 15/06/2022

Time : 11 am – 1 pm

Full Marks : 50

[Use a separate Answer book for each unit]

[Attempt one question from each unit]

Unit –I

[12 Marks]

1. a) What are the effects of Cu^{2+} ion deficiency and excess in human body? (1+2)
b) Define active transport and passive transport write down the mechanism through which the nerve cells maintain the concentrations of Na^+ and K^+ inside and outside of the cells. (2+3)
c) Explain the biological importance and its adverse effect of (i) Ca (ii) Zn, (2+2)
2. a) Explain the role of ATP hydrolysis in human body. Give the mechanism of metal catalysed hydrolysis of ATP molecule. (2+3)
b) What are essential and beneficial elements? What are the basic differences between essential and beneficial elements? Give example in each case. (1+1+2+1)
c) Explain the mechanism and importance of creatine-phosphocreatine inter-conversion in biological system. (2)

Unit –II

[13 Marks]

3. a) What is cytochromes? Give a brief account of the structural differences between cytochromes 'a', 'b' and 'c' and also explain the slow rate of electron transfer in cytochromes 'c'. (1+2+2)
b) Illustrate two use of metal compounds as drugs. (2)
c) State the biological function of
i) Fe-S Proteins
ii) Hemoglobin (2+2)
d) What is cis-platin? State its medicinal use. (2)
4. a) Discuss the role of photosystem I and photosystem II in photosynthesis. (4)
b) Blood is red in colour —why? (2)
c) Would chelation therapy be useful in case of lead poisoning? Explain your answer. (2)
d) Explain the function of carbonate-bicarbonate buffering system, stating its biological importance. (3)
e) How does arsenic exert its toxic effect on biological system? How the toxicity can be removed? (2)

Unit –III

[13 Marks]

5. a) The chemistry of 4f-block elements are mostly those of M^{3+} ions while M^{2+} assumes significance in case of Eu and Yb –justify the statement. (Given: atomic number of Eu = 63; Yb = 70) (3)
- b) Compare between 4f and 5f block elements with respect to their electronic configuration with justification. (3)
- c) The single electron spin-orbit coupling constant (ϵ) value of Eu^{3+} and Tb^{3+} is 1415 cm^{-1} and 1620 cm^{-1} , respectively. Calculate the value of multiplet width and justify its significance regarding theoretical estimation of their magnetic moment values. (3)
- d) What are metal clusters? Is diamagnetic Cr(II) acetate belongs to the group of metal clusters? Give justification in favour of your answer. (1+1+2)
6. a) Give a brief outline of the ion-exchange method of separation of lanthanides. (4)
- b) Use Hund's rule to derive the ground state term of Ce^{3+} ion and calculate its magnetic moment. (3)
- c) Write down the structure of $[Re_2Cl_8]^{2-}$ and discuss its bonding in the light of molecular orbital concept. (2+4)

Unit –IV

[12 Marks]

7. a) Symmetricaldi- μ -hydroxotetrakis(ethylenediamine)dnicobalt(III)chloride (A) reacts with aq. HCl to give a product $Co(en)_2Cl_3$ (B) which is resolvable with optical isomers. When it is kept in acidic solution, the compound changes colour and gives an isomer (C) which is not resolvable. Give structures of (A), (B) and (C) and also write the optical isomers of (B). (4)
- b) A sample and its blank had a percent transmittance of 45.4% and 97.5% respectively. What would be the absorbance due to analyte? (2)
- c) A complex of Ni(II), $[NiCl_2(PPh_3)_2]$ is paramagnetic in nature. The analogous Pd(II) complex is diamagnetic in nature. What would be the number of isomers that will exist for the Ni and Pd complexes? (3)
- d) What is meant by Stepwise Formation Constant and Overall Formation Constant? Derive a relation between them. (3)
8. a) What is Trans effect? What product will be obtained when $[PtCl_4]^{2-}$ is treated with
- i) NH_3 followed by C_2H_4
- ii) C_2H_4 followed by NH_3 (2+2)
- b) $[Ni(en)_3]^{2+}$, where en= ethylenediamine, is nearly 10^6 more stable than $[Ni(NH_3)_6]^{2+}$ though both can be derived from $[Ni(H_2O)_6]^{2+}$ complex. Explain the stability of the former from thermodynamic consideration. (2)

- c) A solution containing 47 ppm of a compound X (FW= 225) has a transmittance of 29.7% (assuming density of water 1gm/cc) in a 1.5 cm cell at 400 nm. What would be the molar absorptivity and give its unit. (3)
- d) Indicate the type of isomerism exhibited by the following pairs of isomers and suggest one test for each set to distinguish them.
- i) $[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$ and $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$
- ii) $[\text{Co}(\text{NH}_3)_5(\text{NO}_3)]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5(\text{SO}_4)](\text{NO}_3)$ (3)

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