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THE *d*-AND *f*-BLOCK ELEMENTS

MCQs with One Correct Answer

1. What would happen when a solution of potassium chromate is treated with an excess of dilute nitric acid?

(a) $Cr_2O_7^{2-}$ and H_2O are formed

(b) CrO_4^{2-} is reduced to +3 state of Cr

(c) CrO_4^{2-} is oxidized to +7 state of Cr

(d) Cr^{3+} and $Cr_2O_7^{2-}$ are formed

2. The correct order of ionic radii of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is

(a) $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$

(b) $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$

(c) $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$

(d) $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$

(Atomic nos. Y = 39, La = 57, Eu = 63, Lu = 71)

3. Which of the following oxides of manganese is amphoteric?

(a) MnO_2 (b) Mn_2O_3

(c) Mn_2O_7 (d) MnO

4. Which of the following compound is called Turnbull's blue?

(a) Ferricyanide (b) Ferrous ferricyanide

(c) Ferrous cyanide (d) Ferri-ferrocyanide

5. A compound of a metal ion $M^{x+}(Z = 24)$ has a spin only magnetic moment of $\sqrt{15}$ Bohr Magnetons. The number of unpaired electrons in the compound are

(a) 2 (b) 4

(c) 5 (d) 3

6. In which of the following compounds manganese has oxidation number equal to that of iodine in KIO_4?

(a) Potassium manganate

(b) Potassium permanganate

(c) Manganous chloride

(d) Manganese chloride

7. When MnO_2 is fused with KOH, a coloured compound is formed, the product and its colour is:

(a) K_2MnO_4, purple green

(b) $KMnO_4$, purple

(c) Mn_2O_3, brown

(d) Mn_3O_4, black

8. If an aqueous solution of KCN is added to a solution of ferrous salt then the complex formed is represented by

(a) $\left[Fe(CN)_6\right]^{4-}$ (b) $\left[Fe(CN)_6\right]^{3-}$

(c) $\left[Fe(H_2O)_6\right]^{3+}$ (d) $\left[Fe(H_2O)_6\right]^{2+}$

9. For the four successive transition elements (Cr, Mn, Fe and Co), the stability of +2 oxidation state will be there in which of the following order?
(a) Mn > Fe > Cr > Co (b) Fe > Mn > Co > Cr
(c) Co > Mn > Fe > Cr (d) Cr > Mn > Co > Fe

10. In neutral or faintly alkaline medium, thiosulphate is quantitatively oxidized by $KMnO_4$ to
(a) SO_3^{2-} (b) SO_4^{2-}
(c) SO_2 (d) SO_5^{2-}

11. An excess of $Na_2S_2O_3$ reacts with aqueous $CuSO_4$ to give
(a) CuS_2O_3 (b) $Cu_2S_2O_3$
(c) $Na_2[Cu(S_2O_3)_2]$ (d) $Na_4[Cu_6(S_2O_3)_5]$

12. Which of the following oxides of Cr is amphoteric
(a) CrO_2 (b) Cr_2O_3
(c) CrO_5 (d) CrO_3

13. The roasting of HgS in air produces
(a) HgO (b) $HgSO_3$
(c) $HgSO_4$ (d) Hg

14. Mercury (I) chloride sublimes, when this compound is heated and the vapours it gives off are cooled the substance collected consists of
(a) Mercury (II) chloride
(b) Mercury (I) and Mercury (II), chlorides
(c) Mercury (II) chloride and mercury
(d) Mercury

15. Consider the following statements
(I) $La(OH)_3$ is the least basic among hydroxides of lanthanoids.
(II) Zr^{4+} and Hf^{4+} posses almost the same ionic radii.
(III) Ce^{4+} can as an oxidizing agent.
Which of the above is/are true ?
(a) (I) and (III) (b) (II) and (III)
(c) (II) only (d) (I) and (II)

Numeric Value Answer

16. The number of water molecule(s) directly bonded to the metal centre in $CuSO_4.5H_2O$ is

17. The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is

18. What is the oxidation states of Cr in butterfly structure.

19. Out of the following, how many oxides are acidic.
MnO, Mn_2O_3, MnO_2, MnO_3, Mn_2O_7

20. A light blue coloured compound (A) on heating gives a block compound (B) which reacts with glucose to give a red compound (C). After the completion of reaction, how many metal oxides are formed?

ANSWER KEY																			
1	(a)	**3**	(a)	**5**	(d)	**7**	(a)	**9**	(a)	**11**	(d)	**13**	(d)	**15**	(b)	**17**	(6)	**19**	(3)
2	(c)	**4**	(b)	**6**	(b)	**8**	(a)	**10**	(b)	**12**	(a)	**14**	(d)	**16**	(4)	**18**	(6)	**20**	(2)

CHAPTER 22

The *d*-and *f*-Block Elements

1. **(a)** When a solution of potassium chromate is treated with an excess of dilute nitric acid. Potassium dichromate and H_2O are formed.

$$2K_2CrO_4 + 2HNO_3 \longrightarrow K_2Cr_2O_7 + 2KNO_3 + H_2O$$

Hence $Cr_2O_7^{2-}$ and H_2O are formed.

2. **(c)** In lanthanoid series there is a regular decrease in the atomic as well as ionic radii of trivalent ions (M^{3+}) as the atomic number increases. Although the atomic radii do show some irregularities but ionic radii decreases from La(103 pm) to Lu (86pm).

3. **(a)** The more the oxidation state, the more is the acid character, MnO, Mn_2O_3 are basic, MnO_2 is amphoteric and Mn_2O_7 is acidic.

4. **(b)** Ferrous ferricyanide is known as Turbull's blue

5. **(d)** Magnetic moment $\mu = \sqrt{n(n+2)}$ where n = number of unpaired electrons $\sqrt{15} = \sqrt{n(n+2)}$

$\therefore$ n = 3

6. **(b)** In KIO_4 O.S of I is +7 and in $KMnO_4$ O.S. of Mn is +7

7. **(a)** Stable oxidation state of Mn in alkaline medium is +6. So, MnO_2 is oxidised to K_2MnO_4 by atmospheric oxygen in KOH medium.

$$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$

8. **(a)** $Fe^{2+} + 6KCN \rightarrow \left[Fe(CN)_6\right]^{4-} + 6K^+$

9. **(a)**

10. **(b)** In neutral or faintly alkaline medium thiosulphate is quantitatively oxidized by $KMnO_4$ to SO_4^{2-}

$$8KMnO_4 + 3Na_2S_2O_3 + H_2O \longrightarrow 3K_2SO_4 + 8MnO_2 + 3Na_2SO_4 + 2KOH$$

11. **(d)** $CuSO_4 + Na_2S_2O_3 \longrightarrow CuS_2O_3 + Na_2SO_4$

$2CuS_2O_3 + Na_2S_2O_3 \longrightarrow Cu_2S_2O_3 + Na_2S_4O_6$

$3Cu_2S_2O_3 + 2Na_2S_2O_3 \longrightarrow Na_4[Cu_6(S_2O_3)_5]$

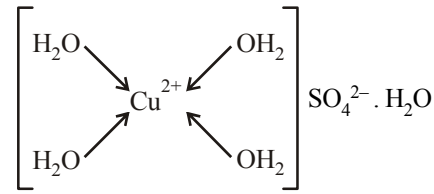
12. **(a)** Acidic nature of oxides increases with the increase in O.S. of the metal atom e.g., Cr_2O_3 is basic. CrO_2 is acidic, CrO_5 is also acidic in nature.

13. **(d)** $HgS + O_2 \xrightarrow{773-873K} Hg + SO_2$

14. **(d)** $Hg_2Cl_2 \xrightarrow{\Delta} Hg + HgCl_2$

15. **(b)** As a result of lanthanoid contraction Zr^{4+} and Hf^{4+} possess almost the same ionic radii. Ce^{4+} is an oxidising agent. Ce^{4+} gains electron to acquire more stable Ce^{3+}state. $La(OH)_3$ is the most basic among lanthanoid hydroxides.

16. **(4)** The number of water molecules directly bonded to the metal centre in $CuSO_4.5H_2O$ is 4.



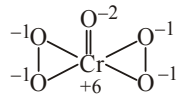
17. **(6)** $2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$

Oxidation number of Mn in K_2MnO_4 is 6

K_2MnO_4 ; $2 + x - 8 = 0$

$x = 6$

18. **(6)** Butterfly structure (CrO_5) is:



There are two peroxide (–O–O–) bond in CrO_5 in which O.S. of each O-atom is –1.

Hence O.S. of Cr = +6.

19. **(3)** Lower O.S. compounds are basic and higher O.S. compounds are acidic.

$\underbrace{\overset{+2}{MnO}, \overset{+3}{Mn_2O_3}}_{\text{Neutral}} \quad \underbrace{\overset{+4}{MnO_2}, \overset{+6}{MnO_3}, \overset{+7}{Mn_2O_7}}_{\text{Acidic}}$

20. **(2)** $\underset{\text{light blue}}{Cu(OH)_2} \xrightarrow{\Delta} \underset{\text{black}}{CuO} + H_2O$;

$2CuO + \text{glucose} \longrightarrow \underset{\text{red}}{Cu_2O}$