



CHEMISTRY

BOOKS - MTG CHEMISTRY (ENGLISH)

THE D- AND F- BLOCK ELEMENTS

Mcqs

1. General electronic configuration of transition metals is

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

B. $nd^{10}ns^2$

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

D. $(n - 1)d^{1-5}ns^2$

Answer: A



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2. Which one of the following is a 'd-block element' ?

A. Gd

B. Hs

C. Es

D. Cs

Answer: B

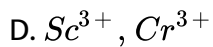
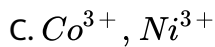
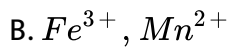


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3. Which of the following pairs of ions have the same electronic configuration
A) Cr^{+3}, Fe^{+3} B) Fe^{+3}, Mn^{+2} C) Fe^{+3}, Co^{+3} D)

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

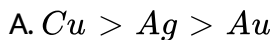
A. Cu^{2+}, Cr^{2+}



Answer: B

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4. The melting points of Cu, Ag and Au follow the order



Answer: B

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5. The melting point of copper is higher than that of zinc because

- A. the s, p as well as d- electrons of copper are involved in metallic bonding.
- B. the atomic volume of copper is higher
- C. the d - electrons of copper are involved in metallic bonding
- D. the s as well as d- electrons of copper are involved in metallic bonding.

Answer: C

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6. Due to lanthanoid contraction which of the following properties is not expected to be similar in the same vertical columns of second and third row transition elements ?

- A. Atomic radii

B. Ionisation energies

C. Magnetic moments

D. Lattice energies

Answer: C

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7. Zr($Z=40$) and Hf($Z=72$) have similar atomic and ionic radii because of:

A. diagonal relationship

B. lanthanoid contraction

C. actinoid contraction

D. belonging to the same group.

Answer: B

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8. The second and third row elements of transition metals resemble each other much more than they resemble the first row because of

- A. lanthanoid contraction which results in almost same radii of second and third row metals
- B. diagonal relationship between second and third row elements
- C. similar ionisation enthalpy of second and third row elements
- D. similar oxidation states of second and third row metals.

Answer: A



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9. Reactivity of transition elements decreases almost regularly from Sc to Cu because of

- A. lanthanoid contraction
- B. regular increase in ionisation enthalpy

C. regular decrease in ionisation enthalpy

D. increase in number of oxidation states.

Answer: B



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10. Which of the following is not correctly matched with the given example ?

A. An element of first transition series which has highest second ionisation enthalpy - Cu.

B. An element of first transition series with lowest third ionisation enthalpy - Zn.

C. An element of first transition series with lowest enthalpy of atomisation - Zn.

D. An element of first transition series with lowest enthalpy - Zn.

Answer: D



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11. Cu^+ ion is not stable in aqueous solution because because of disproportionation reaction. E° value of disproportionation of Cu^+ is

$$\left[E_{Cu^{2+}/Cu^+}^\circ = +0.15V, E_{Cu^{2+}/Cu}^\circ = 0.34V \right]$$

- A. second ionisation enthalpy of copper is less than the first ionisation enthalpy
- B. large value of second ionisation enthalpy of copper is compensated by much more negative hydration energy of $Cu_{(aq)}^{2+}$
- C. hydration energy of $Cu_{(aq)}^{2+}$ is much more negative than that of $Cu_{(aq)}^{2+}$
- D. many copper (I) compounds are unstable in aqueous solution and undergo disproportionation reaction.

Answer: B

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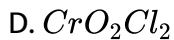
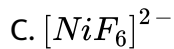
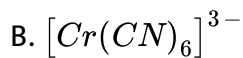
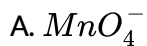
12. The first ionisation energies of the elements of the first transition series ($Ti \rightarrow Cu$)

- A. increases as the atomic number increases
- B. decreases as the atomic number invreases
- C. do not show any change as the addition of electrons takes place in the inner (n- 1) d orbitals
- D. increases from Ti to Mn and then decreases from Mn to Cu.

Answer: A

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13. Identify the species in which the metal atom is in +6 oxidation state.



Answer: D



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14. 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. Dimanganese decacarbonyl

D. Manganese chloride

Answer: B

15. $E_{Mn^{3+}/Mn^{2+}}^{\circ}$ is highly positive than that of $E_{Cr^{3+}/Cr^{2+}}^{\circ}$ or $E_{Fe^{3+}/Fe^{2+}}^{\circ}$ because

- A. $Mn^{2+} (d^5)$ can be easily oxidised to $Mn^{3+} (d^4)$ due to low ionisation enthalpy
- B. third ionisation enthalpy of Mn is much larger due to stable half filled d^5 electronic configuration of Mn^{2+}
- C. Mn^{3+} is more stable than Mn^{2+} due to higher oxidation state
- D. second ionisation enthalpy of Mn is higher than third ionisation enthalpy.

Answer: B

16. The correct order of $E_{M^{2+}/M}^{\circ}$ Values with negative sign for the four successive elements *Cr*, *Mn*, *Fe* and *Co* is:

A. Fe gt Mn gt Cr gt Co

B. Cr gt Mn Fe gt Co

C. Mn gt Cr gt Fe gt Co

D. Cr gt Fe gt Mn gt Co

Answer: C

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17. Which of the following d-block element has half - filled penultimate as well as valence subshell ?

A. Cu

B. Au

C. Ag

D. Cr

Answer: D

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18. Fe^{3+} compounds are more stable than Fe^{2+} compounds because

- A. Fe^{3+} has smaller size than Fe^{2+}
- B. Fe^{3+} has $3d^5$ configuration (half-filled)
- C. Fe^{3+} has higher oxidation state
- D. Fe^{3+} is paramagnetic in nature.

Answer: B

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19. The salts of Cu in +1 oxidation state are unstable because

- A. Cu^+ had $3d^{10}$ configuration
- B. Cu^+ disproportionates easily to Cu (0) and Cu^{2+}
- C. Cu^+ dispropotionates easily to Cu^{2+} and Cu^{3+}
- D. Cu^+ is easily reduced to Cu^{2+}

Answer: B

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20. In which of the following pairs of ions, the higher oxidation state in aqueous solution is more stable than the other?

- I. Tl^+ , Tl^{3+} II. Cu^+ , Cu^{2+}
- III. Cr^{2+} , Cr^{3+} IV. V^{2+} , V^{4+}

- A. I, II
- B. II, III
- C. II, IV
- D. II, III, IV

Answer: D

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21. $CuSO_4$ is paramagnetic while $ZnSO_4$ is diamagnetic because

- A. Cu^{2+} ion has $3d^9$ configuration while Zn^{2+} ion has $3d^{10}$ configuration
- B. Cu^{2+} ion has $3d^5$ configuration while Zn^{2+} ion has $3d^6$ configuration
- C. Cu^{2+} has half filled orbitals while Zn^{2+} has fully filled orbitals
- D. $CuSO_4$ is blue in colour while $ZnSO_4$ is white.

Answer: A

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22. Which of the following transition metal ions has highest magnetic moment ?



Answer: D



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23. Select the correct option, among Sc(III) , Ti(IV), Pd(II) and Cu(II) ions

A. all are paramagnetic

B. all are diamagnetic

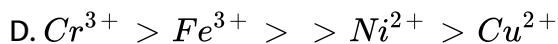
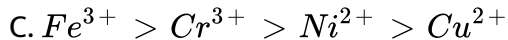
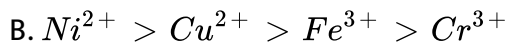
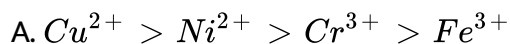
C. Sc(III), Ti(IV) are paramagnetic and Pd(III), Cu(II) are diamagnetic

D. Sc(III), Ti(IV) are diamagnetic and Pd(II), Cu(II) are paramagnetic.

Answer: D

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24. The correct order of the number of unpaired electrons in the ions Cu^{2+} , Ni^{2+} , Fe^{3+} , and Cr^{3+} is



Answer: C

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25. Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

A. 5.9 B.M

B. 2.9 B.M

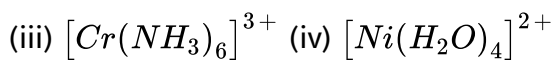
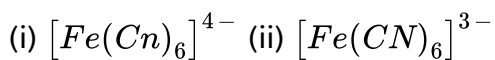
C. 6.9 B.M

D. 9.9 B.M

Answer: A

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26. Arrange the following in increasing value of magnetic moments.



A. $i < ii < iii < iv$

B. $i < ii < iv < iii$

C. $ii < iii < i < iv$

D. $iii < i < ii < iv$

Answer: B

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27. Which of the following statements is not correct about magnetic behaviour of substances ?

A. Diamagnetic substances are repelled by an applied magnetic field.

B. Paramagnetic substances are attracted by an applied magnetic field.

C. Magnetic moment of n unpaired electrons is given by

$$\mu = \sqrt{n(n - 2)} \text{ B.M.}$$

D. Magnetic moment increases as the number of unpaired electrons increases.

Answer: C

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28. The number of unpaired electrons in gaseous species of Mn^{3+} , Cr^{3+} and V^{3+} respectively are.....and most stable species is.....

- A. 4,3 and 2, V^{3+}
- B. 3,3 and 2, Cr^{3+}
- C. 4,3 and 2, Cr^{3+}
- D. 3,3 and 3, Mn^{3+}

Answer: C



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29. Which of the following arrangements represent the correct order of the property stated against it ?

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

A. 1. $\text{Sc} < \text{Ti} < \text{Cr} < \text{Mn}$: number of oxidation states

B. 2. $\text{V}^{2+} < \text{Cr}^{2+} < \text{Mn}^{2+} < \text{Fe}^{2+}$: paramagnetic behaviour

C. 3. $\text{Ni}^{2+} < \text{Co}^{2+} < \text{Fe}^{2+} < \text{Mn}^{2+}$: ionic size

D. 4. $\text{Co}^{3+} < \text{Fe}^{3+} < \text{Cr}^{3+} < \text{Sc}^{3+}$: stability in aqueous solution.

Answer: B

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30. Which of the following transition metal ions is colourless ?

A. V^{2+}

B. Cr^{3+}

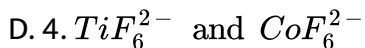
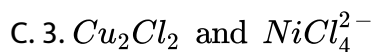
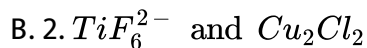
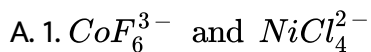
C. Zn^{2+}

D. Ti^{3+}

Answer: C

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31. Amongst TiF_6^{2-} , CoF_6^{3-} , Cu_2Cl_2 and $NiCl_4^{2-}$, which are the colourless species ? (atomic number of Ti = 22 , Co = 27, Cu = 29, Ni = 28)

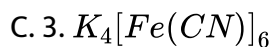
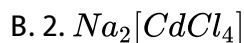
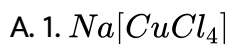


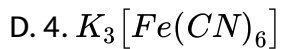
Answer: B



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32. Which of the following compounds is not coloured ?

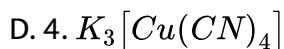
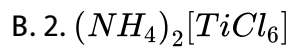
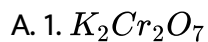




Answer: B

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33. Compound that is both paramagnetic and coloured is:



Answer: C

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34. Most of the transition metals exhibit

- (i) paramagnetic behaviour
- (ii) diamagnetic behaviour
- (iii) variable oxidation states
- (iv) formation of coloured ions

A. (ii), (iii) and (iv)

B. (i) , (iii) and (iv)

C. (i), (ii) and (iii)

D. (i), (ii) and (iv)

Answer: B



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35. For Zn^{2+} , Ni^{2+} , Cu^{2+} and Cr^{2+} which of the following statements is correct ?

- A. 1. Only Zn^{2+} is colourless and Ni^{2+} and Cr^{2+} are coloured.
- B. 2. All the ions are coloured.
- C. 3. All the ions are colourless.
- D. 4. Zn^{2+} and Cu^{2+} are colourless while Ni^{2+} and Cr^{2+} are coloured

Answer: A



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36. Colour of transition metal ions are due to absorption of some wavelength. This results in

- A. 1. d-s transition
- B. 2. s-s transition
- C. 3. s-d transition
- D. 4. d-d transition

Answer: D

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37. Which group contains coloured ions out of the following ?

1. Cu^+ 2. Ti^{4+} 3. Co^{2+} 4. Fe^{2+}

A. a. 1,2,3,4

B. b. 3,4

C. c. 2,3

D. d. 1,2

Answer: B

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38. Transition metals make the most efficient catalysts because of their ability to

- A. adopt multiple oxidation states and to form complexes
- B. form coloured ions
- C. show paramagnetism due to unpaired electrons
- D. form a large number of oxides.

Answer: A

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39. Interstitial compounds are

- A. non-stoichiometric and are ionic in nature
- B. non-stoichiometric and are covalent in nature
- C. non-stoichiometric and are neither typically ionic nor covalent in nature
- D. stoichiometric and are neither ionic nor covalent in nature.

Answer: C



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40. Transition elements form binary compounds with halogens. Which of the following elements will form MF_3 type compounds?

A. 1. Cr

B. 2. Cu

C. 3. Ni

D. 4. All of these.

Answer: A

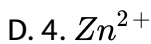
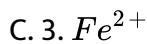


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41. Which of the following is not an amphoteric ion?

A. 1. Al^{3+}

B. 2. Cr^{3+}



Answer: C

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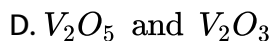
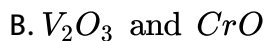
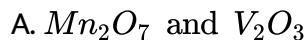
42. The basic character for the transition metal monoxides follows the order (Atomic no's. Ti = 22, V = 23, Cr = 24, Fe = 26)



Answer: D

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43. Which of the following oxides are basic ?

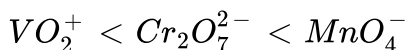


Answer: B



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44. Following order is observed in oxidising power of certain ions :



The reason for this increasing order of oxidising power is

A. increasing stability of the lower species to which they are reduced

B. increasing stability of the higher species to which they are oxidised

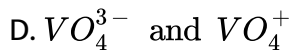
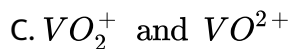
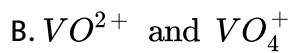
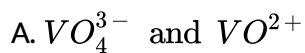
C. increasing stability of the higher species to which they are reduced

D. increasing stability of the lower species to which they are oxidised.

Answer: A

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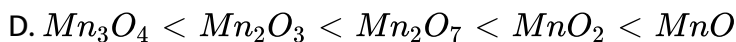
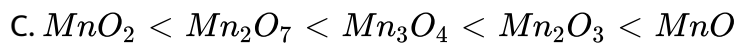
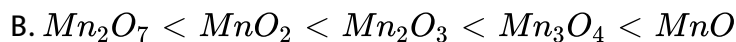
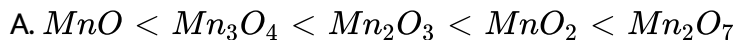
45. V_2O_5 reacts with alkalies as well as acids to give



Answer: D

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46. Arrange the oxides of manganese according to increasing acidic strength.



Answer: A



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47. Potassium dichromate is prepared from

A. chromate obtained by the fusion of chromite ore with sodium carbonate in free access of air

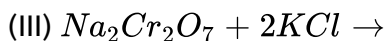
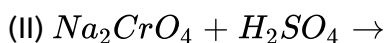
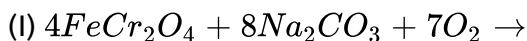
B. pyrolusite which is fused with potassium hydroxide in the presence of air

- C. iron pyrites by the fusion with potassium carbonate in presence of moisture
- D. none of these

Answer: A

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48. Which of the following reactions do not result in the preparation of potassium dichromate?



- A. I and II
- B. II and III
- C. I and III
- D. I, II, and III

Answer: A



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49. Which of the following compounds is used as the starting material for the preparation of potassium dichromate?

A. $K_2SO_4Cr_2(SO_4)_3 \cdot 24H_2O$ (Chrome alum)

B. $PbCrO_4$ (Chromite yellow)

C. $FeCr_2O_4$ (Chromite)

D. $PbCrO_4 \cdot PbO$ (Chrome red)

Answer: C



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50. Yellow coloured aqueous solution of sodium chromate changes to orange when acidified with sulphuric acid because

A. H^+ ions convert chromate ions to dichromate ions

B. H^+ ions react with sodium chromate to give sodium ions which turn solution orange

C. Cr^{3+} ions are liberated in the solution which turn the solution orange

D. sodium hydroxide is formed during the reaction which imparts orange colour to the solution.

Answer: A



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51. What happens when potassium iodide reacts with acidic solution of potassium dichromate ?

A. It liberated iodine.

B. Potassium sulphate is formed.

C. Chromium sulphate is formed.

D. All the above products are formed.

Answer: D

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52. Acidified potassium dichromate reacts with potassium iodide and oxidises it to I_2 . What is the oxidation state of chromium in the products of the reaction?

A. +4

B. +6

C. +3

D. +2

Answer: C

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53. One mole of acidified $K_2Cr_2O_7$ on reaction with excess of KCl will liberate....., moles of I_2 .

A. 3

B. 1

C. 7

D. 2

Answer: A



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

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

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

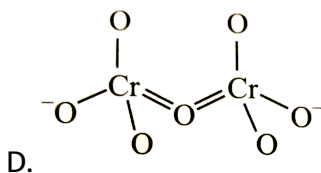
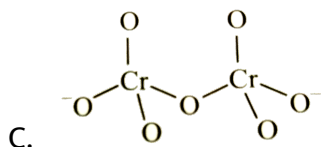
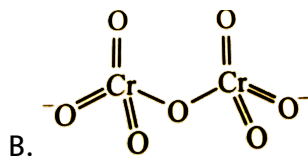
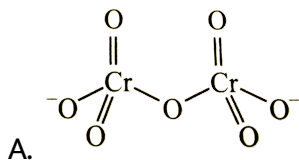
C. CrO_4^{2-} is reduced to +3 state of Cr

D. CrO_4^{2-} is oxidised to +7 state of Cr.

Answer: B

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55. Identify the correct structure of dichromate ion.



Answer: A



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56. In the dichromate anion ($Cr_2O_7^{2-}$)

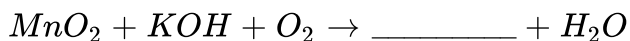
- A. all Cr - O bonds are equivalent
- B. 6 Cr - O bonds are equivalent
- C. 3 Cr - O bonds are equivalent
- D. no bonds in $Cr_2O_7^{2-}$ are equivalent.

Answer: B



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57. When MnO_2 is fused with KOH and O_2 , what is the product formed and its colour?



A. MnO - colourless

B. K_2MnO_4 - purple

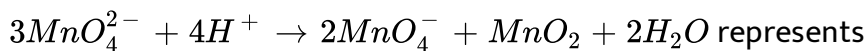
C. K_2MnO_4 -dark green

D. MnO_3 -black

Answer: C

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58. The equation



A. reduction

B. disproportionation

C. oxidation in acidic medium

D. reduction in acidic medium.

Answer: B

59. Explain why does colour of $KMnO_4$ disappear when oxalic acid is added to its solution in acidic medium?

A. the pH of the solution changes on adding oxalic acid, hence

$KMnO_4$ is decolourised

B. $KMnO_4$ oxidises oxalic acid to CO_2 and itself changes to Mn^{2+}

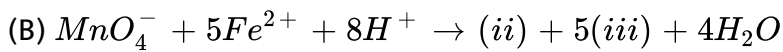
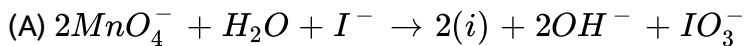
ions which are colourless

C. $KMnO_2$ is oxidised to potassium sulphate which is colourless

D. on exposure to air the acidic solution of $KMnO_4$ becomes colourless.

Answer: B

60. Complete the given reactions.



- A. (i) MnO_2 (ii) Mn^{2+} (iii) Fe^{3+}
- B. (i) Mn^{2+} (ii) MnO_2 (iii) Fe^{3+}
- C. (i) MnO_2 (ii) MnO_4^{2-} (iii) $Fe(OH)_3$
- D. (i) MnO_4^{2-} (ii) Mn^{2+} (iii) Fe_2O_3

Answer: A



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61. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate in acidic solution is:

A. 3/5

B. 2/5

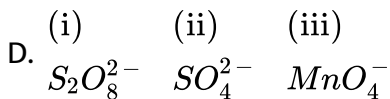
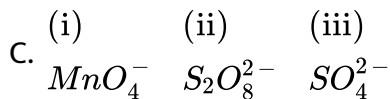
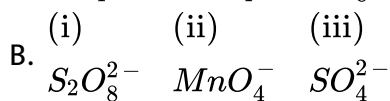
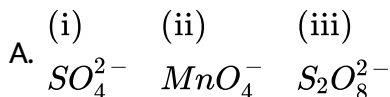
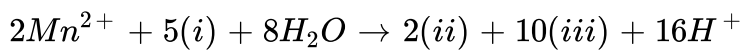
C. 4/5

D. 1

Answer: A

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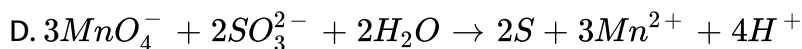
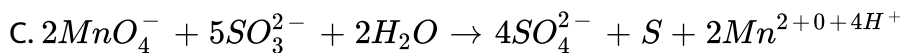
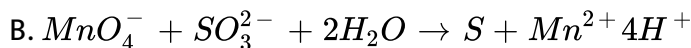
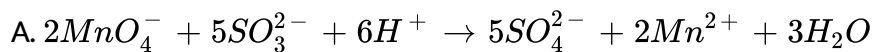
62. Complete the given reaction.



Answer: B

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63. Which of the following is correct representation of reaction of acidified permanganate solution with sulphurous acid ?

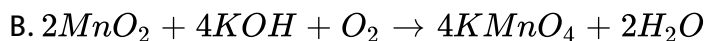
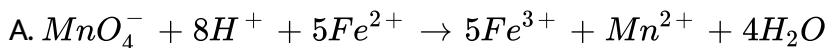


Answer: A

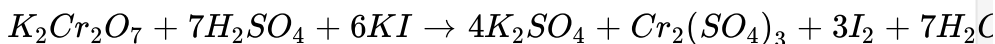


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64. Which of the following reactions is not correct ?



D.



Answer: B

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65. A solution of $KMnO_4$ is reduced to various products depending upon its pH. At pH 7 it is reduced to a colourless solution (A), at pH = 7 it forms a brown precipitate (B) and at pH > 7 it gives a green solution (C), (A), (B) and (C) are

- (A) (B) (C)
- A. Mn^{2+} MnO_2 MnO_4^{2-}
- (A) (B) (C)
- B. MnO_2 Mn^{2+} MnO_4^{2-}
- (A) (B) (C)
- C. Mn^{2+} MnO_4^{2-} MnO_2
- (A) (B) (C)
- D. MnO_4^{2-} Mn^{2+} MnO_2

Answer: A

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66. In acidic medium, $KMnO_4$ oxidises $FeSO_4$ solution. Which of the following statements is correct?

A. 10 mL of 1 N $KMnO_4$ solution oxidises 10 mL of 5 N $FeSO_4$ solution.

B. 10 mL of 1 M $KMnO_4$ solution oxidises 10 mL of 5 M $FeSO_4$ solution.

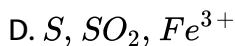
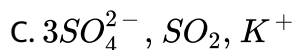
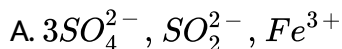
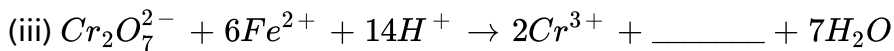
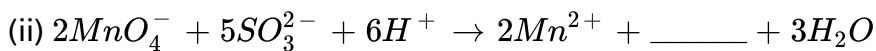
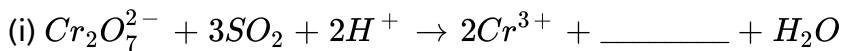
C. 10 mL of 1 M $KMnO_4$ solution oxidises 10 mL of 1 M $FeSO_4$ solution.

D. 10 mL of 1 N $KMnO_4$ solution oxidises 10 mL of 0.1 M $FeSO_4$ solution.

Answer: B

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67. Complete the following reactions.

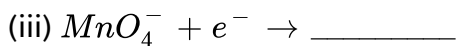
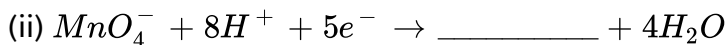
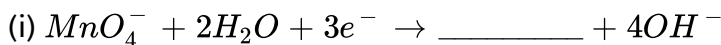


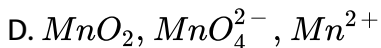
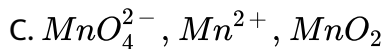
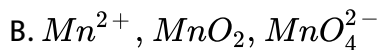
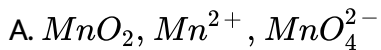
Answer: B



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68. Complete the following reactions.

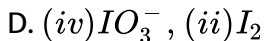
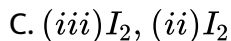
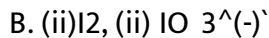
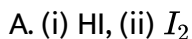
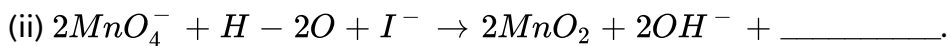
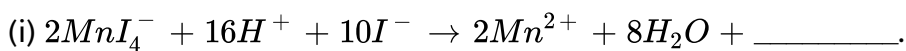




Answer: A

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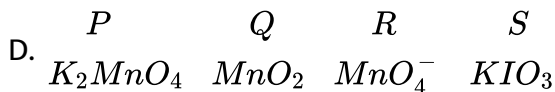
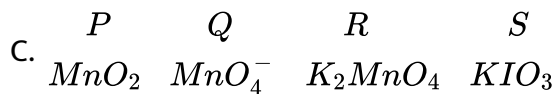
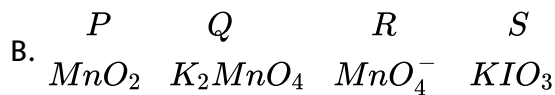
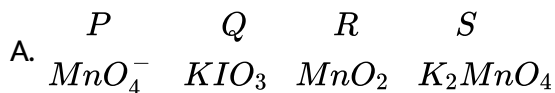
69. Fill the missing products in the following reactions.



Answer: B

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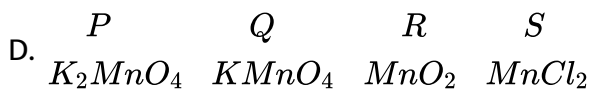
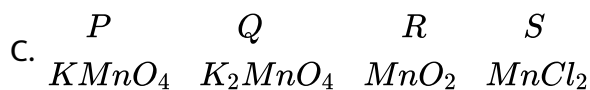
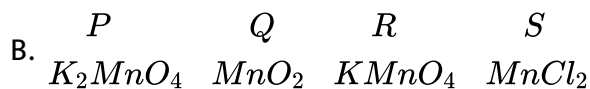
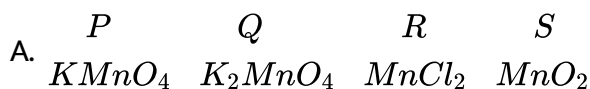
70. When an oxide of manganese (P) is fused with KOH in the presence of an oxidising agent and dissolved in water, it gives a dark green solution of compound (Q). Compound (Q) disproportionates in neutral or acidic solution to give purple compound (R) oxidises potassium iodide solution to a compound (S) and compound (P) is also formed. Compounds P to S are



Answer: B

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71. A violet compound of manganese (P) decomposes on heating to liberate oxygen and compounds (Q) and (R) of manganese are formed. Compound (R) reacts with KOH in the presence of potassium nitrate to give compound (Q). On heating compound (R) with conc. H_2SO_4 and NaCl, Chlorine gas is liberated and a compound (S) of manganese along with other products is formed. Compound P to S are



Answer: C



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72. The most common lanthanoid is :

A. lanthanum

B. cerium

C. samarium

D. plutonium

Answer: B

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73. Which is the non-lanthanide element ?

A. La

B. Lu

C. Pr

D. Pm

Answer: A

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74. The correct configuration of f-block elements is

- A. $(n - 2)f^{1-14}(n - 1)d^{0-1}ns^2$
- B. $(n - 1)f^{1-14}(n - 1)d^{0-1}ns^2$
- C. $(n - 3)f^{1-14}(n - 2)d^{0-1}(n - 1)s^2$
- D. $(n - 2)f^{0-1}(n - 1)d^{0-1}ns^2$

Answer: A



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75. Lanthanoid contraction is due to increase in

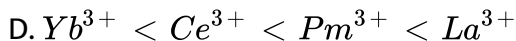
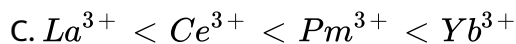
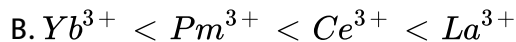
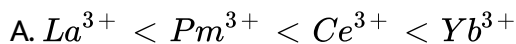
- A. atomic number
- B. effective nuclear charge
- C. atomic radius

D. valence electrons.

Answer: B

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76. The correct order of ionic radii of Ce, La, Pm and Yb in +3 oxidation state is



Answer: B

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77. Which of the following statements is correct about stability of the complexes of lanthanoids?

- A. Stability of complexes increases as the size of lanthanoid decreases.
- B. Stability of complexes decreases as the size of lanthanoid decreases.
- C. Lanthanoids do not form complexes.
- D. All the complexes of lanthanoids have same stability.

Answer: A



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78. The trend of basicity of lanthanoid hydroxides

- A. increases across the lanthanoid series
- B. decreases across the lanthanoid series
- C. first increases and then decreases

D. first decreases and then increases.

Answer: B



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79. The common oxidation state shown by Europium in their compounds is

A. +1

B. +3

C. +5

D. +6

Answer: B



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

- A. The common oxidation states of cerium are +3 and +4.
- B. The +3 oxidation state of cerium is more stable than +4 oxidation state.
- C. The +4 oxidation state of cerium is not known in solutions.
- D. Cerium (IV) acts as an oxidising agent.

Answer: C



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81. Which of the following statements concerning lanthanide elements is false ?

- A. All lanthanides are highly dense metals.
- B. More characteristic oxidation state of lanthanide elements is +3.

C. Lanthanides are separated from one another by ion exchange method.

D. Ionic radii of trivalent lanthanides steadily increases with increases in the atomic number.

Answer: D

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82. Consider the following statements:

- (I) $\text{La}(\text{OH})_3$ is the least basic among the hydroxides of lanthanoids.
- (II) Zr^{4+} and Hf^{4+} possess almost same ionic radii.
- (III) Cr^{4+} can act as an oxidising agent .

which of the above statement is/ are true?

A. I and III

B. II and III

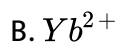
C. II only

D. I and II

Answer: B

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83. Which of the following lanthanide ion is paramagnetic ?



Answer: D

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84. Magnetic moment of Ce^{3+} ion on the basis of 'spin-only' formula will be _____ B.M.

A. 1.232

B. 1.332

C. 1.532

D. 1.732

Answer: D



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85. All Cu(II) halides are known except the iodide. The reason for it is that

A. iodide is a bulky ion

B. Cu^{2+} oxidizes iodide to iodine

C. $Cu_{(aq)}^{2+}$ has much negative hydration enthalpy

D. Cu^{2+} ion has smaller size.

Answer: B



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86. Consider the following statement in respect of Lanthanoids :

- (i) The basic strength of hydroxides of lanthanoids increases from $La(OH)_3$ to $Lu(OH)_3$.
- (ii) The lanthanoid ions Lu^{3+} , Yb^{2+} and Ce^{4+} are diamagnetic.

Which of the statements (s) given above is /are correct ?

A. 1 only

B. 2 only

C. Both 1 and 2

D. neither 1 nor 2

Answer: B



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87. Composition of mischmetal is

- A. 5% of a lanthanoid metal, 95% of iron and traces of S, C, Ca and Al
- B. 95% of an actinoid metal, 5% of iron and traces of S, C, Ca and Al
- C. 95% of a lanthanoid metal, 5% of iron and traces of S, C, Ca and Al
- D. 95% of a transition metal, 5% of iron and traces of S, C, Ca and Al

Answer: C



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88. Which of the following lanthanide is commonly used?

- A. Lanthanum
- B. Nobelium
- C. Thorium
- D. Cerium

Answer: D



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89. What is the total number of inner transition elements in the periodic table?

A. 10

B. 14

C. 30

D. 28

Answer: D



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90. Actinoids in general show more oxidation states than the lanthanoids.

The main reason for this is

- A. higher energy difference between 5f and 6d orbitals than between 4f and 5d orbitals
- B. lower energy difference between 5f and 6d orbitals than between 4f and 5d orbitals
- C. higher reactivity of actinoids than lanthanoids
- D. actinoids are more basic than lanthanoids.

Answer: B

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91. Identify the incorrect statement among the following.

- A. 4f and 5f orbitals are equally shielded.
- B. d-Block elements show irregular and erratic chemical properties among themselves.

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

D. The chemistry of various lanthanoids is very similar.

Answer: A

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92. The actinides showing +7 oxidation state are:

A. U, Np

B. Pu, Am

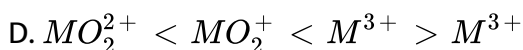
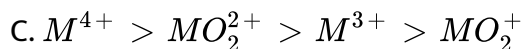
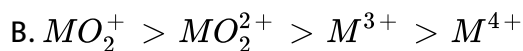
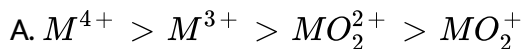
C. Np, Pu

D. Am, Cm

Answer: C

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93. If M is the element of actinoid series, the degree of complex formation decrease in the order



Answer: C



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94. Lanthanides and actinides resemble in

A. electronic configuration

B. oxidation state

C. ionization energy

D. formation of complexes

Answer: A

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95. Which of the following catalysts is not correctly matched with the reaction ?

A. Vanadium (V) oxide in contact process for oxidation of SO_2 to SO_3 .

B. Finely divided iron in Haber's process in conversion of N_2 and H_2 to NH_3 .

C. $PtCl_2$ catalyses the oxidation of ethyne to ethanal in the Wacker process.

D. Ni in presence of hydrogen for conversion of vegetable oil to ghee.

Answer: C

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1. Mercury is a liquid metal because

- A. it has a completely filled d-orbital that prevents d-d overlapping of orbitals
- B. it has a completely filled d-orbital that causes d-d overlapping
- C. it has a completely filled s-orbital
- D. it has a small atomic size.

Answer: A



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2. Which one of the following transition element has the lowest value of enthalpy of atomization?

- A. Cr

B. Cu

C. Zn

D. Mn

Answer: C



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

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

B. In the highest oxidation state, the transition metals show basic character and form cationic complexes.

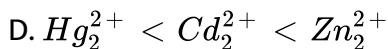
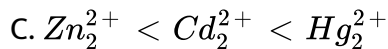
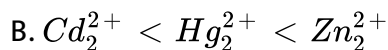
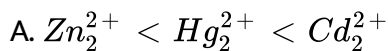
C. In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding.

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

Answer: B

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4. Which of the following has been arranged in order of increasing bond strength ?



Answer: C

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5. Which of the following have maximum and minimum ionic character out of MnO , MnF_2 , MnO_2 , Mn_2O_7 ?

A. MnO , Mn_2O_7 respectively

B. MnF_2 , Mn_2O_7 respectively

C. MnO_2 , MnO respectively

D. Mn_2O_7 , MnO respectively

Answer: B



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6. In which of the following ions, the colour is not due to d-d transition?

A. $[Ti(H_2O)_6]^{3+}$

B. $[Cu(NH_3)_4]^{2+}$

C. $[CoF_6]^{3-}$

D. CrO_4^{2-}

Answer: D

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7. Which of the following statements is wrong ?

- A. Ti^{4+} and Ag^+ are repelled by magnetic field.
- B. Mn^{2+} shows maximum magnetic character among the first transition series.
- C. Fe^{2+} is more stable than Mn^{2+} towards oxidation to + state.
- D. Cr in $Cr_2O_7^{2-}$ ion involves sp^3d^2 hybridisation.

Answer: C

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8. Passing H_2S gas into a mixture of Mn^{2+} , Ni^{2+} , Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates

A. MnS and CuS

B. NiS and HgS

C. MnS and NiS

D. CuS and HgS

Answer: D

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9. Which of the following statements for the reaction, is correct ?

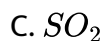


- A. It is redox reaction in which green solution of $[Cr(H_2O)_6]^{+3}$ is produced.
- B. One of the product in reaction has trigonal planar structure.
- C. Dimeric bridged tetrahedral metal ion is produced.
- D. Dark blue colour is obtained in reaction.

Answer: C

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10. In neutral or faintly alkaline medium, thiosulphate is quantitatively oxidized by $KMnO_4$ to



Answer: B

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Exemplar Problems

1. Electronic configuration of a transition element X in +3 oxidation states is $[Ar]3d^5$.

What is its atomic number?

A. 25

B. 26

C. 27

D. 24

Answer: B



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2. The electronic configuration of Cu(II) is $3d^9$ whereas that of Cu(I) is $3d^{10}$. Which of the following is correct ?

A. Cu(II) is more stable.

B. Cu(II) is less stable.

C. Cu(I) and Cu(II) are equally stable.

D. Stability of Cu(I) and Cu(II) depends on nature of copper salts.

Answer: A

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3. Generally transition elements form coloured salts due to the presence of unpaired electrons. Which of the following compounds will be coloured in the solid state ?

A. Ag_2SO_4

B. CuF_2

C. ZnF_2

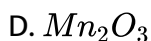
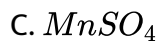
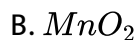
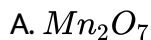
D. $CuCl_2$

Answer: B

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4. On addition of small amount of $KMnO_4$ to concentrated H_2SO_4 , a green oily compound is obtained which is highly explosive in nature.

Identify the compound from the following.



Answer: A



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5. The magnetic nature of elements depends on the presence of unpaired electrons. Identify the configuration of transition element, which shows highest magnetic moment.



B. $3d^5$

C. $3d^8$

D. $3d^2$

Answer: B



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6. Which of the following oxidation state is common for all lanthanoids?

A. +2

B. +3

C. +4

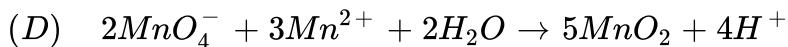
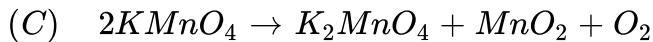
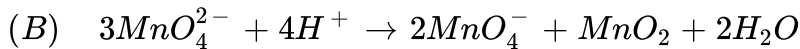
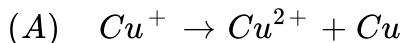
D. +5

Answer: B



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7. Which of the following reactions are disproportionation reactions?



A. I,II

B. I,II,III

C. II,III,IV

D. I,IV

Answer: A



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8. When $KMnO_4$ solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time because

A. CO_2 is formed as the product

B. reaction is exothermic

C. MnO_4^- catalyses the reaction

D. Mn^{2+} acts as autocatalyst.

Answer: D



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9. There are 14 elements in actinoid series. Which of the following elements does not belong to this series?

A. U

B. Np

C. Tm

D. Fm

Answer: C

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10. $KMnO_4$ acts as an oxidising agent in acidic medium. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphide ions in acidic solution is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{4}{5}$

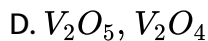
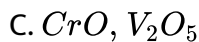
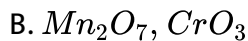
D. $\frac{1}{5}$

Answer: A

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11. Which of the following is an amphoteric oxide?

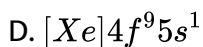
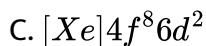
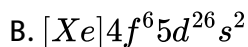
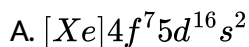
A. V_2O_5, Cr_2O_3



Answer: A

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12. Gadolinium belongs to 4f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium?



Answer: A

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13. Interstitial compounds are formed when small atoms are trapped inside the crystal lattice of metals. Which of the following are not characteristic properties of interstitial compounds?

I. They have high melting points in comparison to pure metals.

II. They are very hard.

III. They retain their metallic conductivity IV. They are chemically reactive

A. I

B. II

C. III.

D. IV

Answer: D



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14. The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion is

A. 2.87 B.M.

B. 3.87 B.M.

C. 3.47 B.M.

D. 3.57 B.M.

Answer: B

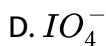
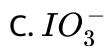


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15. $KMnO_4$ acts as an oxidising agent in alkaline medium. When alkaline $KMnO_4$ is treated with KI , iodide ion is oxidised to

A. I_2

B. IO^-



Answer: C

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16. Which of the following statements is not correct?

A. Copper liberates hydrogen from acids.

B. In higher oxidation states, manganese forms stable compounds with oxygen and fluorine.

C. Mn^{3+} and Co^{3+} are oxidising agents in aqueous solution.

D. Ti^{2+} and Cr^{2+} are reducing agents in aqueous solution.

Answer: A

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17. When acidified $K_2Cr_2O_7$ solution is added to Sn^{2+} salts then Sn^{2+} changes to

A. Sn

B. Sn^{3+}

C. Sn^{4+}

D. Sn^+

Answer: C



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18. Higher oxidation state of manganese in fluoride is $+4(MnF_4)$ but highest oxidation state in oxides is $+7(Mn_2O_7)$ because

A. fluorine is more electronegative than oxygen

B. fluorine does not possess d-orbitals

C. fluorine stabilises lower oxidation state

D. in covalent compounds, fluorine can form single bond only while oxygen forms double bond.

Answer: D



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19. Although zirconium belongs to 4d transition series and hafnium to 5d transition series even then they show similar physical and chemical properties because

- A. both belong to d-block
- B. both have same number of electrons
- C. both have similar atomic radius
- D. both belong to the same group of the periodic table.

Answer: C



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20. Why is HCl not used to make the medium acidic in oxidation reactions of $KMnO_4$ in acidic medium?

- A. Both HCl and $KMnO_4$ act as oxidising agents.
- B. $KMnO_4$ oxidises HCl into Cl_2 which is also an oxidising agent.
- C. $KMnO_4$ is a weaker oxidising agent than HCl.
- D. $KMnO_4$ acts as a reducing agent in the presence of HCl.

Answer: B



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Assertion Reason

1. Assertion : Zn, Cd and Hg are not regarded as transition elements.

Reason : The electronic configurations of Zn, Cd and Hg are represented by the general formula $(n - 1)d^{10}ns^2$.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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2. Assertion : In transition elements radii of 5d series are virtually the same as those of the corresponding members of 4d series.

Reason : The filling of 4f orbitals before 5d orbitals results in regular decrease in atomic radii.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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3. Assertion (A) Cu^{2+} iodide is not known.

Reason (R) Cu^{2+} oxidises I^- to iodine.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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4. Assertion : Cr^{2+} is reducing and Mn^{3+} is oxidising.

Reason : Cr^{2+} and Mn^{3+} have d^4 configuration.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: B

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5. STATEMENT-1: The highest oxidation state of chromium in its compounds is +6. and STATEMENT-2: Chromium atom has only six electrons in ns and (n-1)d orbitals.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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6. Assertion : The ability of oxygen to stabilize high oxidation states exceeds that of fluorine.

Reason : The highest oxidation number in the oxides coincides with the group number

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: B



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7. Assertion : Copper dissolves in dilute nitric acid but not in dilute HCl.

Reason : Copper has positive E° .

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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8. Assertion : In the series Sc to Zn, the enthalpy of atomisation of zinc is the lowest.

Reason : Zinc has greater number of unpaired electrons.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.

- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: C

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9. Assertion : Magnetic moment of Mn^{2+} is less than Cr^{2+}

Reason: Higher the atomic number smaller is the magnetic moment.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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10. Assertion : Cr(VI) in the form of dichromate in acidic medium is a strong oxidising agent where MoO_3 and WO_3 are not.

Reason: In d-block elements higher oxidation states are favoured by heavier members.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A

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11. Assertion : In acidic medium, $K_2Cr_2O_7$ exists as $Cr_2O_7^{2-}$ (orange) while in basic medium it is converted to CrO_4^{2-} (yellow).

Reason : $K_2Cr_2O_7$ is hygroscopic in nature and changes colour on reaction with water.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: C

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12. Assertion : Iron(III) catalyses the reaction between iodide and persulphate ions.

Reason : Transition metals act as catalysts.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: B



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13. Assertion : $KMnO_4$ acts as an oxidising agent in acidic, basic or neutral medium.

$KMnO_4$ oxidises ferrous sulphate to ferric sulphate.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: B



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14. Assertion : Zr and Hf occur together in nature and are difficult to separate.

Reason : Zr and Hf have identical radii due to lanthanide contraction.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A

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15. Assertion : Ce^{4+} is good analytical reagent.

Reason: Ce^{4+} has the tendency to change to Ce^{3+}

- A. If both assertion and reason are true and reason is the correct explanation of assertion.

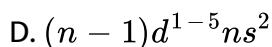
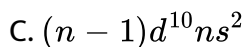
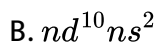
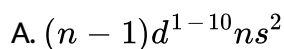
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A

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Electronic Configuration Of D Block Elements

1. General electronic configuration of transition metals is



Answer: A

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2. Which one of the following is a 'd-block element' ?

A. Gd

B. Hs

C. Es

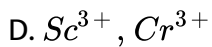
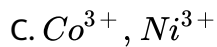
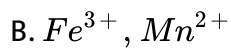
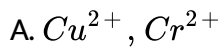
D. Cs

Answer: B

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3. Which of the following pairs of ions have the same electronic configuration

A) Cr^{+3}, Fe^{+3} B) Fe^{+3}, Mn^{+2} C) Fe^{+3}, Co^{+3} D) Sc^{+3}, Cr^{+3}



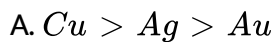
Answer: B



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General Properties Of The Transition Elements

1. The melting points of Cu, Ag and Au follow the order



Answer: B

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2. The melting point of copper is higher than that of zinc because

- A. the s, p as well as d- electrons of copper are involved in metallic bonding.
- B. the atomic volume of copper is higher
- C. the d - electrons of copper are involved in metallic bonding
- D. the s as well as d- electrons of copper are involved in metallic bonding.

Answer: C

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3. Due to lanthanoid contraction which of the following properties is not expected to be similar in the same vertical columns of second and third row transition elements ?

- A. Atomic radii
- B. Ionisation energies
- C. Magnetic moments
- D. Lattice energies

Answer: C



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4. Zr($Z=40$) and Hf($Z=72$) have similar atomic and ionic radii because of:

- A. diagonal relationship
- B. lanthanoid contraction
- C. actinoid contraction

D. belonging to the same group.

Answer: B

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5. The second and third row elements of transition metals resemble each other much more than they resemble the first row because of

- A. lanthanoid contraction which results in almost same radii of second and third row metals
- B. diagonal relationship between second and third row elements
- C. similar ionisation enthalpy of second and third row elements
- D. similar oxidation states of second and third row metals.

Answer: A

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6. Reactivity of transition elements decreases almost regularly from Sc to Cu because of

- A. lanthanoid contraction
- B. regular increase in ionisation enthalpy
- C. regular decrease in ionisation enthalpy
- D. increase in number of oxidation states.

Answer: B



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7. Which of the following is not correctly matched with the given example ?

- A. An element of first transition series which has highest second ionisation enthalpy - Cu.

- B. An element of first transition series with lowest third ionisation enthalpy - Zn.
- C. An element of first transition series with lowest enthalpy of atomisation - Zn.
- D. An element of first transition series with lowest enthalpy - Zn.

Answer: D

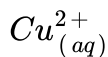
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8. Cu^+ ion is not stable in aqueous solution because because of disproportionation reaction. E° value of disproportionation of Cu^+ is

$$\left[E_{Cu^{2+}/Cu^+}^\circ = +0.15V, E_{Cu^{2+}/Cu}^\circ = 0.34V \right]$$

- A. second ionisation enthalpy of copper is less than the first ionisation enthalpy
- B. large value of second ionisation enthalpy of copper is compensated by much more negative hydration energy of $Cu_{(aq)}^{2+}$

C. hydration energy of $\text{Cu}_{(aq)}^{2+}$ is much more negative than that of



D. many copper (I) compounds are unstable in aqueous solution and undergo disproportionation reaction.

Answer: B

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9. The first ionisation energies of the elements of the first transition series ($\text{Ti} \rightarrow \text{Cu}$)

A. increases as the atomic number increases

B. decreases as the atomic number increases

C. do not show any change as the addition of electrons takes place in the inner (n-1) d orbitals

D. increases from Ti to Mn and then decreases from Mn to Cu.

Answer: A

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10. Match the column I with column II and mark the appropriate choice.

Column I (Property)		Column II (Metal)	
(A)	Element with highest second ionisation enthalpy	(i)	Cr
(B)	Element with highest third ionisation enthalpy	(ii)	Cu
(C)	M in $M(\text{CO})_6$ is	(iii)	Zn
(D)	Element with highest heat of atomisation	(iv)	V

A. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (iv)

B. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (ii)

C. (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iv)

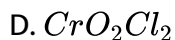
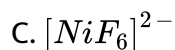
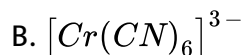
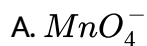
D. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

Answer: A



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11. Identify the species in which the metal atom is in +6 oxidation state.



Answer: D



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12. 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. Dimanganese decacarbonyl

D. Manganese chloride

Answer: B

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13. $E_{Mn^{3+}/Mn^{2+}}^{\circ}$ is highly positive than that of $E_{Cr^{3+}/Cr^{2+}}^{\circ}$ or $E_{Fe^{3+}/Fe^{2+}}^{\circ}$

because

- A. $Mn^{2+} (d^5)$ can be easily oxidised to $Mn^{3+} (d^4)$ due to low ionisation enthalpy
- B. third ionisation enthalpy of Mn is much larger due to stable half filled d^5 electronic configuration of Mn^{2+}
- C. Mn^{3+} is more stable than Mn^{2+} due to higher oxidation state
- D. second ionisation enthalpy of Mn is higher than third ionisation enthalpy.

Answer: B

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14. The correct order of $E_{M^{2+}/M}^{\circ}$ Values with negative sign for the four successive elements *Cr*, *Mn*, *Fe* and *Co* is:

A. Fe gt Mn gt Cr gt Co

B. Cr gt Mn Fe gt Co

C. Mn gt Cr gt Fe gt Co

D. Cr gt Fe gt Mn gt Co

Answer: C

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15. Which of the following d-block element has half - filled penultimate as well as valence subshell ?

A. Cu

B. Au

C. Ag

D. Cr

Answer: D

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16. Fe^{3+} compounds are more stable than Fe^{2+} compounds because

A. Fe^{3+} has smaller size than Fe^{2+}

B. Fe^{3+} has $3d^5$ configuration (half-filled)

C. Fe^{3+} has higher oxidation state

D. Fe^{3+} is paramagnetic in nature.

Answer: B

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17. The salts of Cu in +1 oxidation state are unstable because

- A. Cu^+ had $3d^{10}$ configuration
- B. Cu^+ disproportionates easily to Cu (0) and Cu^{2+}
- C. Cu^+ disproportionates easily to Cu^{2+} and Cu^{3+}
- D. Cu^+ is easily reduced to Cu^{2+}

Answer: B



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18. In which of the following pairs of ions, the higher oxidation state in aqueous solution is more stable than the other?

- I. Tl^+ , Tl^{3+} II. Cu^+ , Cu^{2+}
- III. Cr^{2+} , Cr^{3+} IV. V^{2+} , V^{4+}

A. I, II

B. II, III

C. II, IV

D. II, III, IV

Answer: D



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19. $CuSO_4$ is paramagnetic while $ZnSO_4$ is diamagnetic because

A. Cu^{2+} ion has $3d^9$ configuration while Zn^{2+} ion has $3d^{10}$ configuration

B. Cu^{2+} ion has $3d^5$ configuration while Zn^{2+} ion has $3d^6$ configuration

C. Cu^{2+} has half filled orbitals while Zn^{2+} has fully filled orbitals

D. $CuSO_4$ is blue in colour while $ZnSO_4$ is white.

Answer: A



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20. Which of the following transition metal ions has highest magnetic moment ?



Answer: D



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21. Select the correct option, among Sc(III) , Ti(IV), Pd(II) and Cu(II) ions

A. all are paramagnetic

B. all are diamagnetic

C. Sc(III), Ti(IV) are paramagnetic and Pd(III), Cu(II) are diamagnetic

D. Sc(III), Ti(IV) are diamagnetic and Pd(II), Cu(II) are paramagnetic.

Answer: D

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22. The correct order of the number of unpaired electrons in the ions

Cu^{2+} , Ni^{2+} , Fe^{3+} , and Cr^{3+} is

A. $Cu^{2+} > Ni^{2+} > Cr^{3+} > Fe^{3+}$

B. $Ni^{2+} > Cu^{2+} > Fe^{3+} > Cr^{3+}$

C. $Fe^{3+} > Cr^{3+} > Ni^{2+} > Cu^{2+}$

D. $Cr^{3+} > Fe^{3+} > Ni^{2+} > Cu^{2+}$

Answer: C

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23. Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

A. 5.9 B.M

B. 2.9 B.M

C. 6.9 B.M

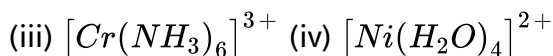
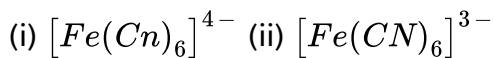
D. 9.9 B.M

Answer: A



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24. Arrange the following in increasing value of magnetic moments.



A. $i < ii < iii < iv$

B. $i < ii < iv < iii$

C. $ii < iii < i < iv$

D. $iii < i < ii < iv$

Answer: B



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25. Which of the following statements is not correct about magnetic behaviour of substances ?

A. Diamagnetic substances are repelled by an applied magnetic field.

B. Paramagnetic substances are attracted by an applied magnetic field.

C. Magnetic moment of n unpaired electrons is given by

$$\mu = \sqrt{n(n - 2)} \text{ B.M.}$$

D. Magnetic moment increases as the number of unpaired electrons increases.

Answer: C



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26. The number of unpaired electrons in gaseous species of Mn^{3+} , Cr^{3+} and V^{3+} respectively are.....and most stable species is.....

- A. 4,3 and 2, V^{3+}
- B. 3,3 and 2, Cr^{3+}
- C. 4,3 and 2, Cr^{3+}
- D. 3,3 and 3, Mn^{3+}

Answer: C



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27. Which of the following arrangements represent the correct order of the property stated against it ?

(i) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

(ii) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution

(iii) $Sc < Ti < Cr < Mn$: number of oxidation states

(iv) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour

A. 1. $Sc < Ti < Cr < Mn$: number of oxidation states

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

C. 3. $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

D. 4. $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution.

Answer: B



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28. Match the column I with column II and mark the appropriate choice.

Column I		Column II	
(A)	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	(i)	Green
(B)	$\text{NiCl}_2 \cdot 4\text{H}_2\text{O}$	(ii)	Light pink
(C)	$\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$	(iii)	Pale green
(D)	$\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$	(iv)	Pink
(E)	Cu_2Cl_2	(v)	Colourless

A. $A \rightarrow iii, B \rightarrow iv, C \rightarrow i, D \rightarrow ii, E \rightarrow v$

B. $A \rightarrow ii, B \rightarrow iii, C \rightarrow iv, D \rightarrow i, E \rightarrow v$

C. $A \rightarrow v, B \rightarrow i, C \rightarrow ii, D \rightarrow iv, E \rightarrow i$

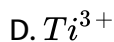
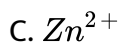
D. $A \rightarrow iii, B \rightarrow i, C \rightarrow ii, D \rightarrow iv, E \rightarrow v$

Answer: D

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29. Which of the following transition metal ions is colourless ?

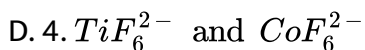
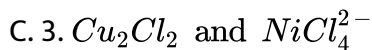
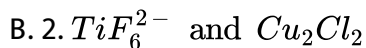
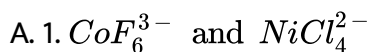
A. V^{2+}



Answer: C

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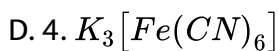
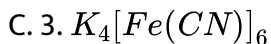
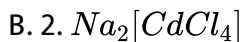
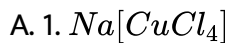
30. Amongst TiF_6^{2-} , CoF_6^{3-} , Cu_2Cl_2 and $NiCl_4^{2-}$, which are the colourless species ? (atomic number of Ti = 22 , Co = 27, Cu = 29, Ni = 28)



Answer: B

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31. Which of the following compounds is not coloured ?

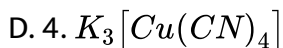
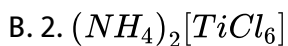
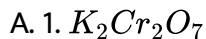


Answer: B



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32. Compound that is both paramagnetic and coloured is:



Answer: C



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33. Most of the transition metals exhibit

- (i) paramagnetic behaviour
- (ii) diamagnetic behaviour
- (iii) variable oxidation states
- (iv) formation of coloured ions

A. (ii), (iii) and (iv)

B. (i) , (iii) and (iv)

C. (i), (ii) and (iii)

D. (i), (ii) and (iv)

Answer: B



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34. For Zn^{2+} , Ni^{2+} , Cu^{2+} and Cr^{2+} which of the following statements is correct ?

- A. 1. Only Zn^{2+} is colourless and Ni^{2+} and Cr^{2+} are coloured.
- B. 2. All the ions are coloured.
- C. 3. All the ions are colourless.
- D. 4. Zn^{2+} and Cu^{2+} are colourless while Ni^{2+} and Cr^{2+} are coloured

Answer: A

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35. Colour of transition metal ions are due to absorption of some wavelength. This results in

- A. 1. d-s transition
- B. 2. s-s transition

C. 3. s-d transition

D. 4. d-d transition

Answer: D

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36. Which group contains coloured ions out of the following ?

1. Cu^+ 2. Ti^{4+} 3. Co^{2+} 4. Fe^{2+}

A. a. 1,2,3,4

B. b. 3,4

C. c. 2,3

D. d. 1,2

Answer: B

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37. Transition metals make the most efficient catalysts because of their ability to

- A. adopt multiple oxidation states and to form complexes
- B. form coloured ions
- C. show paramagnetism due to unpaired electrons
- D. form a large number of oxides.

Answer: A



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38. Interstitial compounds are

- A. non-stoichiometric and are ionic in nature
- B. non-stoichiometric and are covalent in nature
- C. non-stoichiometric and are neither typically ionic nor covalent in nature

D. stoichiometric and are neither ionic nor covalent in nature.

Answer: C

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39. Transition elements form binary compounds with halogens. Which of the following elements will form MF_3 type compounds?

A. 1. Cr

B. 2. Cu

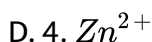
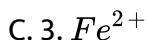
C. 3. Ni

D. 4. All of these.

Answer: A

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1. Which of the following is not an amphoteric ion?



Answer: C



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2. The basic character fo the transition metal monoxides follows the order (Atomic no's. Ti = 22, V = 23, Cr = 24 , Fe = 26)



Answer: D



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3. Which of the following oxides are basic ?

A. Mn_2O_7 and V_2O_3

B. V_2O_3 and CrO

C. CrO and Cr_2O_3

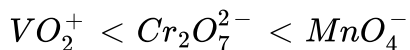
D. V_2O_5 and V_2O_3

Answer: B



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4. Following order is observed in oxidising power of certain ions :



The reason for this increasing order of oxidising power is

- A. increasing stability of the lower species to which they are reduced
- B. increasing stability of the higher species to which they are oxidised
- C. increasing stability of the higher species to which they are reduced
- D. increasing stability of the lower species to which they are oxidised.

Answer: A

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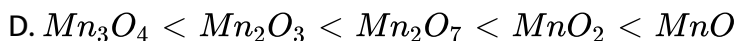
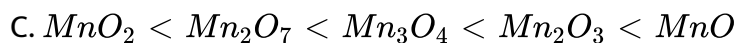
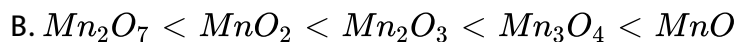
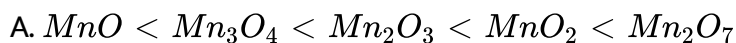
5. V_2O_5 reacts with alkalies as well as acids to give

- A. VO_4^{3-} and VO^{2+}
- B. VO^{2+} and VO_4^+
- C. VO_2^+ and VO^{2+}
- D. VO_4^{3-} and VO_4^+

Answer: D

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6. Arrange the oxides of manganese according to increasing acidic strength.



Answer: A



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7. Potassium dichromate is prepared from

A. chromate obtained by the fusion of chromite ore with sodium carbonate in free access of air

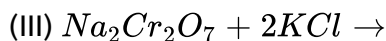
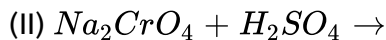
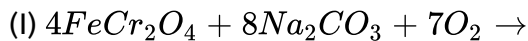
- B. pyrolusite which is fused with potassium hydroxide in the presence of air
- C. iron pyrites by the fusion with potassium carbonate in presence of moisture
- D. none of these

Answer: A



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8. Which of the following reactions do not result in the preparation of potassium dichromate?



- A. I and II
- B. II and III

C. I and III

D. I, II, and III

Answer: A

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9. Which of the following compounds is used as the starting material for the preparation of potassium dichromate?

A. $K_2SO_4Cr_2(SO_4)_3 \cdot 24H_2O$ (Chrome alum)

B. $PbCrO_4$ (Chromite yellow)

C. $FeCr_2O_4$ (Chromite)

D. $PbCrO_4 \cdot PbO$ (Chrome red)

Answer: C

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10. Yellow coloured aqueous solution of sodium chromate changes to orange when acidified with sulphuric acid because

- A. H^+ ions convert chromate ions to dichromate ions
- B. H^+ ions react with sodium chromate to give sodium ions which turn solution orange
- C. Cr^{3+} ions are liberated in the solution which turn the solution orange
- D. sodium hydroxide is formed during the reaction which imparts orange colour to the solution.

Answer: A



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11. What happens when potassium iodide reacts with acidic solution of potassium dichromate ?

- A. It liberated iodine.
- B. Potassium sulphate is formed.
- C. Chromium sulphate is formed.
- D. All the above products are formed.

Answer: D

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12. Acidified potassium dichromate reacts with potassium iodide and oxidises it to I_2 . What is the oxidation state of chromium in the products of the reaction?

- A. +4
- B. +6
- C. +3
- D. +2

Answer: C

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13. One mole of acidified $K_2Cr_2O_7$ on reaction with excess of KCl will liberate....., moles of I_2 .

A. 3

B. 1

C. 7

D. 2

Answer: A

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

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

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

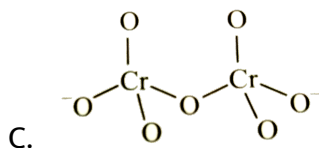
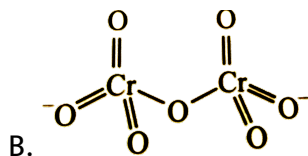
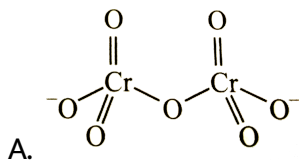
C. CrO_4^{2-} is reduced to +3 state of Cr

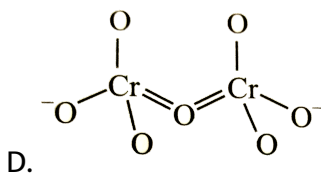
D. CrO_4^{2-} is oxidised to +7 state of Cr.

Answer: B

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15. Identify the correct structure of dichromate ion.





Answer: A

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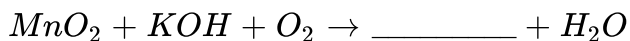
16. In the dichromate anion ($Cr_2O_7^{2-}$)

- A. all Cr - O bonds are equivalent
- B. 6 Cr - O bonds are equivalent
- C. 3 Cr - O bonds are equivalent
- D. no bonds in $Cr_2O_7^{2-}$ are equivalent.

Answer: B

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17. When MnO_2 is fused with KOH and O_2 , what is the product formed and its colour?



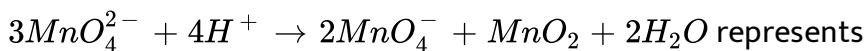
- A. MnO - colourless
- B. K_2MnO_4 - purple
- C. K_2MnO_4 -dark green
- D. MnO_3 -black

Answer: C



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18. The equation



- A. reduction
- B. disproportionation

C. oxidation in acidic medium

D. reduction in acidic medium.

Answer: B

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19. Explain why does colour of $KMnO_4$ disappear when oxalic acid is added to its solution in acidic medium?

A. the pH of the solution changes on adding oxalic acid, hence

$KMnO_4$ is decolourised

B. $KMnO_4$ oxidises oxalic acid to CO_2 and itself changes to Mn^{2+}

ions which are colourless

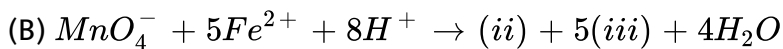
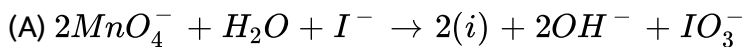
C. $KMnO_2$ is oxidised to potassium sulphate which is colourless

D. on exposure to air the acidic solution of $KMnO_4$ becomes colourless.

Answer: B

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20. Complete the given reactions.



- A. (i) MnO_2 (ii) Mn^{2+} (iii) Fe^{3+}
- B. (i) Mn^{2+} (ii) MnO_2 (iii) Fe^{3+}
- C. (i) MnO_2 (ii) MnO_4^{2-} (iii) $Fe(OH)_3$
- D. (i) MnO_4^{2-} (ii) Mn^{2+} (iii) Fe_2O_3

Answer: A

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21. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate in acidic solution is:

A. $3/5$

B. $2/5$

C. $4/5$

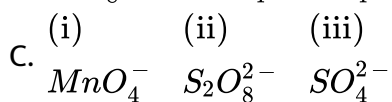
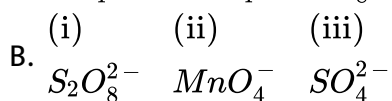
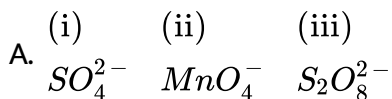
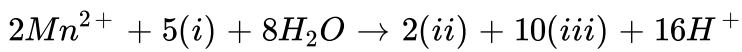
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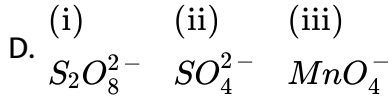
Answer: A



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22. Complete the given reaction.

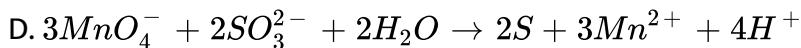
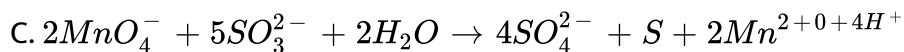
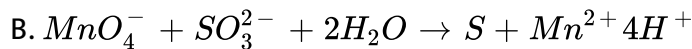
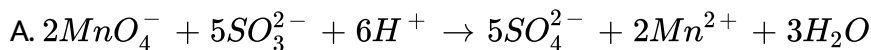




Answer: B

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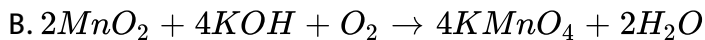
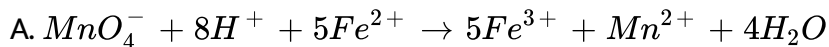
23. Which of the following is correct representation of reaction of acidified permanganate solution with sulphurous acid ?



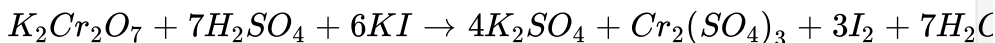
Answer: A

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24. Which of the following reactions is not correct ?



D.

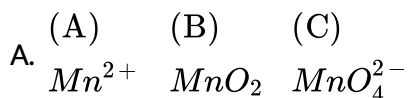


Answer: B



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25. A solution of $KMnO_4$ is reduced to various products depending upon its pH. At pH < 7 it is reduced to a colourless solution (A), at pH = 7 it forms a brown precipitate (B) and at pH > 7 it gives a green solution (C), (A), (B) and (C) are



- (A) (B) (C)
- B. MnO_2 Mn^{2+} MnO_4^{2-}
- (A) (B) (C)
- C. Mn^{2+} MnO_4^{2-} MnO_2
- (A) (B) (C)
- D. MnO_4^{2-} Mn^{2+} MnO_2

Answer: A



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26. In acidic medium, $KMnO_4$ oxidises $FeSO_4$ solution. Which of the following statements is correct?

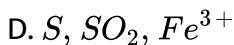
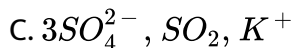
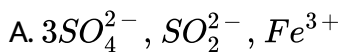
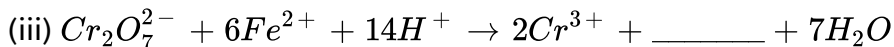
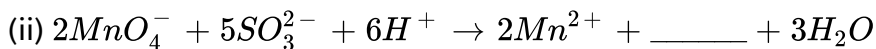
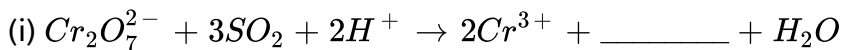
- A. 10 mL of 1 N $KMnO_4$ solution oxidises 10 mL of 5 N $FeSO_4$ solution.
- B. 10 mL of 1 M $KMnO_4$ solution oxidises 10 mL of 5 M $FeSO_4$ solution.
- C. 10 mL of 1 M $KMnO_4$ solution oxidises 10 mL of 1 M $FeSO_4$ solution.

D. 10 mL of 1 N $KMnO_4$ solution oxidises 10 mL of 0.1 M $FeSO_4$ solution.

Answer: B

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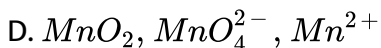
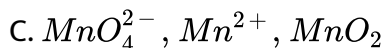
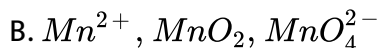
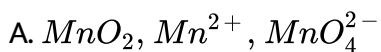
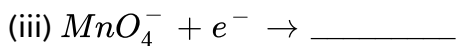
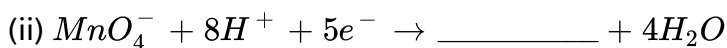
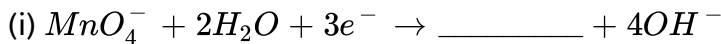
27. Complete the following reactions.



Answer: B

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28. Complete the following reactions.

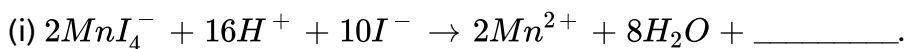


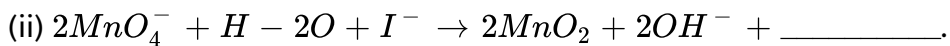
Answer: A



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29. Fill the missing products in the following reactions.





A. (i) HI, (ii) I_2

B. (ii) I_2 , (ii) IO_3^-

C. (iii) I_2 , (ii) I_2

D. (iv) IO_3^- , (ii) I_2

Answer: B



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30. When an oxide of manganese (P) is fused with KOH in the presence of an oxidising agent and dissolved in water, it gives a dark green solution of compound (Q). Compound (Q) disproportionates in neutral or acidic solution to give purple compound (R) oxidises potassium iodide solution to a compound (S) and compound (P) is also formed. Compounds P to S are

A. $\begin{matrix} P & Q & R & S \\ MnO_4^- & KIO_3 & MnO_2 & K_2MnO_4 \end{matrix}$

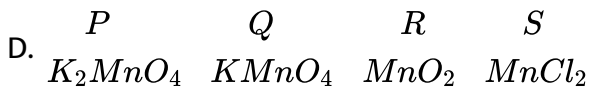
- B. $\begin{matrix} P & Q & R & S \\ MnO_2 & K_2MnO_4 & MnO_4^- & KIO_3 \end{matrix}$
- C. $\begin{matrix} P & Q & R & S \\ MnO_2 & MnO_4^- & K_2MnO_4 & KIO_3 \end{matrix}$
- D. $\begin{matrix} P & Q & R & S \\ K_2MnO_4 & MnO_2 & MnO_4^- & KIO_3 \end{matrix}$

Answer: B

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31. A violet compound of manganese (P) decomposes on heating to liberate oxygen and compounds (Q) and (R) of manganese are formed. Compound (R) reacts with KOH in the presence of potassium nitrate to give compound (Q). On heating compound (R) with conc. H_2SO_4 and NaCl, Chlorine gas is liberated and a compound (S) of manganese along with other products is formed. Compound P to S are

- A. $\begin{matrix} P & Q & R & S \\ KMnO_4 & K_2MnO_4 & MnCl_2 & MnO_2 \end{matrix}$
- B. $\begin{matrix} P & Q & R & S \\ K_2MnO_4 & MnO_2 & KMnO_4 & MnCl_2 \end{matrix}$
- C. $\begin{matrix} P & Q & R & S \\ KMnO_4 & K_2MnO_4 & MnO_2 & MnCl_2 \end{matrix}$



Answer: C

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The Lanthanoids

1. The most common lanthanoid is :

- A. lanthanum
- B. cerium
- C. samarium
- D. plutonium

Answer: B

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2. Which is the non-lanthanide element ?

A. La

B. Lu

C. Pr

D. Pm

Answer: A



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3. The correct configuration of f-block elements is

A. $(n - 2)f^{1-14}(n - 1)d^{0-1}ns^2$

B. $(n - 1)f^{1-14}(n - 1)d^{0-1}ns^2$

C. $(n - 3)f^{1-14}(n - 2)d^{0-1}(n - 1)s^2$

D. $(n - 2)f^{0-1}(n - 1)d^{0-1}ns^2$

Answer: A



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4. Lanthanoid contraction is due to increase in

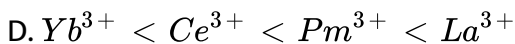
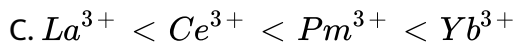
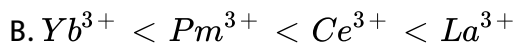
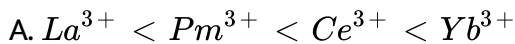
- A. atomic number
- B. effective nuclear charge
- C. atomic radius
- D. valence electrons.

Answer: B



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5. The correct order of ionic radii of Ce, La, Pm and Yb in +3 oxidation state is



Answer: B

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6. Which of the following statements is correct about stability of the complexes of lanthanoids?

A. Stability of complexes increases as the size of lanthanoid decreases.

B. Stability of complexes decreases as the size of lanthanoid decreases.

C. Lanthanoids do not form complexes.

D. All the complexes of lanthanoids have same stability.

Answer: A

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7. The trend of basicity of lanthanoid hydroxides

- A. increases across the lanthanoid series
- B. decreases across the lanthanoid series
- C. first increases and then decreases
- D. first decreases and then increases.

Answer: B

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8. The common oxidation state shown by Europium in their compounds is

- A. +1

B. +3

C. +5

D. +6

Answer: B



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

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

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

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

D. Cerium (IV) acts as an oxidising agent.

Answer: C

10. Match the column I with column II and mark the appropriate choice.

Column I		Column II	
(A)	An element which can show +8 oxidation state	(i)	Ce
(B)	An element with +7 as the most stable oxidation state in its oxides	(ii)	Pm
(C)	Radioactive lanthanoid	(iii)	Os
(D)	Lanthanoid which shows +4 oxidation state	(iv)	Mn

A. $A \rightarrow i, B \rightarrow ii, C \rightarrow iii, D \rightarrow iv$

B. $A \rightarrow ii, B \rightarrow iii, C \rightarrow iv, D \rightarrow i$

C. $A \rightarrow iv, B \rightarrow i, C \rightarrow ii, D \rightarrow iii$

D. $A \rightarrow iii, B \rightarrow iv, C \rightarrow ii, D \rightarrow i$

Answer: D

11. Which of the following statements concerning lanthanide elements is false ?

- A. All lanthanides are highly dense metals.
- B. More characteristic oxidation state of lanthanide elements is +3.
- C. Lanthanides are separated from one another by ion exchange method.
- D. Ionic radii of trivalent lanthanides steadily increases with increases in the atomic number.

Answer: D



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12. Consider the following statements:

- (I) $\text{La}(\text{OH})_3$ is the least basic among the hydroxides of lanthanoids.
- (II) Zr^{4+} and Hf^{4+} possess almost same ionic radii.

(III) Cr^{4+} can act as an oxidising agent .

which of the above statement is/ are true?

A. I and III

B. II and III

C. II only

D. I and II

Answer: B



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13. Which of the following lanthanide ion is paramagnetic ?

A. Ce^{4+}

B. Yb^{2+}

C. Lu^{3+}

D. Eu^{2+}

Answer: D

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14. Magnetic moment of Ce^{3+} ion on the basis of 'spin-only' formula will be _____ B.M.

A. 1.232

B. 1.332

C. 1.532

D. 1.732

Answer: D

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15. All Cu(II) halides are known except the iodide. The reason for it is that

A. iodide is a bulky ion

B. Cu^{2+} oxidizes iodide to iodine

C. $Cu^{2+}_{(aq)}$ has much negative hydration enthalpy

D. Cu^{2+} ion has smaller size.

Answer: B

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16. Consider the following statement in respect of Lanthanoids :

(i) The basic strength of hydroxides of lanthanoids increases from $La(OH)_3$ to $Lu(OH)_3$.

(ii) The lanthanoid ions Lu^{3+} , Yb^{2+} and Ce^{4+} are diamagnetic.

Which of the statements (s) given above is /are correct ?

A. 1 only

B. 2 only

C. Both 1 and 2

D. neither 1 not 2

Answer: B

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17. Composition of mischmetal is

A. 5% of a lanthanoid metal, 95% of iron and traces of S, C, Ca and Al

B. 95% of an actinoid metal, 5% of iron and traces of S, C, Ca and Al

C. 95% of a lanthanoid metal, 5% of iron and traces of S, C, Ca and Al

D. 95% of a transition metal, 5% of iron and traces of S, C, Ca and Al

Answer: C

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18. Which of the following lanthanide is commonly used?

A. Lanthanum

B. Nobelium

C. Thorium

D. Cerium

Answer: D



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The Actinoids

1. What is the total number of inner transition elements in the periodic table?

A. 10

B. 14

C. 30

D. 28

Answer: D

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2. Actinoids in general show more oxidation states than the lanthanoids.

The main reason for this is

- A. higher energy difference between 5f and 6d orbitals than between 4f and 5d orbitals
- B. lower energy difference between 5f and 6d orbitals than between 4f and 5d orbitals
- C. higher reactivity of actinoids than lanthanoids
- D. actinoids are more basic than lanthanoids.

Answer: B

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3. Identify the incorrect statement among the following.

- A. 4f and 5f orbitals are equally shielded.
- B. d-Block elements show irregular and erratic chemical properties among themselves.
- C. La and Lu have partially filled d-orbitals and no other partially filled orbitals.
- D. The chemistry of various lanthanoids is very similar.

Answer: A

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4. The actinides showing +7 oxidation state are:

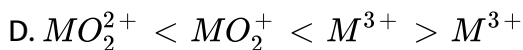
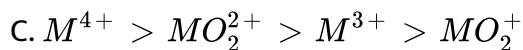
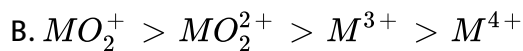
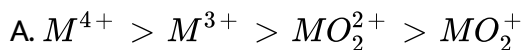
- A. U, Np
- B. Pu, Am
- C. Np, Pu

D. Am, Cm

Answer: C

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5. If M is the element of actinoid series, the degree of complex formation decrease in the order



Answer: C

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6. Lanthanides and actinides resemble in

- A. electronic configuration
- B. oxidation state
- C. ionization energy
- D. formation of complexes

Answer: A



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Application Of D And F Block Elements

1. Match the column I with column II and mark the appropriate choice.

Column I		Column II	
(A)	Mischmetal	(i)	Alloy of Cu and Sn
(B)	Ziegler catalyst	(ii)	Alloy of lanthanoid metals
(C)	Brass	(iii)	$\text{TiCl}_4 + \text{Al}(\text{CH}_3)_3$
(D)	Bronze	(iv)	Alloy of Cu and Zn

A. $A \rightarrow i, B \rightarrow iii, C \rightarrow ii, D \rightarrow iv$

B. $A \rightarrow ii, B \rightarrow iii, C \rightarrow iv, D \rightarrow i$

C. $A \rightarrow iv, B \rightarrow i, C \rightarrow iii, D \rightarrow ii$

D. $A \rightarrow iii, B \rightarrow ii, C \rightarrow i, D \rightarrow iv$

Answer: B



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2. Match the column I with column II and mark the appropriate choice.

Column I		Column II	
(A)	Ni in the presence of hydrogen	(i)	Ziegler Natta catalyst
(B)	Cu_2Cl_2	(ii)	Contact process
(C)	V_2O_5	(iii)	Vegetable oil to ghee
(D)	Finely divided iron	(iv)	Sandmeyer reaction
(E)	$\text{TiCl}_4 + \text{Al}(\text{CH}_3)_3$	(v)	Haber's process

A. $A \rightarrow iv, B \rightarrow ii, C \rightarrow iii, D \rightarrow i, E \rightarrow v$

B. $A \rightarrow ii, B \rightarrow v, C \rightarrow i, D \rightarrow iii, E \rightarrow iv$

C. $A \rightarrow v, B \rightarrow iii, C \rightarrow iv, D \rightarrow ii, E \rightarrow i$

D. $A \rightarrow iii, B \rightarrow iv, C \rightarrow ii, D \rightarrow v, E \rightarrow i$

Answer: D



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3. Which of the following catalysts is not correctly matched with the reaction ?

A. Vanadium (V) oxide in contact process for oxidation of SO_2 to SO_3 .

B. Finely divided iron in Haber's process in conversion of N_2 and H_2 to NH_3 .

C. $PtCl_2$ catalyses the oxidation of ethyne to ethanal in the Wacker process.

D. Ni in presence of hydrogen for conversion of vegetable oil to ghee.

Answer: C

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Higher Order Thinking Skills

1. Mercury is a liquid metal because

- A. it has a completely filled d-orbital that prevents d-d overlapping of orbitals
- B. it has a completely filled d-orbital that causes d-d overlapping
- C. it has a completely filled s-orbital
- D. it has a small atomic size.

Answer: A

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2. Which one of the following transition element has the lowest value of enthalpy of atomization?

- A. Cr
- B. Cu
- C. Zn
- D. Mn

Answer: C



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

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

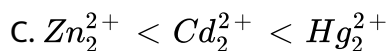
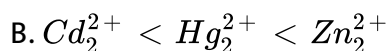
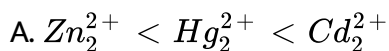
Answer: B





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4. Which of the following has been arranged in order of increasing bond strength ?

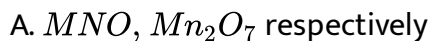


Answer: C



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5. Which of the following have maximum and minimum ionic character out of MnO , MnF_2 , MnO_2 , Mn_2O_7 ?



B. MnF_2 , Mn_2O_7 respectively

C. MnO_2 , MnO respectively

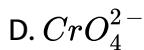
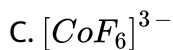
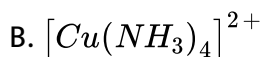
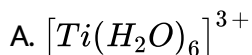
D. Mn_2O_7 , MnO respectively

Answer: B



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6. In which of the following ions, the colour is not due to d-d transition?



Answer: D



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7. Which of the following statements is wrong ?

- A. Ti^{4+} and Ag^+ are repelled by magnetic field.
- B. Mn^{2+} shows maximum magnetic character among the first transition series.
- C. Fe^{2+} is more stable than Mn^{2+} towards oxidation to + state.
- D. Cr in $Cr_2O_7^{2-}$ ion involves sp^3d^2 hybridisation.

Answer: C



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8. Passing H_2S gas into a mixture of Mn^{2+} , Ni^{2+} , Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates

- A. MnS and CuS
- B. NiS and HgS
- C. MnS and NiS

D. CuS and HgS

Answer: D

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9. Which of the following statements for the reaction, is correct ?

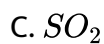


- A. It is redox reaction in which green solution of $[Cr(H_2O)_6]^{+3}$ is produced.
- B. One of the product in reaction has trigonal planar structure.
- C. Dimeric bridged tetrahedral metal ion is produced.
- D. Dark blue colour is obtained in reaction.

Answer: C

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10. In neutral or faintly alkaline medium, thiosulphate is quantitatively oxidized by $KMnO_4$ to



Answer: B



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Ncert Exemplar

1. Electronic configuration of a transition element X in +3 oxidation states is $[Ar]3d^5$.

What is its atomic number?

A. 25

B. 26

C. 27

D. 24

Answer: B

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2. The electronic configuration of Cu(II) is $3d^9$ whereas that of Cu(I) is $3d^{10}$. Which of the following is correct ?

A. Cu(II) is more stable.

B. Cu(II) is less stable.

C. Cu(I) and Cu(II) are equally stable.

D. Stability of Cu(I) and Cu(II) depends on nature of copper salts.

Answer: A

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3. Metallic radii of some transition elements are given below. Which of these elements will has highest density?

Element	Fe	Co	Ni	Cu
Metallic radii/pm	126	125	125	128

A. Fe

B. Ni

C. Co

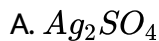
D. Cu

Answer: D



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4. Generally transition elements form coloured salts due to the presence of unpaired electrons. Which of the following compounds will be coloured in the solid state ?



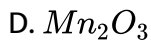
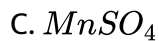
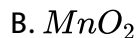
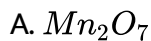
Answer: B



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5. On addition of small amount of $KMnO_4$ to concentrated H_2SO_4 , a green oily compound is obtained which is highly explosive in nature.

Identify the compound from the following.



Answer: A

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6. The magnetic nature of elements depends on the presence of unpaired electrons. Identify the configuration of transition element, which shows highest magnetic moment.



Answer: B

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7. Which of the following oxidation state is common for all lanthanoids?

A. +2

B. +3

C. +4

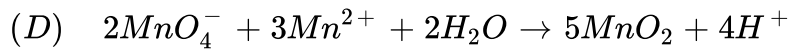
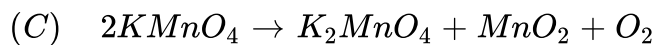
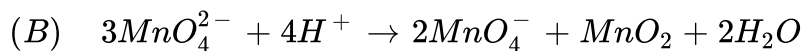
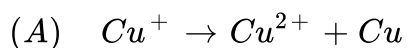
D. +5

Answer: B



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8. Which of the following reactions are disproportionation reactions?



A. I,II

B. I,II,III

C. II,III,IV

D. I,IV

Answer: A

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9. When $KMnO_4$ solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time because

A. CO_2 is formed as the product

B. reaction is exothermic

C. MnO_4^- catalyses the reaction

D. Mn^{2+} acts as autocatalyst.

Answer: D

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10. There are 14 elements in actinoid series. Which of the following elements does not belong to this series?

A. U

B. Np

C. Tm

D. Fm

Answer: C



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11. $KMnO_4$ acts as an oxidising agent in acidic medium. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphide ions in acidic solution is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{4}{5}$

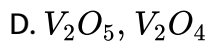
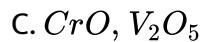
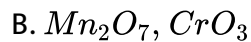
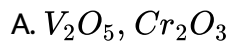
D. $\frac{1}{5}$

Answer: A



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12. Which of the following is an amphoteric oxide?

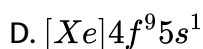
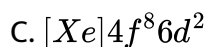
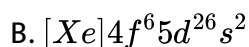
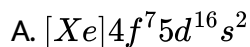


Answer: A



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13. Gadolinium belongs to 4f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium?



Answer: A



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14. Interstitial compounds are formed when small atoms are trapped inside the crystal lattice of metals. Which of the following are not characteristic properties of interstitial compounds?

I. They have high melting points in comparison to pure metals.

II. They are very hard.

III. They retain their metallic conductivity IV. They are chemically reactive

A. I

B. II

C. III.

D. IV

Answer: D



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15. The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion is

A. 2.87 B.M.

B. 3.87 B.M.

C. 3.47 B.M.

D. 3.57 B.M.

Answer: B

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16. $KMnO_4$ acts as an oxidising agent in alkaline medium. When alkaline $KMnO_4$ is treated with KI , iodide ion is oxidised to

A. I_2

B. IO^-

C. IO_3^-

D. IO_4^-

Answer: C

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17. Which of the following statements is not correct?

A. Copper liberates hydrogen from acids.

B. In higher oxidation states, manganese forms stable compounds with oxygen and fluorine.

C. Mn^{3+} and Co^{3+} are oxidising agents in aqueous solution.

D. Ti^{2+} and Cr^{2+} are reducing agents in aqueous solution.

Answer: A

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18. When acidified $K_2Cr_2O_7$ solution is added to Sn^{2+} salts then Sn^{2+} changes to

A. Sn

B. Sn^{3+}

C. Sn^{4+}

D. Sn^+

Answer: C

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19. Higher oxidation state of manganese in fluoride is $+4(MnF_4)$ but highest oxidation state in oxides is $+7(Mn_2O_7)$ because

- A. fluorine is more electronegative than oxygen
- B. fluorine does not possess d-orbitals
- C. fluorine stabilises lower oxidation state
- D. in covalent compounds, fluorine can form single bond only while oxygen forms double bond.

Answer: D

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20. Although zirconium belongs to 4d transition series and hafnium to 5d transition series even then they show similar physical and chemical properties because

- A. both belong to d-block
- B. both have same number of electrons
- C. both have similar atomic radius
- D. both belong to the same group of the periodic table.

Answer: C



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21. Why is HCl not used to make the medium acidic in oxidation reactions of $KMnO_4$ in acidic medium?

- A. Both HCl and $KMnO_4$ act as oxidising agents.
- B. $KMnO_4$ oxidises HCl into Cl_2 which is also an oxidising agent.

C. $KMNO_4$ is a weaker oxidising agent than HCl.

D. $KMNO_4$ acts as a reducing agent in the presence of HCl.

Answer: B

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Assertion And Reason

1. Assertion : Zn, Cd and Hg are not regarded as transition elements.

Reason : The electronic configurations of Zn, Cd and Hg are represented by the general formula $(n - 1)d^{10}ns^2$.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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2. Assertion : In transition elements radii of 5d series are virtually the same as those of the corresponding members of 4d series.

Reason : The filling of 4f orbitals before 5d orbitals results in regular decrease in atomic radii.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is trun but reason is false.

D. If both assertion and reason are false.

Answer: A

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3. Assertion (A) Cu^{2+} iodide is not known.

Reason (R) Cu^{2+} oxidises I^- to iodine.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A

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4. Assertion : Cr^{2+} is reducing and Mn^{3+} is oxidising.

Reason : Cr^{2+} and Mn^{3+} have d^4 configuration.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: B



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5. STATEMENT-1: The highest oxidation state of chromium in its compounds is +6. and STATEMENT-2: Chromium atom has only six electrons in ns and (n-1)d orbitals.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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6. Assertion : The ability of oxygen to stabilize high oxidation states exceeds that of fluorine.

Reason : The highest oxidation number in the oxides coincides with the group number

- A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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7. Assertion : Copper dissolves in dilute nitric acid but not in dilute HCl.

Reason : Copper has positive E° .

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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8. Assertion : In the series Sc to Zn, the enthalpy of atomisation of zinc is the lowest.

Reason : Zinc has greater number of unpaired electrons.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: C



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9. Assertion : Magnetic moment of Mn^{2+} is less than Cr^{2+}

Reason: Higher the atomic number smaller is the magnetic moment.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: D



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10. Assertion : Cr(VI) in the form of dichromate in acidic medium is a strong oxidising agent where MoO_3 and WO_3 are not.

Reason: In d-block elements higher oxidation states are favoured by heavier members.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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11. Assertion : In acidic medium, $K_2Cr_2O_7$ exists as $Cr_2O_7^{2-}$ (orange) while in basic medium it is converted to CrO_4^{2-} (yellow).

Reason : $K_2Cr_2O_7$ is hygroscopic in nature and changes colour on reaction with water.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is trun but reason is false.
- D. If both assertion and reason are false.

Answer: C

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12. Assertion : Iron(III) catalyses the reaction between iodide and persulphate ions.

Reason : Transition metals act as catalysts.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is trun but reason is false.

D. If both assertion and reason are false.

Answer: B

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13. Assertion : $KMnO_4$ acts as an oxidising agent in acidic, basic or neutral medium.

$KMnO_4$ oxidises ferrous sulphate to ferric sulphate.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason not is the correct explanation of assertion.

C. If assertion is trun but reason is false.

D. If both assertion and reason are false.

Answer: B

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14. Assertion : Zr and Hf occur together in nature and are difficult to separate.

Reason : Zr and Hf have identical radii due to lanthanide contraction.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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15. Assertion : Ce^{4+} is good analytical reagent.

Reason: Ce^{4+} has the tendency to change to Ce^{3+}

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason not is the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A



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