D-BLOCK

1. The element that usually does not show variable oxidation states is :

(1) V (2) Ti (3) Sc (4) Cu

2. $\underline{A} \xrightarrow{4\ KOH,\ O_2} 2\underline{B} + 2\ H_2O$ (Green)

$3\ \underline{B} \xrightarrow{4\ HCl} 2\ \underline{C} + MnO_2 + 2\ H_2O$ (Purple)

$2\ \underline{B} \xrightarrow{H_2O,\ KI} 2\ \underline{A} + 2KOH + \underline{D}$

In the above sequence of reactions,
$\underline{A}$ and $\underline{D}$ respectively, are :-

(1) KIO_3 and MnO_2 (2) KI and K_2MnO_4
(3) MnO_2 and KIO_3 (4) KI and $KMnO_4$

3. The transition element that has lowest enthalpy of atomisation, is :

(1) Zn (2) Cu (3) V (4) Fc

4. Match the catalysts **(Column I)** with products **(Column II)**.

Column I	Column II
(A) V_2O_5	(i) Polyethylene
(B) $TiCl_4/Al(Me)_3$	(ii) ethanal
(C) $PdCl_2$	(iii) H_2SO_4
(D) Iron Oxide	(iv) NH_3

(1) (A)-(ii); (B)-(iii); (C)-(i); (D)-(iv)
(2) (A)-(iii); (B)-(i); (C)-(ii); (D)-(iv)
(3) (A)-(iii); (B)-(iv); (C)-(i); (D)-(ii)
(4) (A)-(iv); (B)-(iii); (C)-(ii); (D)-(i)

5. Consider the hydrates ions of Ti^{2+}, V^{2+}, Ti^{3+} and Sc^{3+}. The correct order of their spin-only magnetic moments is :

(1) $Sc^{3+} < Ti^{3+} < Ti^{2+} < V^{2+}$
(2) $Ti^{3+} < Ti^{2+} < Sc^{3+} < V^{2+}$
(3) $Sc^{3+} < Ti^{3+} < V^{2+} < Ti^{2+}$
(4) $V^{2+} < Ti^{2+} < Ti^{3+} < Sc^{3+}$

SOLUTION

1. Ans. (3)

Usally Sc(Scandium) does not show variable oxidation states.

Most common oxidation states of :

(i) Sc : +3

(ii) V : +2, +3, +4, +5

(iii) Ti : +2, +3, +4

(iv) Cu : +1, +2

2. Ans. (3)

$MnO_2(A) \xrightarrow{4KOH, O_2} 2K_2MnO_4(B) + 2H_2O$

(Green)

$3K_2MnO_4(B) \xrightarrow{4HCl} 2KMnO_4(C) + 2H_2O$

(Purple)

$2KMnO_4(C) \xrightarrow{H_2O, KI} 2MnO_2(A) + 2KOH + KIO_3(D)$

$A \rightarrow MnO_2$

$D \rightarrow KIO_3$

3. Ans. (2)

Since Zn is not a transition element so transition element having lowest atomisation energy out of Cu, V, Fe is Cu.

4. Ans.(2)

V_2O_5 is catalyst $\rightarrow$ contact process for H_2SO_4

$TiCl_4/Al(Me)_3 \rightarrow$ Ziegler Natta salt used as catalyst for polymerisation of ethene.

$PdCl_2 \rightarrow$ used as catalyst for ethanal (Wacker process).

Iron oxide $\rightarrow$ is used as catalyst in Haber's synthesis.

5. Ans.(1)

$Ti^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2$

unpaired electrons = 2.

spin only magnetic moment (μ) = $\sqrt{2(2+2)}$

= $\sqrt{8}$ B.M

$Ti^{+3} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$

unpaired electrons = 1

$\mu = \sqrt{1(1+2)} = \sqrt{3}$ B.M

$V^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$

$\mu = \sqrt{3(3+2)} = \sqrt{15}$ B.M

$Sc^{+3} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

$\mu = 0$