S1. Ans.(d)

Ions	No. of unpaired electrons	Configuration
Ti^{3+}	1	$3d^1$
Cr^{2+}	4	$3d^4$
Mn^{2+}	5	$3d^5$
Fe^{2+}	4	$3d^6$
Sc^{3+}	0	$3d^0$

Spin magnetic moment is given by $\sqrt{n(n+2)}BM$

∴ Cr^{2+} and Fe^{2+} will have same spin only magnetic moment.

S2. Ans.(b)

$E^\circ_{Mn^{3+}/Mn^{2+}} > E^\circ_{Cr^{3+}/Cr^{2+}}$ or $E^\circ_{Fe^{3+}/Fe^{2+}}$

Electronic configuration of Mn^{3+} = $[Ar]3d^4$

Electronic configuration of Mn^{2+} = $[Ar]3d^5$

Electronic configuration of Cr^{3+} = $[Ar]3d^3$

Electronic configuration of Cr^{2+} = $[Ar]3d^4$

As Mn^{3+} from d^4 configuration goes to more stable d^5 configuration (Half-filled), due to more exchange energy in d^5 configuration.

S3. Ans.(d)

Magnetic moment $\mu = \sqrt{n(n+2)}BM$

n ⟶ number of unpaired electrons

n → number of unpaired electron

Ce^{4+} ⇒ $(Xe)\ 4f^0$

$\mu = 0$ Diamagnetic

Yb^{2+} ⇒ $(Xe)\ 4f^{14}$ [↿⇂][↿⇂][↿⇂][↿⇂][↿⇂][↿⇂][↿⇂]

$\mu = 0$ Diamagnetic

Ce^{3+} ⇒ $(Xe)\ 4f^1$ [↿][ ][ ][ ][ ][ ][ ]

$\mu = \sqrt{3}$ Paramagnetic

Eu^{2+} ⇒ $(Xe)\ 4f^7$ [↿][↿][↿][↿][↿][↿][↿]

$\mu = \sqrt{63}$ Paramagnetic

Gd^{3+} ⇒ $(Xe)\ 4f^7$ [↿][↿][↿][↿][↿][↿][↿]

$\mu = \sqrt{63}$ Paramagnetic

Eu^{3+} ⇒ $(Xe)\ 4f^6$ [↿][↿][↿][↿][↿][↿][ ]

$\mu = \sqrt{48}$ Paramagnetic

Pm^{3+} ⇒ $(Xe)\ 4f^4$ [↿][↿][↿][↿][ ][ ][ ]

$\mu = \sqrt{24}$ Paramagnetic

Sm^{3+} ⇒ $(Xe)\ 4f^5$ [↿][↿][↿][↿][↿][ ][ ]

$\mu = \sqrt{35}$ Paramagnetic

Hence Ce^{4+} & Yb^{2+} are only diamagnetic.

S4. Ans.(c)

Reason is the correct explanation of Assertion.

S5. Ans.(b)

$Cu(s) \longrightarrow Cu(g) \longrightarrow Cu^{+}(g) \longrightarrow Cu^{+2}(g) \longrightarrow Cu^{+2}(aq)$

$\Delta H_{atomisation}$ IE_1 IE_2 Hydration energy

Cu^{+2} is more stable than Cu^{+1} because released hydration energy is more in case of Cu^{+2} than Cu^{+1}.

S6. Ans.(b)

$C \longrightarrow \overset{+3}{V_2}O_3 \longrightarrow \overset{+4}{V_2}O_4 \longrightarrow \overset{+5}{V_2}O_5$

Acidic Nature ↑

D ⟶ V_2O_5 dissolve in acid to give VO_4^{-3} salts. This doesn't shown by V_2O_4

S7. Ans.(a)

Statement I: Cr^{2+} is reducing as its configuration changes from d^4 to d^3, the latter having a half-filled t_{2g} level. On the other hand, the change from Mn^{3+} to Mn^{2+} results in the half-filled (d^5) configuration which has extra stability.

Statement II: Sc^{3+} has zero unpaired electron, so magnetic moment is also zero. Hence, Sc^{3+} will repelled by the applied magnetic field.

S8. Ans.(b)

Conceptual

S9. Ans.(a)

Conceptual

S10. Ans.(a)

The electronic configuration of $Cr^{2+}[Ar]3d^4$

So, Number of unpaired electron is 4

Spin only magnetic moment =

$\mu = \sqrt{n(n+2)} = \sqrt{4(4+2)} = 4.9$ B.M.

S11. Ans.(c)

In the +6 oxidation state, the most important species formed by chromium are the chromate, CrO_4^{-2}, and dichromate, $Cr_2O_7^{2-}$, ion

Thus, correct option is c.

S12. Ans.(a)

(A) In 3d-series, Manganese shows maximum number of oxidation states i.e., (+2, to +7)

(B) Zinc atom has completely filled d-orbitals in its ground state as well as in its oxidized state, thus it is not regarded as a transition element.

(C) Scandium shows only one oxidation state i.e., +3.

(D) Cu^+ undergoes disproportionation reaction in aqueous solution

$2Cu^+(aq) \rightarrow Cu^{2+}(aq) + Cu(s)$

S13. Ans.(a)

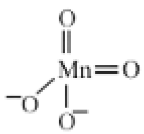
Lanthanoids can also show +2 or +4 oxidation states in solution or in solid compounds.

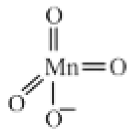
Most common oxidation state of Lanthanoids is +3

S14. Ans.(c)

(A)	Copper	(ii)	Transition metal
(B)	Fluorine	(i)	Non-metal
(C)	Silicon	(iv)	Metalloid
(D)	Cerium	(iii)	Lanthanoid

S15. Ans.(a)

• Manganate (MnO_4^{2-}): 

• Permanganate (MnO_4^-): 

$^{25}Mn - 3d^5 4s^2$

If bonding take place by overlap of p-orbital of oxygen & d-orbital of Mn, then manganate and permaganate ions are tetrahedral.

S16. Ans.(c)

S17. Ans.(a)

Co^{3+} = [Ar]$3d^6$, Unpaired electron (n) = 4

Spin magnetic moment = $4\sqrt{4(4+2)}$

= $\sqrt{24}$ B.M

$Cr^{3+} = [Ar]3d^3$, Unpaired electron (n) = 3

Spin magnetic moment = $\sqrt{3(3+2)}$

= $\sqrt{15}$ B.M

$Fe^{3+} = [Ar]3d^5$, Unpaired electron (n) = 5

Spin magnetic moment = $\sqrt{5(5+2)}$

= $\sqrt{35}$ B.M

$Ni^{2+} = [Ar]3d^8$, Unpaired electron (n) = 2

Unpaired electron (n) = 0; Diamagnetic

S18. Ans.(c)

SO_2 is a gas that can readily decolourise acidified $KMnO_4$ solution.

S19. Ans.(d)

$5f, 6d, 7s$ level having comparable energies. There is very less energy gap between them.

S20. Ans.(d)

In a solution containing $HgCl_2, I_2$ and I^-, both $HgCl_2$ and I_2 compete for I^-.

Since formation constant of $[HgI_4]^{2-}$ is 1.9 × 10^{30} which is very large as compared with $I_3^-(K_f = 700)$

∴ I^- will preferentially combine with

$HGCl_2 + 2I^- \rightarrow HgI_2 \downarrow + 2Cl^-$

Red ppt

$HgI_2 + 2I^- \rightarrow [HgI_4]^{2-}$

soluble

S21. Ans.(b)

Ce a have +4 oxidation state.

S22. Ans.(a)

Lanthanon's or lanthanoids are much less reactive as compared to aluminium because of high ionization potential because of lanthanoid contraction extremely over dominates on inert pair effect.

Ce^{4+} is a good oxidizing agent +4 state and readily converts to +3 state. As one moves from Ce to Lu, ionic radius regularly decreases or covalent character increases because of which basic character decreases.

S23. Ans.(a)

Electronic configuration of Eu, Gd and Tb:

$Eu = [Xe]4f^7 6s^2 Gd = [Xe]4f^7 5d^1 6s^2$

$Tb\ = [Xe]4f^9 6s^2$

S24. Ans.(b)

$K_2Cr_2O_7 + H_2SO_4 + 3SO_2 \rightarrow K_2SO_4$

$+Cr_2(SO_4)_3 + H_2O$

S25. Ans.(d)

Gadolinium belongs to $4f$ series.

Atomic number = 64

Electronic configuration for 'f' series is $(n-2)f^{1-14}(n-1)d^{1-10}ns^2$

So, electronic configuration is $[Xe]4f^7 5d^1 6s^2$

$4f^7$ provides extra stability.

S26. Ans.(b)

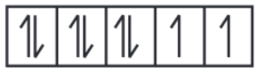
Zr (40) and Hf (72) will have same atomic size because of lanthanoid contraction and poor shielding effect.

S27. Ans.(b)

Formation of $Fe(CO)_5$ does not involve oxidation of Fe because here oxidation state of Fe is 0.

S28. Ans.(d)

Magnetic moment (μ) for $Ni^{2+} = \sqrt{n(n+2)}$



$3d^8$

n = 2

$\mu = \sqrt{2(2+2)} = 2\sqrt{2}$

~ 2.84 B.M

S29. Ans.(d)

Lanthanoid contraction is a significant decrement in atomic size of atoms in 'f' block because of poor shielding effect of 'f' orbital electrons as nuclear charge effectively increases & atom shrinks.

S30. Ans.(a)

$\mu = \sqrt{n(n+2)}$

n = unpaired electron

$Ni^{2+} = 3d^8$ 2 unpaired electron

$= 2\sqrt{2} = 2.83$ BM

S31. Ans.(b)

Interstitial compounds are chemically inert. They do not show reactivity & lie at the end in reactivity series

S32. Ans.(d)

$Yb(70) = [Xe]4f^{14}5d^0 6s^2$

$Yb^{2+} = [Xe]4f^{14}5d^0 6s^0$

Yb^{2+} has no unpaired electron so, it is a diamagnetic species.

S33. Ans.(b)

Sodium sulphide is soluble in water. The solubility product (and hence solubility) of ZnS is larger than that of CuS.