KENDRIYA VIDYALAYA SANGATHAN LUCKNOW REGION

MONTHLY ASSESSMENT OF LEARNING (AUGUST 2025)

CLASS – XII

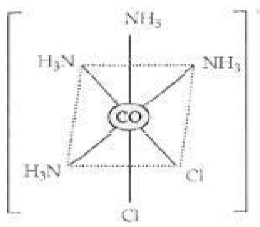
SUBJECT – CHEMISTRY

MARKING SCHEME

1	(c) E_a	1
2	(a)The ion that cannot show d-d transition is Ti^{+4}because it has no d-electrons.	1
3	(c)A ligand is a molecule or ion that can donate a lone pair of electrons to a central metal atom to form a coordination complex. Ammonium ion (NH4+) does not have any lone pairs of electrons available for donation, as the nitrogen atom in NH^{4+} is already bonded to four hydrogen atoms, using all of its valence electrons.	1
4	(b)The overall order of the reaction is 3	1
5	(c) Triamminebromidochloridonitrito-N-platinum(IV)chloride	1
6	(c) Due to completely filled d orbital	1
7	(d)$[Fe(CN)_6]^{3-}$ actually has a magnetic moment corresponding to one unpaired electron. This is because CN^- is a strong field ligand, causing the electrons to pair up in the d orbitals, resulting in only one unpaired electron.	1
8	(c)Order and molecularity of a reaction are not always equal, especially in complex reactions. Order is determined experimentally and can be fractional, while molecularity is a theoretical concept representing the number of molecules involved in a single elementary step.	1
9	(i) Transition elements and their compounds are excellent catalysts due to their ability to exhibit variable oxidation states and form complexes, allowing them to readily interact with reactants and facilitate chemical reactions. (ii)Copper(I) ions are not commonly found in aqueous solutions because they readily disproportionate into copper(II) ions and copper metal, making the +1 oxidation state unstable in water. **OR** The complete and balanced chemical equations are: (i) $8MnO_4^-(aq)+3S_2O_3^{2-}(aq)+H_2O(l)\rightarrow 8MnO_2(s)+6SO_4^{2-}(aq)+2OH^-(aq)$ (ii) $Cr_2O_7^{2-}(aq)+6Fe^{2+}(aq)+14H^+(aq)\rightarrow 2Cr^{3+}(aq)+6Fe^{3+}(aq)+7H_2O(l)$	1×2 1×2
10	I. Chromium and Molybdenum Cr – $[Ar]3d^54s^1$ Mo- $[Kr]4d^55s^1$ have similar electronic configuration and same number of unpaired electrons (6). Therefore, both show similar magnetic behaviour. II. Zinc and Scandium Zinc shows +2 oxidation state in its salts and Zn^{2+} – $[Ar]3d^{10}$ has no unpaired electrons as it has completely filled d subshell, so it forms white salts and Sc shows +3 oxidation state in its salts and Sc^{3+} [Ar] and no unpaired electron, so it forms white salts. Nickel and Vanadium salts are coloured as their ions have unpaired electrons.	1×2
11	(a) (i) Oxidation state of Co = +3 Electronic configuration of Co = $[Ar]3d^74s^2$ Electronic configuration of Co^{3+} = $[Ar]3d^64s^04p^0$ NH_3 is a strong field ligand, causing pairing of 3delectrons. This leads to d^2sp^3hybridization. The shape is octahedral. OR (ii) The oxidation state of Ni is 0. The electronic configuration of Ni is $[Ar]\ 3d^84s^2$.	1/2 1/2 ½,1/2

<table>
<tr><td></td><td>CO is a strong field ligand, causing pairing of 4selectrons into the 3d orbitals. This results in a filled 3d subshell and one empty 4sorbital and three empty 4p orbitals. The hybridization is sp^3.The shape is tetrahedral.
(b) Ethylenediamine (en) forms a more stable complex compared to ammonia (NH_3) because it is a bidentate ligand, forming a chelate ring with the metal ion, leading to the chelate effect. This chelation results in a more thermodynamically stable complex.
.OR
(a) No, ionization isomers are possible by exchange of ligand with counter ion only and not by exchange of central metal ion.
(b) The complex ion $[Cr(NH_3)_4Cl_2]^+$ exhibits geometrical isomerism. Also, the cis isomer can also exhibit optical isomerism.
(c) (i) If $\Delta_0 > P$ (strong field), the fourth electron will pair up in a t_2g orbital, resulting in the configuration $t_2g^4eg^0$.
(ii) If $\Delta_0 < P$ (weak field), the fourth electron will occupy an eg orbital, leading to the configuration $t_2g^3eg^1$.</td><td>1

1
1</td></tr>
<tr><td>12</td><td>Here, $T_1 = 298$ K, $T_2 = 308$ K, $k_1 = k$, $k_2 = 2k$
We know,
$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303k}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$$
$$\log\frac{2k}{k} = \frac{E_a}{2.303\times 8.314}\left(\frac{308-298}{308\times 298}\right)$$
$$\log 2 = \frac{E_a}{2.303\times 8.314}\times\frac{10}{308\times 298}$$
$$\Rightarrow E_a = \frac{(\log 2)(2.303\times 8.314)(308\times 298)}{10}$$
$$= 52897.7\ \text{J mol}^{-1} = 52.8\ \text{kJ mol}^{-1}$$ (deduct half mark for incorrect or not writing unit)</td><td>1
1

½ +
1/2</td></tr>
<tr><td>13</td><td>(a)

cis : isomer of [Co(NH3
(1 mark for arranging the ligands in correct position)
(b) (i) $[Co(NH_3)_6]Cl_3$(1 mark for writing the correct formula or drawing correct structure)
(ii)IUPAC name: Hexaamminecobalt(III)Chloride(1 mark for writing the correct IUPAC)</td><td>1

1,1</td></tr>
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14	a.) rate = $k[A]^x[B]^y$ b.) mol^{-1} litre $second^{-1}$ c.) $k = (2.303/t)\log[R_o]/[R]$ $2.54 \times 10^{-3} = (2.303/t_{3/4})\log 4R/R$ $t_{3/4} = 545.67$ second **OR** When reaction is completed 99.9%, $[R]_n = [R]_0 - 0.999[R]_0$ $k = 2.303 \log\frac{R0}{R} = 2.303\ R \log \frac{R0}{R0\ \ 0.999\ R0} = \frac{2.303}{t} \log 10^3$ $t = 6.909/k$ For half-life of the reaction $t\ 1/2 = 0.693/k$ $\frac{t}{t1/2} = \frac{6.909}{k} \times \frac{k}{0.693} = 10$	1 1 ½ 1 1/2 1 ½ 1/2
15	(a) Both Ti^{3+} and Cu^{2+} have 1 unpaired electron, so the magnetic moment for both will be 1.73 BM. (b) Zn, it has a more negative electrode potential so will corrode itself in place of iron. (c) Mn+ has $3d^5 4s^1$ configuration and configuration of Cr^+ is $3d^5$, therefore ionisation enthalpy of Mn^+ is lower than Cr^+. (d) Sc and Zn both form colourless compound and are diamagnetic. (e) The decrease in the atomic and ionic radii with increase in atomic number of actinoids due to poor shielding effect of 5f electron. (f) In both chromate and dichromate ion the oxidation state of Cr is +6 (g) $10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$	1 mark each (Any 5)