

# The d & f-Block Elements

1. In context with the transition elements, which of the following statements is incorrect?

[AIEEE-2009]

- (1) In the highest oxidation states, the transition metals show basic character and form cationic complexes
- (2) In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding.
- (3) Once the  $d^5$  configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases
- (4) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes

2. Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of the following statements is incorrect? [AIEEE-2009]

- (1) The ionic sizes of Ln (III) decrease in general with increasing atomic number
- (2) Ln (III) compounds are generally colourless
- (3) Ln (III) hydroxides are mainly basic in character
- (4) Because of the large size of the Ln (III) ions the bonding in its compounds is predominantly ionic in character

3. The correct order of  $E_{M^{2+}/M}^{\circ}$  values with negative sign for the four successive elements Cr, Mn, Fe and Co is [AIEEE-2010]

- (1) Cr > Mn > Fe > Co (2) Mn > Cr > Fe > Co
- (3) Cr > Fe > Mn > Co (4) Fe > Mn > Cr > Co

4. Iron exhibits +2 and +3 oxidation states. Which of the following statements about iron is incorrect? [AIEEE-2012]

- (1) Ferrous compounds are relatively more ionic than the corresponding ferric compounds.
- (2) Ferrous compounds are less volatile than the corresponding ferric compounds.

- (3) Ferrous compounds are more easily hydrolysed than the corresponding ferric compounds

- (4) Ferrous oxide is more basic in nature than the ferric oxide.

5. Which of the following arrangements does not represent the correct order of the property stated against it? [JEE (Main)-2013]

- (1)  $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$  : paramagnetic behaviour
- (2)  $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$  : ionic size
- (3)  $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$  : stability in aqueous solution
- (4)  $Sc < Ti < Cr < Mn$  : number of oxidation states

6. Four successive members of the first row transition elements are listed below with atomic numbers. Which one of them is expected to have the highest  $E_{M^{3+}/M^{2+}}^{\circ}$  value? [JEE (Main)-2013]

- (1) Cr ( $Z = 24$ )
- (2) Mn ( $Z = 25$ )
- (3) Fe ( $Z = 26$ )
- (4) Co ( $Z = 27$ )

7. Which series of reactions correctly represents chemical reactions related to iron and its compound? [JEE (Main)-2014]

- (1)  $Fe \xrightarrow{dil.\text{H}_2\text{SO}_4} Fe\text{SO}_4 \xrightarrow{\text{H}_2\text{SO}_4, \text{O}_2} Fe_2(\text{SO}_4)_3 \xrightarrow{\text{heat}} Fe$
- (2)  $Fe \xrightarrow{\text{O}_2, \text{heat}} Fe\text{O} \xrightarrow{dil.\text{H}_2\text{SO}_4} Fe\text{SO}_4 \xrightarrow{\text{heat}} Fe$
- (3)  $Fe \xrightarrow{\text{Cl}_2, \text{heat}} Fe\text{Cl}_3 \xrightarrow{\text{heat, air}} Fe\text{Cl}_2 \xrightarrow{\text{Zn}} Fe$
- (4)  $Fe \xrightarrow{\text{O}_2, \text{heat}} Fe_3\text{O}_4 \xrightarrow{\text{CO, } 600^\circ\text{C}} Fe\text{O} \xrightarrow{\text{CO, } 700^\circ\text{C}} Fe$

8. Match the catalysts to the correct processes :

Catalyst	Process
a. $\text{TiCl}_3$	(i) Wacker process
b. $\text{PdCl}_2$	(ii) Ziegler-Natta polymerization
c. $\text{CuCl}_2$	(iii) Contact process
d. $\text{V}_2\text{O}_5$	(iv) Deacon's process

[JEE (Main)-2015]

- (1) a(iii), b(ii), c(iv), d(i) (2) a(ii), b(i), c(iv), d(iii)  
 (3) a(ii), b(iii), c(iv), d(i) (4) a(iii), b(i), c(ii), d(iv)

9. The color of  $\text{KMnO}_4$  is due to [JEE (Main)-2015]

- (1) M  $\rightarrow$  L charge transfer transition  
 (2) d - d transition  
 (3) L  $\rightarrow$  M charge transfer transition  
 (4)  $\sigma$  -  $\sigma^*$  transition

10. Which of the following compounds is metallic and ferromagnetic? [JEE (Main)-2016]

- (1)  $\text{CrO}_2$  (2)  $\text{VO}_2$   
 (3)  $\text{MnO}_2$  (4)  $\text{TiO}_2$

11. The pair having the same magnetic moment is

[At. No.: Cr = 24, Mn = 25, Fe = 26, Co = 27]  
 [JEE (Main)-2016]

- (1)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$   
 (2)  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$   
 (3)  $[\text{CoCl}_4]^{2-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$   
 (4)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{CoCl}_4]^{2-}$

12. In the following reactions,  $\text{ZnO}$  is respectively acting as a/an [JEE (Main)-2017]

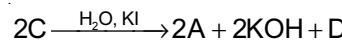
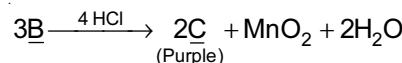
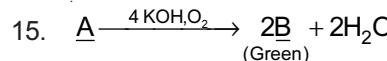
- (a)  $\text{ZnO} + \text{Na}_2\text{O} \rightarrow \text{Na}_2\text{ZnO}_2$   
 (b)  $\text{ZnO} + \text{CO}_2 \rightarrow \text{ZnCO}_3$   
 (1) Acid and acid (2) Acid and base  
 (3) Base and acid (4) Base and base

13. The effect of lanthanoid contraction in the lanthanoid series of elements by and large means [JEE (Main)-2019]

- (1) Increase in atomic radii and decrease in ionic radii  
 (2) Decrease in atomic radii and increase in ionic radii  
 (3) Decrease in both atomic and ionic radii  
 (4) Increase in both atomic and ionic radii

14. The element that usually does NOT show variable oxidation states is [JEE (Main)-2019]

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



In the above sequence of reactions,  $\underline{\text{A}}$  and  $\underline{\text{D}}$ , respectively, are [JEE (Main)-2019]

- (1) KI and  $\text{K}_2\text{MnO}_4$   
 (2)  $\text{KIO}_3$  and  $\text{MnO}_2$   
 (3)  $\text{MnO}_2$  and  $\text{KIO}_3$   
 (4) KI and  $\text{KMnO}_4$

16. The lanthanide ion that would show colour is [JEE (Main)-2019]

- (1)  $\text{Gd}^{3+}$  (2)  $\text{Lu}^{3+}$   
 (3)  $\text{La}^{3+}$  (4)  $\text{Sm}^{3+}$

17. The statement that is INCORRECT about the interstitial compounds is [JEE (Main)-2019]

- (1) They are chemically reactive.  
 (2) They are very hard.  
 (3) They have high melting points.  
 (4) They have metallic conductivity.

18. The maximum number of possible oxidation states of actinoids are shown by [JEE (Main)-2019]

- (1) Berkelium (Bk) and californium (Cf)  
 (2) Neptunium (Np) and plutonium (Pu)  
 (3) Actinium (Ac) and thorium (Th)  
 (4) Nobelium (No) and lawrencium (Lr)

19. Consider the hydrated ions of  $\text{Ti}^{2+}$ ,  $\text{V}^{2+}$ ,  $\text{Ti}^{3+}$ , and  $\text{Sc}^{3+}$ . The correct order of their spin-only magnetic moments is : [JEE (Main)-2019]

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

