Chapter 8

The *d* and *f*-Block Elements

Solutions

SECTION - A

Objective Type Questions (One option is correct)

1. Group-12 elements have ns^2 (n–1) d^{10} configuration and generally show an oxidation state of +2. However their univalent ions (M_2^{2+}) are also known to exist. Consider the species Zn_2^{2+}, Cd_2^{2+}, Hg_2^{2+}. Which of the following correctly represents the stability?

   (1) $Zn_2^{2+} > Cd_2^{2+} > Hg_2^{2+}$ (2) $Hg_2^{2+} > Cd_2^{2+} > Zn_2^{2+}$ (3) $Zn_2^{2+} > Hg_2^{2+} > Cd_2^{2+}$ (4) $Cd_2^{2+} > Zn_2^{2+} > Hg_2^{2+}$

Sol. Answer (2)

Stability increases down the group.

2. AgI, Ag_3PO_4 , Na_2CrO_4 and $K_2Cr_2O_7$ are all coloured. Different concepts are used to explain colour of compounds. In which of following sets, compounds are differently coloured but same concept is used to explain colour?

   (1) Ag_3PO_4 and AgI (2) Na_2CrO_4 and Ag_3PO_4

   (3) $K_2Cr_2O_7$ and Na_2CrO_4 (4) All of AgI, Ag_3PO_4 and Na_2CrO_4

Sol. Answer (3)

AgI and Ag_3PO_4 are coloured due to polarisation whereas CrO_4^{2-} is coloured due to Ligand to metal charge transfer.

3. Which of the following is incorrectly matched regarding *d* block element as a catalyst?

   (1) Cu : Manufacturing of silicones

   (2) $CuCl_2$: Deacon's process

   (3) $PdCl_2$: Catalytic decomposition of $KClO_3$ to form O_2

   (4) Rh : Ostwald's process

Sol. Answer (3)

MnO_2 is used as a catalyst in decomposition of $KClO_3$ to form O_2.

4. Which of the following is incorrect regarding $FeSO_4$?

   (1) It can be prepared by dissolving scraps of Fe in H_2SO_4

   (2) Its heptahydrate is known as Green Vitriol

   (3) Its aqueous solution is basic

   (4) It can reduce both $KMnO_4$ and $K_2Cr_2O_7$

Sol. Answer (3)

Its aqueous solution is acidic due to cationic hydrolysis.

5. Which of the following reactions leads to formation of such product(s) in which element is present in zero oxidation state?

I. $I^- + MnO_4^- \xrightarrow{H^+}$

II. $I^- + MnO_4^- \xrightarrow{H_2O}$

III. $C_2O_4^{2-} + MnO_4^- \xrightarrow{H_2O}$

IV. $MnO_4^- + OH^- \xrightarrow[(Boil)]{\Delta}$

(1) I and III Only (2) II and IV Only (3) I and IV Only (4) II and III Only

Sol. Answer (3)

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

$OH^- + MnO_4^- \xrightarrow{Boil} MnO_4^{2-} + O_2$

6. Which of the following is correct?

(1) Actinoids react with HCl but are slightly affected by HNO_3 due to protective oxide layer

(2) Actinoids are radio active in nature and show lesser range of oxidation states as compared to lanthanoids

(3) Actinoids dissolve in NaOH liberating hydrogen

(4) Actinoids are not affected by boiling water

Sol. Answer (1)

Actinoids are highly reactive but slightly affected by HNO_3.

7. Identify the incorrect statement among the following.

(1) Ce^{+4} is formed because of its noble gas configuration

(2) Thermodynamically Ce^{+4} can oxidise water

(3) Eu^{2+} is stable because of its f^7 configuration

(4) Both Eu^{2+} and Ce^{+4} are good reducing agents

Sol. Answer (4)

Ce^{+4} is an oxidising agent

$E^o\ Ce^{+4} \mid Ce^{3+} = 1.74\ V$

8. Identify the group that contains colorless ions.

(1) La^{3+} and Lu^{3+} (2) Eu^{3+} and Tb^{3+} (3) Ce^{3+} and La^{3+} (4) Tm^{3+} and Yb^{3+}

Sol. Answer (1)

La^{3+} and Lu^{3+} are colourless.

9. Identify the correct statement out of the following.

(1) The basic nature of $Ln(OH)_3$ increase from left to right along the period

(2) LnC_2 upon hydrolysis liberate acetylene

(3) Ln have high tendency of complex formation

(4) Due to small size, Lanthanoids form compound with high covalent character

Sol. Answer (2)

LnC_2 upon hydrolysis liberate acetylene.

10. Which of the following is not same regarding Lanthanoids and actinoids?

(1) Both series have colored ions due to f-f transition

(2) Both series show gradual decrease in size

(3) Both series show equal tendency for complex formation

(4) Both series have stable oxidation state of +3 in general

Sol. Answer (3)

Actinoid contraction is greater than Lanthanoid contraction.

11. $KMnO_4$ dissolution in concentrated H_2SO_4 results in explosion due to

(1) Formation of MnO which explode

(2) Formation of Mn_2O_7 which explode

(3) Formation of MnO_2 which explode

(4) Formation of $MnSO_4$ which explode

Sol. Answer (2)

$$H_2SO_4 + 2KMnO_4 \rightarrow K_2SO_4 + Mn_2O_7 + H_2O$$

12. Consider the following statements:

S_I. *d*-Block metal have high melting points because of participation of $(n-1)d\ e^-$ in interatomic metallic bonding ($n \rightarrow$ outermost shell)

S_{II}. Metal-Metal bonding in compounds of transition elements increases from top to bottom in a group.

The correct option is

(1) S_I is true, S_{II} is false

(2) S_I is false, S_{II} is true

(3) S_I and S_{II} are both true

(4) S_I and S_{II} are both false

Sol. Answer (3)

Both statements are correct.

13. Which of the following lanthanoids has highest tendency to form complexes?

(1) Ce^{+3} (2) Pm^{+2} (3) Lu^{+3} (4) Eu^{+2}

Sol. Answer (3)

Due to small size.

14. What will the structure of CrO_5 is presence of pyridine?

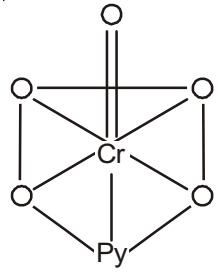
(1) Butterfly

(2) Square pyramidal

(3) Pentagonal pyramidal

(4) Cannot be predicted

Sol. Answer (3)



15. Choose the correct statement regarding bonding in $FeCl_3$.

(I) It contains $2c - 2e^-$ bond (II) It contains $3c - 2e^-$ bond

(III) It contain co-ordinate bond

(1) (I), (II) (2) (I), (III) (3) (II), (III) (4) (I), (II) & (III)

Sol. Answer (2)

It contains $3c–2e^-$ bond

16. Stability of an oxidation state depend on

(1) Ionisation energy (2) Hydration energy

(3) Sublimation energy (4) All of these

Sol. Answer (4)

It depends on reduction potential.

SECTION - B

Objective Type Questions (More than one options are correct)

1. Which of the following compounds are coloured due to charge transfer spectra?

(1) $K_2Cr_2O_7$ (2) $KMnO_4$ (3) AgBr (4) $FeSO_4$

Sol. Answer (1, 2)

$K_2Cr_2O_7 \longrightarrow$ Colour due to charge transfer (CTLM)

$KMnO_4 \longrightarrow$ Colour due to charge transfer (CTLM)

2. A magnetic moment of 1.73 B.M. will be shown by

(1) $[Cu(NH_3)_4]^{2+}$ (2) $[Zn(CN)_4]^{2-}$ (3) $TiCl_3$ (4) $[Fe(CN)_6]^{4-}$

Sol. Answer (1, 3)

Cu^{2+} and Ti^{+3} have one unpaired e^- so magnetic moment of these is 1.73 B.M.

3. The oxidation of manganate ion to permanganate ion can be done by

(1) Cl_2 (2) O_3 (3) SO_2 (4) KNO_3

Sol. Answer (1, 2)

Oxidation of manganate ion to permanganate ion can be done by Cl_2 and O_3.

4. Highest oxidation state of Manganese and Osmium is shown with

(1) S (2) H (3) O (4) F

Sol. Answer (3, 4)

Highest oxidation state of any element is stable with O and F.

5. The correct statement

(1) Green vitriol and blue vitriol are isomorphous

(2) Upon strong heating paramagnetic gases are evolved by $CuSO_4$ and $AgNO_3$

(3) Ag_2S and Cu_2Cl_2 are colourless

(4) $KMnO_4$ and $K_2Cr_2O_7$ are coloured due to charge transfer spectra

Sol. Answer (2, 4)

$CuSO_4 \xrightarrow{\Delta} CuO + SO_3$

$SO_3 \longrightarrow SO_2 + \frac{1}{2}O_2$.

$AgNO_3 \longrightarrow Ag + NO_2 + \frac{1}{2}O_2$

O_2 and NO_2 are paramagnetic.

$KMnO_4$ and $K_2Cr_2O_7$ are coloured due to C.T. spectra.

6. Which of the following metals have both valence shell and penultimate shell partially filled?

(1) Cr (2) Mo (3) Cu (4) Zn

Sol. Answer (1, 2)

Cr and Cu have both valence shell and penultimate shell partially filled.

$Cr \longrightarrow 3d^5\ 4s^1$

$Cu \longrightarrow 3d^{10}\ 4s^1$

7. Which of the following statement is correct when a mixture of $CaCl_2$ and $K_2Cr_2O_7$ is gently warmed with conc. H_2SO_4 acid?

(1) Deep red vapours are evolved

(2) The vapours when passed into NaOH solution gives a yellow solution of Na_2CrO_4

(3) Chlorine gas is evolved

(4) Chromyl chloride is formed

Sol. Answer (1, 2, 4)

$Cl^- + Cr_2O_2^{-2} \xrightarrow{H_2SO_4} \underset{\text{deep red vapours}}{CrO_2Cl_2}$

$CrO_2Cl_2 + NaOH \longrightarrow Na_2CrO_4 + NaCl$

8. $CuSO_4 \xrightarrow{A} Cu(OH)_2$; $CuSO_4 \xrightarrow{B} [Cu(NH_3)_4]SO_4$

(1) A is NaOH and B is NH_4OH

(2) Both $Cu(OH)_2$ and $[Cu(NH_3)_4]SO_4$ are pale blue and dark blue ppt. respectively

(3) Blue colour of solution is due to *d-d* transition

(4) $Cu(OH)_2$ is paramagnetic and $[Cu(NH_3)_4]^{+2}$ is diamagnetic

Sol. Answer (1, 2, 3)

$CuSO_4 \xrightarrow{NaOH} Cu(OH)_2$; $CuSO_4 \xrightarrow{NH_4OH} [Cu(NH_3)_4]SO_4$

$Cu(OH)_2$ and $[Cu(NH_3)_4]SO_4$ both have $3d^0$ E.C. so both are pale blue coloured due d-d transition.

9. Which of the following pairs are both coloured in aqueous solution?

(1) Sc^{3+}, Co^{3+} (2) Ni^{2+}, Cu^{2+} (3) Ni^{2+}, Ti^{3+} (4) Sc^{3+}, Ti^{3+}

Sol. Answer (2, 3)

Ni^{2+} and Ti^{3+} both have unpaired electrons.

10. Correct statement about FeO at room temperature

(1) It is non-stoichiometric and metal deficient

(2) It is basic oxide

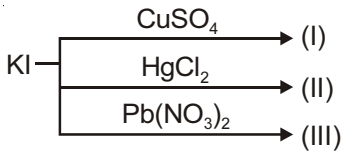
(3) Its aqueous solution changes to $Fe(OH)_3$ and then to $Fe_2O_3.x\,H_2O$ by atmospheric oxygen

(4) It gives red colour with KCNS

Sol. Answer (1, 2, 3)

It is non-stoichiometric due to pressure of Fe^{+3}. It is a basic oxide.

11. Consider following reactions.

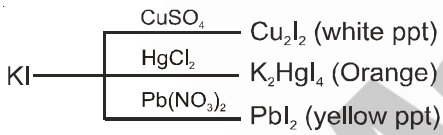


Correct statement is

(1) A white ppt. of CuI in (I) (2) An orange ppt. dissolving to HgI_4^{2-} in (II)

(3) A yellow ppt. of PbI_2 in (III) (4) A white ppt. of CuI, HgI_2 and PbI_2 in each case

Sol. Answer (1, 2, 3)



12. Which of the following is correct about prussian blue?

(1) $Fe_4[Fe(CN)_6]_3$ (2) $K[Fe'''Fe(CN)_6]$ (3) Blue colour (4) $Fe_3[Fe(CN)_6]_4$

Sol. Answer (1, 2, 3)

Prussian blue is $Fe_4[Fe(CN)_6]_3$ and $K[Fe'''Fe(CN)_6]$

13. Correct statement about calomel is

(1) Ionises as Hg_2^{2+} and $2Cl^-$ ions (2) Cation is diamagnetic

(3) Used in medicine as purgative (4) With aqueous ammonia it turns black

Sol. Answer (1, 2, 3, 4)

$$\underset{\text{(Calomel)}}{Hg_2Cl_2} \longrightarrow Hg_2^{+2} + 2Cl^-$$

Due to metal-metal bonding Hg_2^{+2} is diamagnetic

$$Hg_2Cl_2 + NH_3 \xrightarrow{H_2O} \underbrace{Hg\begin{matrix}NH_2 + Hg\\ Cl\end{matrix}}_{\text{Black}}$$

14. Some of the following reagents are used as primary standard

I. $KMnO_4$ II. NaOH

III. $K_2Cr_2O_7$ IV. $FeSO_4(NH_4)_2SO_4.6H_2O$

V. $H_2C_2O_4.2H_2O$

Select the primary standard.

(1) II, IV (2) I, II (3) III, IV, V (4) All of these

Sol. Answer (3)

Only $K_2Cr_2O_7$ is used as primary standard.

15. Incorrect statement is/are

(1) In acidic medium MnO_4^- disproportionates to MnO_2 and MnO_4^{2-}

(2) $KMnO_4$ spot can be bleached by H_2O_2

(3) Alkaline $KMnO_4$ can be used to test unsaturation in 

(4) Eq. wt. of $KMnO_4$ in acidic medium is $\frac{M}{5}$

Sol. Answer (1, 3)

$KMnO_4 \xrightarrow{H^+} Mn^{+2}$

Eq. wt. : $\frac{M}{5}$

In acidic medium $KMnO_4$ does not show disproportional reaction because it cannot show the oxidation number higher than 7.

16. Which of the following statement(s) is/are correct?

(1) Hydrated ferric chloride can be produced by action of HCl on Ferric oxide and allowing the solution to crystallise

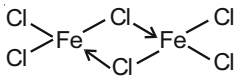
(2) Hydrated ferric chloride crystals are yellow in color

(3) Anhydrous ferric chloride is a dark red deliquescent solid

(4) Ferric chloride can exists in the form of chlorine bridged dimer

Sol. Answer (1, 2, 3, 4)

$Fe_2O_3 + 6HCl \rightarrow 2FeCl_3 + 3H_2O$



SECTION - C

Linked Comprehension Type Questions

Comprehension-I

The transition elements (with few exceptions) show a large number of oxidation states. The various oxidation states are related to the electronic configuration of their atoms. The variable oxidation states of a transition metal is due to the involvement of (n – 1)*d* and outer *ns* electrons. For the first five elements of 3*d* transition series, the minimum oxidation state is equal to the number of electrons in 4*s* shell and the maximum oxidation state is equal to the sum of 4*s* and 3*d* electrons. The relative stability of various oxidation states of a given element can be explained on the basis of stability of d^0, d^5 and d^{10} configurations.

1. In 3*d* series, the maximum oxidation state is shown by

(1) Sc(At. no. 21) (2) Cr(At. no. 24) (3) Mn(At. no. 25) (4) Fe(At. no. 26)

Sol. Answer (3)

Mn show the maximum oxidation state of +7.

2. In which of the following pairs, the first species is more stable than second one?

(1) Ti^{3+}, Ti^{4+} (2) Mn^{2+}, Mn^{3+} (3) Fe^{2+}, Fe^{3+} (4) Sc^{+2}, Sc^{+3}

Sol. Answer (2)

Due to half filled E.C. Mn^{+2} is more stable.

3. Identify the correct statement.

(1) The most common oxidation state of 3*d* series is +2

(2) The lowest oxidation state of Cr and Cu is +1 while for others it is +2

(3) Ti^{4+}, Mn^{2+} are stable oxidation states

(4) All of these

Sol. Answer (4)

Fact.

Comprehension-II

Transition metals combine with halogens at high temperature to form compounds called halides. On account of high activation energy, the reactions require high temperature to start, but once the reaction is started, the heat of reaction is sufficient to maintain the continuity.

Metals in higher oxidation state form flourides as it is the most electronegative element. Flourides are ionic in nature. The chlorides, bromides and iodides have ionic as well as covalent character. Halides of metals in higher oxidation states are relatively unstable and hydrolysed very easily.

1. ΔH_f is negative for

(1) Fluorides (2) Bromides (3) Iodides (4) All of these

Sol. Answer (4)

Enthalpy of formation of all halides is negative.

2. $Cr_2O_7^{2-} \xrightarrow{pH=x} CrO_4^{2-} \xrightarrow{pH=y} Cr_2O_7^{2-}$

pH values x and y can be

(1) 4 and 5 (2) 4 and 8 (3) 8 and 4 (4) 8 and 9

Sol. Answer (3)

$Cr_2O_7^{-2} \xrightarrow{Basic} CrO_4^{-2} \xrightarrow{acidic} Cr_2O_7^{-2}$

3. Aqueous solution of which compound will have pH < 7?

(1) $TiCl_4$ (2) $FeCl_3$ (3) $CuSO_4$ (4) All of these

Sol. Answer (4)

$TiCl_4 + H_2O \longrightarrow Ti(OH)_4 + HCl$

$TiCl_3 + H_2O \longrightarrow Fe(OH)_3 + HCl$

$CuSO_4 + H_2O \longrightarrow Cu(OH)_2 + H_2SO_4$

Comprehension-III

Compounds of transition and inner transition elements are coloured, colour may be due to

I. d-d transition II. f-f transition

III. Charge transfer spectra IV. Polarisation

1. $Co(H_2O)_4^{+2}$ is blue coloured, then $Co(H_2O)_6^{+2}$ will be

(1) Blue (2) Colourless (3) White coloured (4) Pink coloured

Sol. Answer (4)

Due to crystal field splitting.

2. A trivalent lanthanoid has electronic configuration $4f^4$, then which of the following E.C. has same colour to that ion (M^{+3})

(1) f^5 (2) f^3

(3) f^{10} (4) Cannot be determined

Sol. Answer (3)

If unpaired elusion are same, then colour will same.

3. $KMnO_4$ is coloured due to

(1) *d-d* transition (2) *f-f* transition (3) Charge transfer (4) Polarisation

Sol. Answer (3)

Due to charge transfer

4. Both AgBr and AgI are yellow coloured. But AgI has more intense colour because of

(1) More polarising power of Ag^+ (2) More polarizability of I^-

(3) More polarizability of Br^- (4) Both (1) & (2)

Sol. Answer (2)

More polarizability of I^-.

SECTION - D

Matrix-Match Type Questions

1. Match the underlined atoms in Column-I with oxidation number in Column-II.

Column-I	Column-II
(A) $\underline{Fe}[Fe^{II}(CN)_6]^-$	(p) 3
(B) $\underline{Ag}[(CN)_2]^-$	(q) 0
(C) $\underline{Ni}(CO)_4$	(r) 1
(D) $\underline{Cr}O_5$	(s) 6

Sol. Answer A(p), B(r), C(q), D(s)

(A) $Fe[Fe(CN)_6]^- \longrightarrow$ (p) (3)

(B) $Ag(CN_2)^- \longrightarrow$ (r) (1)

(C) $Ni(CO)_4 \longrightarrow$ (q) (0)

(D) $CrO_5 \longrightarrow$ (s) (6)

2. Match the following.

Column-I	**Column-II**
(A) Lunar caustic	(p) $ZnSO_4.7H_2O$
(B) Malachite	(q) An ore of copper
(C) Prussian blue	(r) $Fe_4[Fe(CN)_6]_3$
(D) White vitriol	(s) $AgNO_3$

Sol. Answer A(s), B(q), C(r), D(p)

Lunar caustic $\longrightarrow AgNO_3$

Malachite $\longrightarrow$ an ore of copper.

Prussian blue $\longrightarrow Fe_4[Fe(CN)_6]_3$

White vitriol $\longrightarrow ZnSO_4 . 7H_2O$

3. Match the following.

Column-I	**Column-II**
(A) Mn^{+2}	(p) Diamagnetic
(B) V^{+3}	(q) Paramagnetic
(C) Zn^{+2}	(r) Coloured compound
(D) Fe^{+3}	(s) $\mu = \sqrt{35}$ B.M

Sol. Answer A(q, s), B(q, r), C(p), D(q, r, s)

$Mn^{+2} \longrightarrow \sqrt{5\times7} = \sqrt{35}$ B.M. paramagnetic and colourless

$V^{+3} \longrightarrow$ Paramagnetic coloured

$Zn^{+2} \longrightarrow$ Diamagnetic colourless

$Fe^{+3} \longrightarrow \sqrt{35}$ B.M. paramagnetic coloured

4. Match the following.

Column-I (Compounds)	**Column-II (Properties)**
(A) $KFe[Fe(CN)_6]$	(p) *d-d* transition is possible in any of atom
(B) $KMnO_4$	(q) Charge transfer from metal to metal
(C) $Cu_2[Fe(CN)_6]$	(r) Paramagnetic
(D) AgBr	(s) Colour due to polarisation
	(t) Charge transfer from ligand to metal

Sol. Answer A(p, q, r), B(t), C(p, q, r), D(s)

AgBr is coloured due to polarisation. $KFe[Fe(CN)_6]$ show *d-d* transition and charge transfer.

5. Match the product of given reaction in Column-I to the properties given in Column-II.

Column-I (Reaction)	**Column-II (About Product and Reaction)**
(A) $K_2Cr_2O_7 + H_2O_2 \xrightarrow{\text{acidic medium}}$	(p) Change in oxidation state of Cr

(B) $K_2Cr_2O_7 + Cl^- \xrightarrow{H^+}$

(C) $K_2Cr_2O_7 + \underset{30\%}{H_2O_2} \xrightarrow{\text{basic}}$

(D) $K_2Cr_2O_7 + SO_2 \xrightarrow{H^+}$

(q) Blood red coloured complex

(r) Blue colour in etheral layer

(s) Oxidation state of Cr is 6 in product

(t) Green colour

Sol. Answer A(r, s), B(q, s), C(p), D(p, t)

(A) CrO_5

(B) CrO_2Cl_2

(C) K_3CrO_8

(D) $Cr_2(SO_4)_3$

6. Match the following.

Column-I	**Column-II**
(A) Pm	(p) Radioactive
(B) Hg	(q) Typical transition metal
(C) Fe	(r) High tendency to form metal-metal bond
(D) U	(s) Actinoid
	(t) Liquid at room temperature.

Sol. Answer A(p), B(r, t), C(q, r), D(p, s)

Pm is radioactive lanthanoid while U is radioactive actinoid.

7. Match the following.

Column-I	**Column-II**
(A) $Co(NH_3)_6^{+2}$	(p) Paramagnetic
(B) $Fe(CN)_6^{-3}$	(q) Coloured due to *d-d* transition
(C) CuF_2	(r) Blue vitrol
(D) $CuSO_4 \cdot 5H_2O$	(s) Hydrogen bonding
	(t) Ionic bonding

Sol. Answer A(p, q), B(p, q), C(p, q, t), D(p, q, r, s, t)

CuF_2 is coloured due to *d-d* transition $CuSO_4 . 5H_2O$ is blue coloured due to *d-d* transition. All of these are paramagnetic.

SECTION - E

Assertion-Reason Type Questions

1. STATEMENT-1 : Oxidation number of Cr in K_3CrO_8 is +5.

and

STATEMENT-2 : It contains tetraperoxo species, i.e., $[Cr(O_2)_4]^{3-}$

Sol. Answer (1)

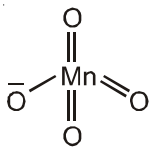
$\overset{+5}{[Cr}\overset{-8}{(O_2)_4]^{3-}}$

2. STATEMENT-1 : MnO_4^- is tetrahedral in shape.

and

STATEMENT-2 : $KMnO_4$ is purple in colour.

Sol. Answer (2)



MnO_4^- is pink coloured due to charge transfer.

3. STATEMENT-1 : In zinc outermost shell is completely filled.

and

STATEMENT-2 : Zn does not show much resemblance with transition metals.

Sol. Answer (4)

In Zinc, outermost shell is not completely filled.

Zn does not show variable oxidation number because it has full filled *d*-orbital in its atomic or ionic state.

4. STATEMENT-1 : Chromium atom has electronic configuration $[Ar]3d^5 4s^1$.

and

STATEMENT-2 : Atomic number of chromium is 24.

Sol. Answer (2)

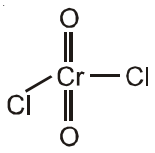
Fact.

5. STATEMENT-1 : CrO_2Cl_2 has tetrahedral shape.

and

STATEMENT-2 : CrO_3 reacts with HCl to form CrO_2Cl_2.

Sol. Answer (2)



$$CrO_3 + HCl \longrightarrow CrO_2Cl_2 + H_2O$$

6. STATEMENT-1 : Common oxidation states of iron are +2 and +3 in its compounds.

and

STATEMENT-2 : Iron can have only +2 and +3 oxidation states in its compounds.

Sol. Answer (3)

Fe can show the oxidation state + 8/3.

7. STATEMENT-1 : K_2PtCl_6 is well known compound whereas corresponding Ni compound is not known.

and

STATEMENT-2 : The sum of four ionisation energies of Pt in less than that of Ni.

Sol. Answer (1)

Ni does not show co-ordination number of six.

8. STATEMENT-1 : Zn is not a typical transition metal.

and

STATEMENT-2 : Zn is a *d*-block element.

Sol. Answer (2)

Group-12 elements are not transition metals.

9. STATEMENT-1 : In $Cr_2O_7^{-2}$ bond length of all Cr-O bonds is equal.

and

STATEMENT-2 : $Cr_2O_7^{-2}$, resonance is possible.

Sol. Answer (4)

Two set of Cr–O bond length is present in $Cr_2O_7^{-2}$.

10. STATEMENT-1 : Lanthanoids show less oxidation states than actinoids.

and

STATEMENT-2 : 4*f* subshell is dieperseated than 5*f*.

Sol. Answer (1)

Fact.

11. STATEMENT-1 : Out of all actinoids, Th has highest melting point.

and

STATEMENT-2 : Th has largest size among actinoids.

Sol. Answer (2)

Fact.

12. STATEMENT-1 : AgBr is yellow coloured.

and

STATEMENT-2 : AgBr is unstable is presence of sunlight.

Sol. Answer (2)

Reduction of AgBr may take place in presence of sunlight.

13. STATEMENT-1 : Hg exists in liquid state at room temperature.

and

STATEMENT-2 : Hg has $(n-1)d^{10}\ ns^2$ E.C.

Sol. Answer (2)

Fact.

14. STATEMENT-1 : CuO is called black oxide of copper.

and

STATEMENT-2 : CuO is diamagnetic.

Sol. Answer (3)

CuO is paramagnetic.

15. STATEMENT-1 : $Lu(OH)_3$ is more basic than $Ce(OH)_3$.

and

STATEMENT-2 : Lu^{+3} has smaller size than Ce^{+3}.

Sol. Answer (4)

$Lu(OH)_3$ is less basic than $Ce(OH)_3$.

SECTION - F

Integer Answer Type Questions

1. What is the maximum number of Cu–F bonds which have highest bond length in CuF_2 (crystalline)?

Sol. Answer (2)

Four bond length are small and two bond length are large.

2. What is the number of CdI_2 units in one unit cell of CdI_2?

Sol. Answer (3)

CdI_2 show hcp packing.

3. What is the oxidation state of Mn in product formed by the oxidising action of $KMnO_4$ in neutral medium?

Sol. Answer (4)

$KMnO_4$ is converted into MnO_2 in neutral medium.

4. $Sc_2O_3 + C \xrightarrow{1000^\circ C} \text{Carbide}$.

How many C – C π bonds are present in carbide?

Sol. Answer (2)

$Sc_2O_3 + C \xrightarrow{1000^\circ C} ScC_2$.

5. What will be oxidation state of Sc in ScC_2?

Sol. Answer (3)

Sc show only +3 oxidation state.

6. What should be the stable oxidation state of iron for maximum magnetic moment?

Sol. Answer (3)

Fe^{3+} has five electron.

7. What will be oxidation state of iron in Haemoglobin?

Sol. Answer (2)

(Fe^{2+})

8. A trivalent lanthanoid ion having yellow colour in aqueous solution has five 4*f* electrons. What should be number of electrons in 4*f* orbital of another trivalent lanthanoid ion having yellow colour in aqueous solution?

Sol. Answer (9)

Colour of element having 'n' electron in f-sub-shell is same that having 14-n electron.

9. If the number of transition elements belonging to the 4^{th} period having an atomic radii lesser than Sc is x, then the value of 3x is

Sol. Answer (24)

Ti, V, Cr, Mn, Fe, Co, Ni, Cu

x = 8

3x = 24

10. The highest oxidation state of Mn in its oxide = X

The highest oxidation state of Mn in its compound with fluorine only = Y

The highest oxidation state of Cr in its oxide = Z

The highest oxidation state of Cr in its fluoride = W

The value of X + Y +Z + W is

Sol. Answer (23)

X = 7

Y = 4

Z = 6

W = 6

Sum = 23

❑ ❑ ❑