# CHAPTER - 16
# THE d- AND f- BLOCK ELEMENTS

1. 2 Ionisation energy generally increases from left to right in a period

2. 1 $Fe^{2+}$ has $3d^6$ configuration. Thus third ionisation enthalpy is minimum for Fe

3. 2 Order of atomisation enthalpy is V > Fe > Cu > Zn

   Zn is not a transition element

4. 3 $E^0_{M^{3+}/M^{2+}}$ is positive for Mn, Fe and Co, whereas negative for Ti, V and Cr

5. 4 $E^0_{Mn^{3+}/Mn^{2+}}$ is positive. Thus, $Mn^{2+}$ does not liberate hydrogen from acids

6. 4 $Z = 25 \Rightarrow M = Mn$

   $\mu = \sqrt{24}\ BM \Rightarrow$ no.of unpaired electrons = 4

   Thus, Mn is present in +3 oxidation state ($3d^4$)

7. 3 $Mn_2O_7$ - acidic

   $V_2O_5$ - amphoteric

   CrO - basic

8. 1 $2KMnO_4 \xrightarrow{573\ K} 2K_2MnO_4 + MnO_2 + O_2$

   $KMnO_4$ is diamagnetic

9. 2 $Gd^{3+} \longrightarrow 4f^7$

   $\mu = \sqrt{7 \times 9} \approx 7.9\,BM$

10. 4 Oxidation states of U are +3, +4, +5 and +6; Pu are +3, +4, +5, +6 and +7

11. 1 $Sm^{3+}$ has partially filled f-orbitals

12. 3 Mo and W have similar size due to lanthanoid contraction

13. 6 Chromate has 2 whereas dichromate has $4\pi$ bonds

14. 4 Sc, Ti, V and Mn have larger metallic radius than Cr

15. 3 $I^- + Cr_2O_7^{2-} \xrightarrow{H^+} I_2 + Cr^{3+}$

$I^- + MnO_4^- \xrightarrow{H^+} I_2 + Mn^{2+}$

Thus, x = 3 and y = 0; $\therefore x + y = 3$

16. 7 $Eu^{2+} \longrightarrow 4f^7$ (7 unpaired electrons)

$Ce^{4+} \longrightarrow 4f^0$ (zero unpaired electrons)

17. D Metal with highest positive $E^0_{M^{x+}/M}$ will be the least reactive one.

18. C Metal with positive $E^0_{M^{x+}/M}$ does not liberate hydrogen from dilute acids

19. C Cu has high $\Delta_a H^\theta$ and $Cu^{2+}$ has low $\Delta_{hyd} H^\theta$.

20. B $X = FeCr_2O_4$ ; $A = Na_2CrO_4$ ; $B = Na_2Cr_2O_7$ ; $C = (NH_4)_2Cr_2O_7$

$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2\uparrow + Cr_2O_3 + 4H_2O$

(C)

21. B $2\,Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

(A) (B)

22. B $CrO_4^{2-}$ is stable in basic medium. $Cr_2O_7^{2-}$ is stable in acidic medium

23. D $2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4$

$Na_2SO_4.10H_2O$ crystallized out first.

24. D O–Cr–O bond angle in the chromate ion is $109.5^\circ$.

**SECTION - IV (More than one correct answer)**

25. B, C Sm, Eu and Yb are known to exhibit +2 oxidation state

26. A, B, C, D

All are correct Statrements

27. A,B,C,D

Tetrahedral $[MO_4]^{n-}$ ions are known for $V^{5+}$, $Cr^{6+}$, $Mn^{5+}$, $Mn^{6+}$ and $Mn^{7+}$

28. A,D

$V_2O_4$ dissolves in acids to form $VO^{2+}$.

$V_2O_5$ reacts with acids and alkalies to form $VO_2^+$ and $VO_4^{3-}$, respectively.

29. A

Only compound (A) has an incompletely filled d-subshell.

**SECTION - V (Numerical Type - Upto two decimal place)**

30. 4.00 $MnO_4^-$ is tetrahedral.

31. 2.00

$Ti^{2+}$ and $Cr^{2+}$ are more reducing than $V^{2+}$.

32. 4.00 All are true statements

33. 5.00 $3H_2S \longrightarrow 6H^+ + 3S\downarrow + 6e^-$

34. 2.00 $2MnO_4^- + H_2O + I^- \longrightarrow 2MnO_2 + 2OH^- + IO_3^-$

**SECTION - VI (Matrix Matching)**

35. B

| Element | Classification |
|---|---|
| Cd | d-block element, not a transition element |
| Rh | d-block element, transition element |
| Fm | f-block element, inner transition element, actinoid |
| Gd | f-block element, inner transition element, lanthanoid |

36. D

$NiSO_4$ and $VO^+$ $\Rightarrow$ Both have two unpaired electrons

$TiCl_4$ and $ZnSO_4$ $\Rightarrow$ Both ave zero unpaired electrons

$Mn^{2+}$ and $Ca^{2+}$ $\Rightarrow$ Both are pink coloured

$FeCl_3$ and $MnSO_4$ $\Rightarrow$ Both have $3d^5$ configuration