U.G. 5th Semester Examination - 2021

CHEMISTRY

[HONOURS]

Course Code : CHEM-H-CC-T-11

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: $2\times5=10$

    a) A deep blue solution of Co(II) in conc. HCl gradually turns pale pink on addition of excess water. Explain.

    b) The CrO_4^{2-} ion is a d^0 and is yet coloured. Explain.

    c) OH^- lies at lower position than H_2O in the spectrochemical series. Explain.

    d) State Curie's law.

    e) What do you mean by temperature independent paramagnetism (TIP)?

    f) Give two examples of eight coordinated complexes of lanthanides.

    g) Why yttrium is is taken to be a member of lanthanides?

    h) What is *cis*-effect?

2. Answer any **two** questions: $5\times2=10$

    a) What do you mean by magnetic moment and magnetic susceptibility? Explain ferromagnetism and antiferromagnetism.
                                               $2+3=5$

    b) What do you mean by lanthanide contraction? Explain the anomalous magnetic behaviour of Sm^{3+} and Eu^{2+}. $2+3=5$

    c) Why all six $Cu-OH_2$ distances in $[Cu(H_2O)_6]^{2+}$ are not equal? What is Dq? 10 Dq increases in the order: $[CrCl_6]^{3-} < [Cr(NH_3)_6]^{3+} < [Cr(CN)_6]^{3-}$
    . $2+1+2=5$

    d) Write a short note on: *trans*-effect.   5

3. Answer any **two** questions: $10\times2 = 20$

    a) i)   Of the two complexes of Ni(II), designated as A & B, one is octahedral and the other is tetrahedral. Each shows three absorption bands but complex A has $\varepsilon = 10$ and B has $\varepsilon = 150$. Which one probably is the tetrahedral complex? Measurement of what physical property

would exclude the possibility of either complex being square planar? Give appropriate explanation for your answer.

ii) Both Ni(IV) and Co(III) are d^6 system, but $K_2[NiF_6]$ is diamagnetic while $K_3[CoF_6]$ is paramagnetic. Explain.

iii) State and explain Laporte selection rules.

4+3+3=10

b) i) You have passed a solution containing La^{3+}, Gd^{3+} and Lu^{3+} through a column exchange resin. Then you elute the column with ammonium citrate solution. Explain in which order the ions will be eluted out.

ii) Calculate the effective magnetic moment (μ_{eff}) of Pr^{3+} ion.

iii) The lanthanide elements show the common stable oxidation state of +3. Explain.

4+3+3=10

c) i) $[Pt(NH_3)_2Cl_2]$ forms two isomers. One isomer gives $[Pt(NH_3)_2(tu)_2]^{2+}$ on treatment with thiourea (tu); the other isomer gives $[Pt(tu)_4]^{2+}$ on similar treatment. Identify the isomers and explain your answer.

ii) Room temperature magnetic moment of $CuSO_4.5H_2O$ is almost equal to the spin-only moment of Cu(II) ion. Explain.

iii) Explain the magnetic behaviour of actinide elements. 4+3+3=10

d) Write short note on (any **two**): 5×2=10

i) Orgel diagram for d^9 ion.

ii) Orbital contribution and Spin-Orbit coupling.

iii) Diamagnetic correction.

iv) Spectrochemical series.

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