Coordination Compounds

Assertion & Reason Type Questions

consists of two statements, one is Assertion (A) and the other is Reason (R). Give answer:

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

c. Assertion (A) is true but Reason (R) is false.

d. Assertion (A) is false but Reason (R) is true.

Q 1. Assertion (A): Toxic metal ions are removed by the chelating ligands.
Reason (R): Chelate complexes tend to be more stable.

Answer : (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Q 2. Assertion (A): $[Cr(H_2O)]Cl_2$ and $[Fe(H_2O)]Cl_2$ are reducing in nature.
Reason (R): Unpaired electrons are present in their d-orbitals.

Answer : (b) Both are reducing in nature as the unpaired electrons get paired up by reduction thus gaining electrons. Hence, reason is not the correct explanation of assertion.

Q 3. Assertion (A): Complexes of MX_6 and MX_5L type (X and L are unidentate) do not show geometrical isomerism.
Reason (R): Geometrical isomerism is shown by complexes with coordination number 6.

Answer : (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

Q 4. Assertion (A): Linkage isomerism arises in coordination compounds containing ambidentate ligand.
Reason (R): Ambidentate ligand has two different donor atoms.

Answer : (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Q 5. Assertion (A): EDTA is used to determine hardness of water.
Reason (R): EDTA is a bidentate ligand.

Answer : (c) EDTA is a hexadentate ligand and is used to remove hardness of water. Hence, assertion is true but reason is false.

Q 6. Assertion (A): $[Fe(CN)_6]^{-3}$ ion shows magnetic moment corresponding to two unpaired electrons.
Reason (R): Because is has $d^2 sp^3$ type hybridisation.

Answer : (d) [Fe(CN)) ion shows magnetic moment corresponding to one unpaired electron. Hence, assertion (A) is false but $[Fe(CN)_6]^{3-}$ has d^2sp^3 hybridisation, is true.

Q 7. Assertion (A): $[Cu(NH_3)_4]^{2+}$ is coloured while $[Cu(CN)_4]^{2+}$ ion is colourless.
Reason (R): $[Cu(NH_3)_4]^3$ has dsp^2 hybridisation.

Answer : (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

Q 8. Assertion (A): $[Ni(CN_4),^{2-}$ has square planar and $[NiCl_4]^{2-}$ has tetrahedral shape.
Reason (R): $[Ni(CN)_4]^{2-}$ is diamagnetic while $[NICl_4]^{2-}$ is paramagnetic.

Answer : (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

Q 9. Assertion (A): Low spin tetrahedral complexes are rarely observed.
Reason (R): Crystal field splitting energy is less than pairing energy for tetrahedral complexes.

Answer : (a) Crystal field stabilisation energy for tetrahedral complexes is less than pairing energy. As Δ_t< pairing energy, so electron occupies a higher energy orbital because less energy is required than occupying a lower energy orbital and pairing with another electron. Hence, electron does not pair up to form low spin complexes.

Q 10. Assertion (A): In tetrahedral complexes, low spin configurations are rarely observed.

Reason (R): $\Delta_t = \left(\frac{4}{9}\right)\Delta_0$

Answer : (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Q11. Assertion : NF_3 is a weaker ligand than $N(CH_3)_3$.
Reason : NF_3 ionizes to give F^- ions in aqueous solution.

Q12. Assertion : $[Fe(CN)_6]^{3-}$ is weakly paramagnetic while $[Fe(CN)_6]^{4-}$ is diamagnetic.
Reason : $[Fe(CN)_6]^{3-}$ has +3 oxidation state while $[Fe(CN)_6]^{4-}$ has +2 oxidation state.

Q13. Assertion : $[Ti(H_2O)_6]^{3+}$ is coloured while $[Sc(H_2O)_6]^{3+}$ is colourless.
Reason : d-d transition is not possible in $[Sc(H_2O)_6]^{3+}$.

ANSWER KEY 11 to 13

Q11 : (c) **Q12 :** (b) **Q13 :** (a)