CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

D AND F BLOCK ELEMENTS

Illustration

1. The ions of $d-$ block elements are mostly paramagnetic-

A. Because their $d-$ orbitals are complete

B. Because they have mostly paired electrons

C. Because they have mostly unpaired electrons

D. Because they form coloured ions.

Answer: C

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2. Silver jewelry can be made to retain its silvery white appearance by-

A. Coating the silver with a film of oxide by dipping the silver in conc. HNO_3.

B. Coating with a film of the insoluble chloride by dipping the silver in conc. HNO_3

C. Plating with Palladium

D. Plating with gold

Answer: C

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3. The order of stability of complex of ion $CU^{+2}, Ni^{+2}, Mn^{+2}$ and Fe^{+2} decreases in the order-

A. $Cu^{+2} > Ni^{+2} > Fe^{+2} > Mn^{+2}$

B. $Mn^{+2} > Ni^{+2} > Cu^{+2} > Fe^{+2}$

C. $Ni^{+2} > Cu^{+2} > Fe^{+2} > Mn^{+2}$

D. $Fe^{+2} > Ni^{+2} > Cu^{+2}Mn^{+2}$

Answer:

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4. The elements which exhibit both vertical and horizontal similarities are:

A. Inert gas elements

B. Representative elements

C. Rare elements

D. Transition elements

Answer:

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Solved Example

1. Which of the following statements is correct?

A. Iron belongs to third transition series of the periodic table

B. Iron belongs to $f-$ block of the periodic table

C. Iron belongs to first transition series

D. Iron belongs to group $VIII$ of the periodic table

Answer:

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2. Zn and Hg do not show variable valency like $d-$ block elements because-

A. They are soft

B. Their $d-$ shell are complete

C. They have only two electrons in the outermost subshell

D. Their $d-$ shells are incomplete

Answer:

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3. A metal ion from the first transition series has a magnetic moment (calculated) of $2.83BM$. How many unpaired electrons are expected to be presetn in the ion?

A. 1

B. 2

C. 3

D. 4

Answer:

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4. Out of the compounds $K_2SO_4, MgCl_2, FeSO_4, NiCl_2$ and ZNO which of the following pair will show paramagnetism-

A. $K_2SO_4, MgCl_2$

B. $ZnO, MgCl_2$

C. $K_2SO_4, ZnCl_2$

D. $FeSO_4, NiCl_2$

Answer:

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5. Variable valency is generally shown by-

A. $s-$ block elements

B. $p-$ block elements

C. Transition elements

D. All elements in periodic table

Answer:

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6. The common oxidation states of gold are-

A. 1,2 and 3

B. 1,3

C. 2 and 3

D. 3,4

Answer:

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7. The $d-$ block elements easily form alloys because-

A. Their $d-$ block are only partly filled

B. They have very widely differing atomic sizes.

C. They are very similar in their atomic sizes

D. They are highly electronegative in character

Answer:

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8. Wilkinson's catalyst used as a homogenous catalyst

In the hydrogenation of alkene contains-

A. Fe

B. Al

C. RH

D. Co

Answer:

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9. Which of the following is the softest metals-

A. Sc

B. Zn

C. Ti

D. V

Answer:

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10. In which of the following transition metal ions $d - d$ transition is possible-

A. Cu^+

B. Zn^{+2}

C. Ti^{+3}

D. Sc^{+3}

Answer:

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11. Which of the following cuprous compounds is not stable-

A. $CuCl_2$

B. $Cu_2(CNS)_2$

C. Cu_2Cl_2

D. Cu_2SO_4

Answer:

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12. A developer used in photography is-

A. A weak acid

B. A weak base

C. A mild reducing agent

D. Anoxidizing agent

Answer:

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Exercise

1. Trasition metals and their oxides are used in industrial processes as-

A. Detergents

B. Insecticides

C. Catalysts

D. None

Answer: C

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2. Blue solution of $CuSO_4$ becomes darker when treated with ammonia because

A. ammonia molecules replace water molecules in the solution

B. ammonia forms a stable complex ion $\left[Cu(NH_3)_4\right]^{2+}$ with Cu^{2+} ions

C. All are correct

D.

Answer:

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3. A metal gives two chlorides 'A' and 'B'.'A' gives black precipitate with NH_4OH and 'B' gives white ppt. With KI 'B' gives a red precipitate soluble in excess of KI.'A' and 'B' are respectively :

A. $HgCl_2$ and Hg_2Cl_2

B. Hg_2Cl_2 and $HgCl_2$

C. $HgCl_2$ and $HgCl$

D. None of these

Answer:

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Exercise 1 Single Correct Choice Type

1. Arrange Ce^{3+}, La^{3+}, Pm^{3} and Yb^{3+} in increasing order of their size -

A. $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$

B. $Ce^{3+} > Yb^{3+} < Pm^{3+} La^{3+}$

C. $Yb^{3+} Pm^{3+} < La^{3+} < Ce^{3+}$

D. $Pm^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

Answer: A

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2. Which of the following is not a characteristic property of transition metal-

A. Hight enthalpy of atomisation

B. Formation of interstitial compounds

C. Diamagnetism

D. Variable oxidation state

Answer: C

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3. The atomic numbers of vanadium (V). Chromium (Cr), managanese (Mn) and iron (Fe) respectively $23, 24, 25$ and 26. Which one of these may be expected to have the higer second ionization enthalpy?

A. Cr

B. Mn

C. Fe

D. V

Answer: A

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4. Transition metals ions form interstial compounds because-

A. Interstices are available in their crystal lattice

B. They have empty $d-$ orbitals

C. They have high value of ionic potential

D. They show variable oxidation states

Answer: A

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5. Paramagnetism is a property due to the presence of unpaired electrons. In case of transition metals, as they contain unpaired contain unpaired electrons in the $(n-1)$ d orbitals , most of the transition metal ions and their compounds are paramagnetic . Paramagnetism increases with increases in number of unpaired electrons. Magnetic moment is calculated from spin only formula

$\mu = \sqrt{n(n+2)}B.\ Mn = \text{number of unpaired electrons}$

Similarly the colour of the compounds of transition metals may be attributed to the presence of incomplete $(n-1)$ d sub-shell. When an electron from a lower energy of d-orbitals is excited to a higher energy d-orbital, the energy of excitation

corresponds to the frequency of light absorbed. This frequency generally lies in the visible region. The colour observed corresponds to complementary colour of the light observed. The frequency of the light absorbed is determined by the nature of the ligand.

Titanium shows magnetic moments of $1.73BM$ in its compound. What is the oxidation state of titanium in the compound?

A. $+1$

B. $+4$

C. $+3$

D. $+2$

Answer: C

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6. The ion pair of the following in which both the ions have unpaired electron-

A. Cr^{3+}, Co^{2+}

B. Sc^{3+}, Cr^{3+}

C. Cu^{+}, Fe^{3+}

D. Mn^{2+}, Cu^{+}

Answer: A

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7. What happen when a solution of potassium chromate is treated with an excess of dil. Nitic acid?

A. Cr^{3+} and $Cr_2O_7^{2-}$ are formed

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

C. $Cr_2O_7^{2-}$ is reduced to $+3$ state pf Cr

D. $Cr_2O_7^{2-}$ is oxidised to $+7$ state of Cr

Answer: B

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8. Transition elements act as catalyst because-

A. Their melting points are higher

B. Their $I.P.$ values are higher

C. They have high density

D. They can show variable oxidation states

Answer: D

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9. The radius of La^+ (at no 57) is 1.06Å. What may be the radius of Lu^{3+} (at no.71)?

A. $1.6Å$

B. $1.4Å$

C. $1.06Å$

D. $0.85Å$

Answer: D

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10. Calomel is the name of

A. $Hg_2Cl_2 + Hg$

B. $HgCl_2$

C. $Hg + HgCl_2$

D. Hg_2Cl_2

Answer: D

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11. Cerium $(Z = 58)$ is an important nember of the lanthanoids . Which of the following statements about cerium is incorrect ?

A. Cerium (IV) acts as an oxidising agent

B. The +3 oxidatio state of cerium is more stable than the $+4$ oxidation state

C. The +4 oxidation state of cerium is not known in solutions

D. The common oxidation states of cerium are $+3$ and $+4$

Answer: C

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12. Excess of KI reacts with $CuSO_4$ solution and Na_2SO_3 solution is added to it. Which of the following statements in incorrect for the reaction?

A. Evolved I_2 is reduced

B. Cul_2 is formed

C. $Na_2S_2O_3$ is oxidised

D. Cu_2I_2 is formed

Answer: B

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13. Formula of chromyl chloride is-

A. $CrPCL_2$

B. CrO_2Cl

C. CrO_2Cl_2

D. $(CrOCl)_2$

Answer: C

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14. Calomel (H_2Cl_2) on reaction with ammonium hydroxide gives

A. $HgNH_2Cl$

B. $NH_2 - Hg - Hg - Cl$

C. Hg_2O

D. Hg_2O

Answer: A

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15. The reaction, $2Cu^{+} \rightarrow Cu + Cu^{2+}$ is called-

A. Reduction

B. Oxidation

C. Displacement

D. disproportionation

Answer: D

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16. The lanthanide contraction is responsible for the fact that

A. Zr and Y have about the same radius

B. Zr and Nb have similar oxidation state

C. Zr and Hf have about the same radius

D. Zr and Zn have similar oxidation state

Answer: C

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17. Amongst $[TiE_6]^{2-}$, $[CoF_6]^{3-}$, Cu_2Cl_2 and $[NiCl_4]^{2-}$ [Atomic no. $Ti = 22, Co = 27, Cu = 29, Ni = 28$] the colourless species are :

(A) $[TiF_6]^{2-}$ and $[Cu_2Cl_2]$

(B) Cu_2Cl_2 and $[NiCl_4]^{2-}$

(C) $[TiF_6]^{2-}$ and $[CoF_6]^{3-}$

(D) $[CoF_6]^{3-}$ and $[NiCl_4]^{2-}$

A. TiF_6^{2-} &Cu_2Cl_2

B. Cu_2Cl_2&$NiCl_4^{2-}$

C. TiF_6^{2-} &CoF_6^{3-}

D. CoF_6^{3-} &$NiCl_4^{2-}$

Answer: A

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18. Lanthanoid contraction is caused due to:

A. the same effective nuclear charge from Ce to Lu

B. the imperfect shielding on outer electrons by 4f electrons fro the nuclear charge

C. the appreciable shielding on outer electrons by 4f electrons from the nuclear charge

D. the appreciable shielding on outer electrons by 5d electrons from the nuclear charge

Answer: B

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19. CrO_3 is $a/an.\ldots.$

A. Acidic oxide

B. Basic oxide

C. Neutral oxide

D. Amphoteric

Answer: A::B

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20. Which of the following is expected to have lowest magnetic moment-

A. Ti^{2+}

B. Mn^{2+}

C. Co^{2+}

D. Cu^{2+}

Answer: D

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21. Identify the incorrect statement among the following.

A. d-block elements show irregular and erratic chemical properties among themselves

B. La and Lu have partially filled d-orbitals and no other partially filled orbitals

C. The chemistry of various lanthanoids is very similar

D. 4f and 5f-orbitals are equally shielded

Answer: D

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22. Which of the following ion has the maximum magnetic moment?

A. Sc^{3+}

B. Ti^{3+}

C. Cu^{+}

D. Zn^{2+}

Answer: B

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23. Transition elements are usually characterised by variable oxidation states but Zn does not show this property because of :

A. completion of np-orbitals

B. completion of (n-1)d orbitals

C. completion of ns-orbitals

D. inert pair effect

Answer: B

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

A. In the highest oxidation states, the transition metal show basic character and form cationic complexes

B. In the highest oxidation states of the first five transitio elements (Sc to Mn), all the 4s and 3d electrons are used for bonding

C. Once the d^(5) configuration is exceeded, the tendency to involve all the the 3d electrons in bonding decreases.

D. In addition to the normal oxidation states, the zero oxidation state is also show by these element in complexes

Answer: A

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25. What is the general electronic configuration of transition elements

A. $(n-1)d^{1-5}$

B. $(n-1)d^{1-10}ns^1$

C. $(n-1)d^{1-10}ns^{1-2}$

D. None of these

Answer: C

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26. Knowing that the chemistry of lanthanoids (Ln) is dominated by its $+3$ oxidation state, which of the following statement is incorrect?

A. The ionic sizes of Ln (III) decreases in general with increasing atomic number

B. Ln (III) compounds are generally colourless

C. Ln (III) hydroxides are mainly basic in character

D. Because of the large size of the Ln(III) ions the bonding in its compounds is predominently ionic in character

Answer: B

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27. The highest oxidation state achieved by trantion metal is given by -

A. ns electrons

B. (n-1)d electrons

C. (n+1) d electrons

D. ns+(n-1) d electrons

Answer: D

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28. In context of the lanthanoids, which of the following statements is not correct?

A. There is gradual decrease in the radii of the members with increasing atomic number in the

series

B. All the members exhibit +3 oxidation state

C. Because of similar properties the separation of lanthanoids in not easy

D. Availability of 4f electrons results in the formation of compounds in +4 state for all members of the series

Answer: D

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29. The equilibrium $Cr_2O_7^{2-} \Leftrightarrow 2CrO_4^{2-}$

A. An acidic medium

B. A basic medium

C. A neutral medium

D. It does not exist

Answer: B

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30. When the same amount of Zn is treated with excess of H_2SO_4 and excess of $NaOH$ separately, the ratio of the volume of hydrogen evolved is-

A. $1:1$

B. $1:2$

C. $2:1$

D. $9:4$

Answer: A

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31. $(NH_4)_2Cr_2O_7$(Ammonium dichromate) is used in fire works. The green coloured powder blown in air is

A. Cr_2O_3

B. CrO_2

C. Cr_2O_4

D. CrO_3

Answer: A

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32. The $d-$ block elements which is a liquid at room temperature, having high specific heat, less reactivity than hydrogen and its chloride (Mx_2) is Volatile on heating is

A. Cu

B. Hg

C. Ce

D. Pm

Answer: B

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33. Coinage metals show the properties of

A. typical elements

B. normal elements

C. inner-transition elements

D. transition element

Answer: D

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34. $Cr_2O_7^{2-} \underset{Y}{\overset{X}{\rightleftharpoons}} 2CrO_4^{2-}$ X and Y are respectively:

A. $X = OH^-, Y = H^+$

B. $X = H^+, Y = OH^-$

C. $X = OH^-, Y = H_2O_2$

D. $X = H_2O_2, Y = OH^-$

Answer: A

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35. CrO_3 dissolves in aqueous NaOH to give:

A. $Cr_2O_7^{2-}$

B. CrO_4^{2-}

C. $Cr(OH)_3$

D. $Cr)OH)_2$

Answer: B

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36. An ornament of gold having 75% of gold, is of _____carat.

A. 18

B. 16

C. 24

D. 20

Answer: A

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37. Solution of MnO_4^- is purple-coloured due to :

A. d-d-transition

B. charge transfer from O to Mn

C. due to both d-d-transition and charge transfer

D. none of these

Answer: B

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38. Transition elements having more tendency to form complex than representative elements (s and p-block elements) due to:

A. availability of d-orbitals for bonding

B. variable oxidation states are not shown by transition elements

C. all electrons are paired in d-orbitals

D. f-orbitals are available for bonding

Answer: A

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39. $\uparrow Y(g) \xleftarrow{KI} CuSO_4 \xrightarrow{dil\,H_2SO_4} X(\text{Bluecolour}), X$ and Y are

A. $X = I_2, Y = \left[Cu(H_2O)_4\right]^{2+}$

B. $X = \left[Cu(H_2O)_4\right]^{2+}, Y = I_2$

C. $X = \left[Cu(H_2O)_4\right]^{+}, Y = I_2$

D. $X = \left[Cu(H_2O)_5\right]^{2+}, Y = I_2$

Answer: B

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40. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because

A. The 5f-orbitals are more burried than the 4f-orbitals

B. There is a similarly between 4f-and-5f in the their angular part of the wave function

C. The actinoids are more reactive than the lanthanoids

D. The 5f-orbitals extend further from the nucleus than the 4f-orbitals

Answer: D

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41. 

x, y and z are respectively

A. $1, 2, 3$

B. $1, 5, 3$

C. $1, 3, 5$

D. $5, 3, 1$

Answer: B

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42. $Cu + \underset{(\text{bot})}{conc.}\ HNO_3 \rightarrow Cu(NO_3)_2 + X$

(oxide of nitrogen) then X is:

A. N_2O

B. NO_2

C. NO

D. N_2O_3

Answer: B

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43. Pick out the incorrect statement:

A. MnO_2 dissolves in conc. HCL, but does not form Mn^{4+} ions

B. MnO_2 oxidizes hot concentrated H_2SO_4 liberating oxygen

C. K_2MnO_4 is formed when MnO_2 in fused KOH is oxidised by air, KNO_3, PbO_2 or $NaBiO_3$

D. Decomposition of acidic $KMnO_4$ is not catalysed by sunlight

Answer: D

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44. The metals present in insulin and haemoglobin are respectively:

A. Zn, Hg

B. Zn, Fe

C. Co, Fe

D. Mg, Fe

Answer: B

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45. Metre scales are madeup of alloy:

A. invar

B. stainless steel

C. electron

D. magnalium

Answer: A

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46. A metal M which is not affected by strong acids like conc. HNO_3, *conc.* H_2SO_4 and conc. Solution of alkalies like $NaOH, KOH$ forms MCI_3 which finds use for toning in photography. The metal M is

A. Ag

B. Hg

C. Au

D. Cu

Answer: C

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47. $KMnO_4 + HC < oH_2O + X(g)$, X is a:
(Acidified)

A. red liquid

B. violet gas

C. greenish yellow gas

D. yellow-brown gas

Answer: C

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48. Amongst the following species, maximum covalent character is exhibited by:

A. $FeCl_2$

B. $ZnCl_2$

C. $HgCl_2$

D. $CdCl_2$

Answer: C

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49. Number of moles of $K_2Cr_2O_7$ can be reduced by 1 mole of Sn^{2+} ions is:

A. 3

B. 2

C. 1

D. $1/3$

Answer: A

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50. Pick out the incorrect statement:

A. MnO_4^{2-} is quite strongly oxidizing and stable only in very strong alkalies, In dilute alkali, neutral solutions, it disproportionates

B. In acidic solution, MnO_4^- is reduced to Mn^{2+} and thus, $KMnO_4$ is widely used as oxidising agent

C. $KMnO_4$ does not acts as oxidising agent in alkaline medium

D. $KmnO_4$ is manufactured by the fusion of pyrolusite ore with KOH in presence of air or

KNO_3, followed by electrolytic oxidation in alkaline solution

Answer: C

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51. The aqueous solution of $CuCrO_4$ is green because it contains:

A. green Cu^{2+} ions

B. green CrO_4^{2-} ions

C. blue Cu^{2+} ions and green CrO_4^{2-} ions

D. blue Cu^{2+} ions and yellow CrO_4^{2-} ions

Answer: D

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52. The aqueous solution of the following salts will be coloured in the case of :

A. $Zn(NO_3)_2$

B. $LiNO_3$

C. $Co(NO_3)_2$

D. $Mg(NO_3)_2$

Answer: C

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53. Rusting of iron in moist air involves-

A. Loss of electrons by iron

B. Gain of electrons by iron

C. Neither gain nor less of electrons

D. Hydration of iron

Answer: A

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54. Transition metals normally have unfilled $'d'$ orbitals which are degenerate. The colour of transition metal ions is due to absorption of light in visible region. Which of the following transition is responsible for providing the colour?

A. d-s transition

B. s-d transition

C. d-d transition

D. s-s transition

Answer: C

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55. Which one of the following transition metal ions is paramagnetic?

A. Au^+

B. Zn^{2+}

C. Cu^{2+}

D. Ag^+

Answer: C

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56. E^{Θ} value for the couple Cr^{3+}/Cr^{2+} and Mn^{3+}/Mn^{2+} are -0.41 and $+1.51$ volts respectively. Considering these value select the correct option from the following statements.

A. Cr^{2+} is a reducing and Mn^{3+} is an oxidising agent

B. Cr^{2+} is more stable than Cr^{3+}

C. Mn^{3+} is more stable than Mn^{2+}

D. Cr^{2+} acts as on oxidising whereas Mn^{3+} acts as a reducing agent

Answer: A

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57. When ammonium dichloromate is heated it decompose and a spark is produced. The accompanying reaction is called

A. phosphorescence

B. incandescence

C. chemical valcano

D. fluorescence

Answer: C

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58. A mixture of $K_2Cr_2O_7$ and conc. H_2SO_4 forms

A. perchromic acid

B. chromic sulphate

C. chromium oxide

D.

Answer: B

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59. When a photographic film is exposed and developed, the image is due to the formation of

A. Ag

B. Ag_2O

C. AgBr

D. $\left[Ag(S_2O_3)_2\right]^{3-}$

Answer: A

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60. When SO_2 is passed through acidified $K_2Cr_2O_7$ solution

A. the solution turns blue

B. the solution is decolourised

C. SO_2

D. chromium sulphate is formed

Answer: D

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61. Which compound is deliquescent-

A. Gg_2Cl_2

B. $HgCl_2$

C. $ZnCl_2$

D. $CdCl_2$

Answer: C

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62. Anelement which is highly toxic for plants and animals is-

A. Au

B. Mn

C. Hg

D. Ca

Answer: C

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Exercise 2 Paragraph Type

1. When hydrogen peroxide is added to an acidified solution of a dichromate gives a deep blue coloured compound $'A'$ in presence of organic solvent, which

decomposes rapidly in aqueous solution into $'B'$ and dioxygen. Compound $'A'$ can be extracted by dimethyl ether forming the adduct $'C'$.

The oxidation state of the metal ion in compound $'A'$ are

A. $3+$

B. $10+$

C. $6+$

D. $4+$

Answer: C

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2. When hydrogen peroxide is added to an acidified solution of a dichromate gives a deep blue coloured compound $'A'$ in presence of organic solvent, which decomposes rapidly in aqueous solution into $'B'$ and dioxygen. Compound $'A'$ can be extracted by dimethyl ether forming the adduct $'C'$.

The magnetic moment of compound $'B'$ is:

A. $2.8B.\ M$

B. $4.9B.\ M$

C. 0

D. $3.8B.\ M$

Answer: D

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3. (T) imparts violet colour $\xrightarrow{compd\,(U)\,+conc.\,H_2SO_4}(V)\text{Red gas}\xrightarrow{NaOH+AgNO_3}(W)$

Red $ppt.\xrightarrow{NH_3 soin.}(X)$

$(W)\text{Red ppt.}\xrightarrow{dil.\,HCl}(Y)$ white ppt.

$(U)\xrightarrow[\Delta]{NaOH}(Z)$ gas (gives white fumes with HCl)

The compound $'W'$ is

A. CrO_3

B. Ag_2CrO_4

C. HgI_2

D. $AgNO_2$

Answer: B

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4. (T) imparts violet colour

$\xrightarrow{compd\,(U)\,+conc.\,H_2SO_4}(V)\text{Red gas}\xrightarrow{NaOH+AgNO_3}(W)$

Red $ppt.\xrightarrow{NH_3soin.}(X)$

$(W)\text{Red ppt.}\xrightarrow{dil.\,HCl}(Y)$ white ppt.

$(U)\xrightarrow[\Delta]{NaOH}(Z)$ gas (gives white fumes with HCl)

The compound $'T'\&'U'$ are

A. $KMnO_4, HCL$

B. $K_2Cr_2O_7, HCL$

C. $K_2Cr_2O_7, NH_4Cl$

D. K_2CrO_4, KCL

Answer: C

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5. (T) imparts violet colour

$\xrightarrow{compd\,(U)\,+conc.\,H_2SO_4}(V)\text{Red gas}\xrightarrow{NaOH+AgNO_3}(W)$

Red $ppt.\xrightarrow{NH_3soin.}(X)$

$(W)\text{Red ppt.}\xrightarrow{dil.\,HCl}(Y)$ white ppt.

$(U)\xrightarrow[\Delta]{NaOH}(Z)$ gas (gives white fumes with HCl)

The compound $'V'$ is

A. CrO_3

B. Cl_2

C. Br_2

D. CrO_2Cl_2

Answer: D

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6. Statement-1: The highest oxidation state of chromium in its compound is +6.

Statement-2: Chromium atom has only six electrons in ns and $(n-1)d$ orbitals.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statement-II are True but Statement-II is not a correct explanation of the Statement-I

C. If statement-I is True but the Statement-II is False

D. If Statement-I is False but the but the Statement-II is True

Answer: A

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7. Assertion : CrO_3 reacts with HCl to form chromyl chloride gas

Reason : Chromyl chloride (CrO_2Cl_2) has tetrahedral shape.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statement-II are True but Statement-II is not a correct explanation of the Statement-I

C. If statement-I is True but the Statement-II is False

D. If Statement-I is False but the but the Statement-II is True

Answer: B

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8. Statement-1: Zinc does nt show characteristic properties of transition metals.

Statement-2: In zinc outermost shell is completely filled.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statement-II are True but Statement-II is not a correct explanation of the Statement-I

C. If statement-I is True but the Statement-II is False

D. If Statement-I is False but the but the Statement-II is True

Answer: C

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9. Statement-I: Tungsten has a very high melting point.

Statement-II: $Ag_2S_2O_3$ is soluble in excess of Hypo solution.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statement-II are True but Statement-II is not a correct explanation of the Statement-I

C. If statement-I is True but the Statement-II is False

D. If Statement-I is False but the but the Statement-II is True

Answer: C

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10. Statement_I: Na_2O_3 is used in Photography.

Statement_II: $Ag_2S_2O_3$ is soluble in excess of Hypo solution.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statement-II are True but Statement-II is not a correct explanation of the Statement-I

C. If statement-I is True but the Statement-II is False

D. If Statement-I is False but the but the Statement-II is True

Answer: B

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11. An element of 3d-transition series shows two oxidation states x and y, differing by two units. Then:

A. compounds in oxidation state X are ionic if

$X < y$

B. compound in oxidation state x are ionic if

$x > y$

C. compounds in oxidation state y are covalent if

$x < y$

D. compounds in oxidation state y are covalent if

$$y > x$$

Answer: B::C

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12. To an acidified dichromate solution, a pinch of Na_2O_2 is added and shaken. What is observed ?

A. blue colour

B. Orange colour changing to green

C. Copious evolution of oxygen

D. Bluish-green precipitate

Answer: A::C

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13. Amongst CuF_2, $CuCl_2$ and $CuBr_2$

A. only CuF_2 is ionic

B. both $CuCl_2$ and $CuBr_2$ are covalent

C. CuF_2 and $CuCl_2$ are ionic but $CuBr_2$ is covalent

D. both (A) and (B)

Answer: D

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14. $CuSO_4(aq) + 4NH_3 \rightarrow X$, then X is

A. $\left[Cu(NH_3)_4\right]^{2+}$

B. paramagnetic

C. coloured

D. of a magnetic moment of $1.73BM$

Answer: A::B::C::D

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15. Which of the following statements concern with d-block metals?

A. compounds containing ions of transition elements are usually coloured

B. the most common oxidation state is $+3$

C. `they show variable oxidation states, which differ by two units only

D. they easily form complexes

Answer: A::B::D

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16. Correct statement(s) is/are:

A. an acidified solution of $K_2Cr_2O_7$ liberates iodine from KI

B. $K_2Cr_2O_7$ is used as a standard solution for estimation of Fe^{2+} ions

C. in acidic medium, $M = N/6$ for $K_2Cr_2O_7$

D. $(NH_4)_2Cr_2O_7$ on heating decomposes to yield Cr_2O_3 through an exothermic reaction

Answer: A::B::C

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17. In the equation:

$$M + 8CN^- + 2H_2O + O_2 \rightarrow 4\left[M(CN)_2\right]^- + 4OH^-$$

metal M is:

A. Ag

B. Au

C. Cu^(+)`

D. Hg

Answer: A::B

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18. Match the column-

A. $Column - I$ $Column - II$
Highest density $(P)Os$

B. $Column - I$ $Column - II$
Colourless salts $(Q)Os$

C. $Column - I$ $Column - II$
Maximum magnetic moment $(R)Cr$

D. $Column - I$ $Column - II$
Variable oxidation state $(S)Mn$

Answer: A::B::C::D

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Exercise 3 Miscellaneous Exercise

1. In laboratory $K_2Cr_2O_7$ is used mainly not $Na_2Cr_2O_7$. Why?

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2. How to standardise $Na_2S_2O_3$ solution in iodometry?

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3. What is the oxidation state of Fe and NO in nitroprusside ion. How can it be determined?

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4. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, th equivalent weight of K_2Cr_2O is

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5. Explain the difference between rust formation and passivity of a metal.

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6. Write the balanced chemical equations for the following reactions

(i) A mixture of potassium dichromate and sodium chloride is heated with concentrated H_2SO_4

(ii) Potassium permanganate is added to a hot solution of manganese sulphate.

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7. Write the balanced chemical equation for the reaction of aqueous NH_3 with $KMnO_4$.

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8. (a) Sulphur dioxide gas turns a dichromate solution green. Write the reaction.

(b) Also write the reaction when nickel salts in basic medium react with dimethyl glyoxime.

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9. Although the chemical formulae of Prussian blue and Turnbull's blue are different yet these are supposed to be identical. How is it justified?

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10. Calculate the oxidation numbers of Cr in K_3CrO_8:

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Exercise 4 Section A

1. Among these, identify the species with an atom in $+6$ oxidation state: .

A. MnO_4^-

B. $Cr(CN)_6^{3-}$

C. NiF_6^{2-}

D. CrO_2Cl_2

Answer: D

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2. The complex ion which has no d electrons in the central atom is

$(at.\ Cr = 24, Mn = 25, Fe = 26, Co = 27)$

A. $[MnO_4]^-$

B. $\left[Co(NH_3)_6\right]^{3+}$

C. $\left[Fe(CN)_6\right]^{3-}$

D. $\left[Cr(H_2O)_6\right]^{3+}$

Answer: A

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3. Anhydrous ferric chloride is prepared by:

A. heating hydrated ferric chloride at a high temperature in a stream of air

B. heating metallic iron in a stream of dry chlorine gas

C. reaction of ferric oxide with HCL

D. reaction of metallic iron with HCL

Answer: B

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

A. K_2MnO_4, purple colour

B. $KMnO_4$, purple

C. Mn_2O_3, brown

D. Mn_3O_4, black

Answer: A

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5. The pair of the compounds in which both the metals are in the highest possible oxidation state is

A. $[Fe(N)_6]^{3-}$, $[Co(CN)_6]^{3-}$

B. CrO_2Cl_2, MnO_4^-

C. TiO_3, MnO_2

D. $[Co(CN)_6]^{3-}$, MnO_2

Answer: B

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6. The product of oxidation of I^- with MnO_4^- in alkaline medium is:

A. IO_3^-

B. I_2

C. IO^-

D. IO_4^-

Answer: A

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7. Which of the following statement are correct about Cr^{2+} (Z = 24) and Mn^{3+} (Z = 25) ?

(i) Cr^{2+} is a reducing agent

(ii) Mn^{3+} is an oxidizing agent

(iii) Both Cr^{2+} and Mn^{3+} exhibit d^4 configuration

(iv) When Cr^{2+} is used as a reducing agent, the chromium ion attains d^5 electronic configuration

A. Cr^{2+} is a reducing agent

B. Mn^{3+} is an oxidizing agent

C. Both Cr^{2+} and Mn^{3+} exhibit d^4 electronic configuration

D. When Cr^{2+} is used as a reducing agent, the chromium ion attains d^5 electronic configuration

Answer: A::B::C

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Exercise 4 Section B

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

A. In the gighest oxidation states, the transition metal show basic character and form cationic complexes

B. In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding

C. Once the d^5 configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases

D. In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes

Answer: A

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2. Knowing that the chemistry of lanthanoids (Ln) is dominated by its $+3$ oxidation state, which of the following statement is incorrect?

A. The ionic sizes of Ln (III) decreases in general with increasing atomic number

B. Ln (III) compounds are generally colourless

C. Ln (III) hydroxides are mainly basic in character

D. Because of the large size of the Ln(III) ions the bonding in its compounds is predominently ionic in character

Answer: B

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3. In context of the lanthanoids, which of the following statements is not correct?

A. There is gradual decrease in the radii of the members with increasing atomic number in the series

B. All the members exhibit +3 oxidation state

C. Because of similar properties the separation of lanthanoids in not easy

D. Availability of 4f electrons results in the formation of compounds in +4 state for all members of the series

Answer: D

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4. Iron exhibits $+2$ and $+3$ oxidation states. Which of the following statements about iron is incorrect?

A. Ferrous compounds are less volatile than the corresponding ferric compounds

B. Ferrous compounds are more easily hydrolysed than the corresponding ferric compounds

C. Ferrous oxide is more basic in nature than the ferric oxide

D. Ferrous compounds are relatively more inonic than the corresponding ferric compounds

Answer: B

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5. Four successive members of first row transition element are listed belw. Which one of them is

expected to have highest $E_{\frac{M^{3+}}{\left(M^{2+}\right)^{\ominus}}}$ value?

A. $Mn(Z=25)$

B. $Fe(Z=26)$

C. $Co(Z=27)$

D. $Cr(Z=24)$

Answer: C

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6. Which one of the following arrangements does not represent the correct order of the property stated against it?

A. $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

B. $Co^{3+} < Fe^{3+} < Sc^{3+}$: stability in aqueous solution

C. $Sc < Ti < Cr < Mn$: number of oxidation states

D. $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour

Answer: B::D

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7. The color of $KMnO_4$ is due to :

A. $L \rightarrow M$ charge transfer transition

B. $\sigma - \sigma^*$ transition

C. $M \rightarrow L$ charge transfer transition

D. $d - d$ transition

Answer: A

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