CHEMISTRY

BOOKS - MODERN PUBLISHERS CHEMISTRY (HINGLISH)

D AND F-BLOCK ELEMENTS

Solved Example

1. Write the electronic configurations of the following ions :

$(i)Cu^{+}(ii)Co^{2+}(iii)Cr^{3+}(iv)Mn^{2+}$

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

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3. Why is the E^{Θ} value for the Mn^{3+}/Mn^{2+} couple much postive than for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+}? Example

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4. Why is Cr^{2+} reducing and Mn^{3+} oxidising when both have d^4 configuration ?

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5. On what ground can you say that scandium $(Z = 21)$ is a transition element but zinc $(Z = 30)$ is not?

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6. For the first row transition metals, the E^{Θ} values are:

Explain the irregularity in the above values.

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7. Why do the transition elements exhibit higher enthalpies of atomisation?

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8. What is meant by disproportionation of an oxidation state ? Give an example

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9. (a) Following are the transition metal ions of 3d series:

$Ti^{4+}, V^{2+}, Mn^{3+}, Cr^{3+}$

(Atomic numbers: $Ti = 22, V = 23, Mn = 25, Cr = 24$)

Answer the following:

(i) Which ion is most stable in an aqueous solution and why?

(ii) Which ion is a strong oxidising agent and why?

(iii) Which ion is colourless and why?

(b) Complete the following equations:

(i) $2MnO_4^- + 16H^+ + 5S^- \rightarrow$

(ii) $KMnO_4 \xrightarrow{heat}$

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10. Why are Mn^{2+} compounds more stable than Fe^{2+} toward oxidation to their $+3$ state?

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11. The $E^0\left(M^{2+}/M\right)$ value for copper is positive $(+0.34V)$. What is possibly the reason for this?

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12. Complete the chemical equations :

$Cr_2O_7^{2-} + H^+ + I^- \rightarrow$

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13. Complete the chemical equations :

$MnO_4^- + NO_2 + H^+ \rightarrow$

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14. Complete the chemical equations :

$KMnO_4 \xrightarrow{\text{heated}}$

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15. Complete the chemical equations :

$MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow$

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16. Complete the chemical equations :

$Cr_2O_7^{2-} + H_2S + H^+ \rightarrow$

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17. Complete the chemical equations :

$MnO_4^-(aq) + S_2O_3^{2-}(aq) + H_2O(l) \rightarrow$

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18. Complete the chemical equations :

$Cr_2O_7^{2-}(aq) + Fe^{2+}(aq) + H^+(aq) \rightarrow$

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19. Complete the chemical equations :

$MnO_4^-(aq) + H_2O_2(aq) + H^+(aq) \rightarrow$

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20. Complete the chemical equations :

$2CrO_4^{2-} + 2H^+ \rightarrow$

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21. Complete the chemical equations :

$MnO_4^- + H^+ + SO_3^{2-} \rightarrow$

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22. Complete the chemical equations :

$2MnO_4 + 16H^+ + 5S^{2-} \rightarrow$

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23. Complete the chemical equations :

$Fe^{2+} + MnO_4^- + H^+ \rightarrow$

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24. Complete the chemical equations :

$MnO_4^- + H_2O + I^- \rightarrow$

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25. Write chemical equation for

(i) Oxidation of Fe^{2+} by $Cr_2O_7^{2-}$. in acidic medium.

(ii) Oxidation of $S_2O_3^{2-}$ by MnO_4^- in neutral medium.

(iii) Oxidation of I^- by MnO_4^- in alkaline medium.

(iv) Oxidation of SO_3^{2-} by $Cr_2O_7^{2-}$ in acidic medium.

(v) Oxidation of sulphur dioxide by MnO_4^- in acidic medium.

(vi) Reaction of potassium iodide with acidified potassium dichromate.

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26. Write chemical equations for the following reactions:

(a) Oxidation of nitrite ion by MnO_4^- in acidic medium,

(b) Acidification of potassium chromate solution.

(c) Disproportionation of manganese (VI) in acidic solution.

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27. Write down the electronic configurations of the following ions :

$Pm^{3+}(Z=61), Ce^{4+}(Z=58), Lu^{2+}(Z=71), Th^{4+}(Z=90)$

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28. Among lanthanoids, Ln (III) compounds are predominant. However, occasionally in solutions or in solid compounds, +2 and +4 ions are also obtained.

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29. Actinoid contraction is greater from element to element than lanthanoid contraction Why?

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30. Use Hund's rule to derive the electronic configuration of Ce^{3+} ion, and calculate its magnetic moment on the basis of spin-only formula.

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31. Which is the last element in the series of the actinods? Write the electronic configuration of this element. Comment on the possible oxidation state of this element.

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

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33. Which out of the two $La(OH)_3$ and $Lu(OH)_3$, is more basic and why?

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34. Name a member of the lanthanoid series which is well known to exhibit $+4$ oxidation state.

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Practice Problem

1. Name the third and fourth transition elements of first transition series.

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2. What is the theoretical magnetic moment of Ti^{3+} ion ?

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3. Calculate the number of unpaired electrons in Cr^{3+} and V^{3+} ions.

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4. Which of the following ions are expected to be coloured ?

$Ni^{2+}, Ti^{3+}, Cu^{+}, Sc^{3+}, Zn^{2+}$

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5. How many unpaired electrons are present in each of the following ?

$Fe^{3+}, Co^{2+}, Zn^{2+}$

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6. Out of Fe^{2+} and Fe^{3+} which is more paramagnetic and why?

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7. Calculate the magnetic moments of Fe^{2+} and Fe^{3+}

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8. Name any three elements of second transition series which have abnormal electronic configurations.

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9. Explain why Zn^{2+} salts are colouless while Ni^{2+} salts are coloured ?

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10. A compound has been found to have magnetic moment of 3.9 B.M. How many unpaired electrons does it contain ?

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11. The catalyst used in the manufacture of H_2SO_4 by contact process is.

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12. Give reason, Mn^{2+} ion is more paramagnetic than Fe^{2+} ion.

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13. The oxidation state of Cr in $K_2Cr_2O_7$ is:

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14. The orange colour of dichromate solution changes of blue on heating with alkalies due to the formation of chromate ions.

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15. MnO_2 on heating with potassium hydroxide in the presence of air forms.....

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16. Chromite is .....

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17. $KMnO_4 \xrightarrow{\text{heat}} \ldots\ldots\ldots\ldots + MnO_2 + \ldots\ldots\ldots\ldots$

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18. Write ionic equation showing $KMnO_4$ acting as an oxidising agent in acidic medium.

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19. What is the oxidation state of

(i) Cr in dichromate ion

(ii) Mn is manganate ion,

(iii) Cr in CrO_5

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20. The equivalent weight of $KMnO_4$ in (a) neutral medium, (b) acidic medium and (c) alkaline medium is $M/..$ (where M is mol.wt. of $KMnO_4$)

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21. Complete the chemical reactions :

(i) $MnO_4^- + SO_2 + H^+ \rightarrow$

(ii) $S_2O_3^{2-} + Cr_2O_7^{2-} + H^+ \rightarrow$

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22. What is the shape of chromate ion ?

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23. In chromyl chloride test orange red vapours are obtained. These are due to.....

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24. Which out of the two ,$La(OH)_3$ and $Lu(OH)_3$, is more basic and why?

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25. Most stable oxidation state of Lanthanoids

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26. How many unpaired electrons are present in Gd(Z = 64) ?

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27. Name the actinoid used for the manufacture of fine rods for atomic reactors.

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28. Arrange Ce^{3+} (Z = 58), $Sm^{3+}(Z = 62)$ and Yb^{3+} (Z = 70) in decreasing order of ionic radii.

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29. Name the basic cause of similar atomic radii of Hf and Zr.

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30. Does actinoids show actinoid contraction similar to lanthanoid contraction ?

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31. Name the trivalent lanthanoid having the configuration [Xe]$4f^7$

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32. Which of the following ion is colourless?

U^{3+}, Cm^{4+}, Th^{4+}

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33. Name two tripositive lanthanoid ions which are colourless.

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Conceptual Question

1. Why Cu, Ag and Au are transition elementsm although they have completely filled d-orbititals ?

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2. Ions of Zn^{2+} and Ti^{4+} are colourless while Cu^{2+} and Ni^{2+} are coloured. Why?

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3. (a) of the ions Ag^{+}, Co^{2+} and Ti^{+}, which one will be coloured in aqueous solution? (Atomic no. s: Ag=47,Co=27,Ti=22)

(b) If each ore each one of the above ionic species is in turn placed in a magnetic field, how will it respond and why?

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4. Which of the following exhibits the greatest number of oxidation states ?

(i) Zr (ii) Ti (iii) V (iv) Ni (v) Mn.

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5. Out of cobalt and zinc salts, which is attracted in a magnetic field. Explain with reasons.

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6. Which divalent metal ion has maximum paramagnetic character among the first transition metals? Why?

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7. Giving reasons indicate which one of the following would be coloured ?

Cu^+, V^{2+}, Sc^{3+}, Ni^{2+} (At. no. of Cu = 29, V = 23, Sc = 21, Ni = 28)

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8. Why are the ionisation energies of 5d elements greater than 3d elements?

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9. K_2PtCl_6 compound whereas corresponding Ni compound is not known. Explain?

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10. The standard reduction potentials of Co^{2+} and Co^{3+} are -0.28 V and 1.8 V respectively. Which should be a better oxidising agent in water:

Co^{2+} or Co^{3+} ?

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11. The sum of IE_1 and IE_2 and those of IE_3 and IE_4 in $\left(kJmol^{-1}\right)$ of Ni and Pt are :

	$(IE_1 + IE_2)$	$(IE_3 + IE_4)$	Total
Ni	2.5×10^3	8.8×10^3	11.3×10^3
Pt	2.7×10^3	6.7×10^3	9.4×10^3

a. What is the most common oxidation state (O.S.) of Ni and Pt.

b. Name of the metal (Nior Pt) which can more easily form compounds in its $+4$ O.S.

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12. Which of the two ferrous or ferric ion has larger magnetic moment and why?

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13. which metal in the first series of transition metals exhibits +1 oxidation state most frequently and why?

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14. Name the following:

(i) Divalent ion of first transition series having maximum magnetic moment.

(ii) Coloured ion out of Cu^{+} or Cu^{2+}

(iii) Two ions of first transition series having zero magnetic moment.

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15. The melting and boiling points of Zn, Cd and Hg are low. Why?

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16. What may be the stable oxidation state of the transition element with the following d electron configurations in the ground state of their atoms : $3d^3 3d^5 3d^8$ and $3d^4$?

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17. Name the transition element which does not exhibit variable oxidation states .

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

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19. How would you account for the increasing oxidising power in the series $VO_2^{\oplus} < Cr_2O_7^{2-} < MnO_4^{\ominus}$?

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20. On the basis of the standard electroe potential values stated for acid solution, predict whether, Ti^{4+} species may be used to oxidise Fe^{II} to Fe^{III}. Given.

$Ti^{4+} +_{e}^{-} \rightarrow Ti^{3+}, E^{É\,\mu} = +0.01V, Fe^{3+} + e^{-} \rightarrow Fe^{2+}, E^{É\,\mu} = +0.$

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21. Chromium is a typical hard metal while mercury is a liquid.

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22. Silver is a transition metal but zinc is not.

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23. The magnetic moments of few transition metal ions are given below :

Metal ion:	Sc^{3+}	Cr^{2+}	Ni^{2+}	Ti^{3+}
Megnetic moment (BM):	0.00	4.90	2.84	1.73

(at no. Sc=21, Ti =22, Cr=24,Ni =28)

Which of the given metals ions:

(i) has the maximum number of unpaired electrons ?

(ii) forms colourless aqueous solution ?

(iii) exhibits most stable +3 oxidation state ?

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24. (i) On the basis of the standard electrode potential values stated for acid solutions, predict whether Ti^{4+} species may be used to oxidise Fe(II) to Fe(III)

$Ti^{4+} + e^- \rightarrow Ti^{3+} \quad E^\circ = +0.01V$

$Fe^{3+} + e^- \rightarrow Fe^{2+} \quad E^\circ = +0.77V$

(ii) Based on the data arrange Fe^{3+}, Mn^{2+} and Cr^{2+} in the increasing order of stability of +2 oxidation state. (Give a brief reason)

$E^\circ_{Cr^{3+}/Cr^{2+}} = -0.4V$

$E^{\circ}_{Mn^{3+}/Mn^{2+}} = +1.5V$

$E^{\circ}_{Fe^{3+}/Fe^{2+}} = +0.8V$

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25. (a) Why do transition elements show variable oxidation states?

(i) Name the element showing maximum number of oxidation states among the first series of transition metals from Sc (Z = 21) to Zn (Z = 30).

(ii) Name the element which shows only + 3 oxidation state.

(b) What is lanthanoid contraction? Name an important alloy which contains some of the lanthanoid metals.

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26. When MnO_2 is fused with KOH in the presence of KNO_3 as an oxidising agent, it gives a dark green compound (A). Compound (A) disproportionates in acidic solution to give purple compound (B). An alkaline solution of compound (B) oxidises KI to compound (C) whereas acidified solution of compound (B) oxidises KI to (D). Identify A, B, C and D.

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27. (a) Write a metal oxide compound for manganese in each of the following oxidation states: +2, +3, +4, + 6, +7

(b) List these metal oxides in the decreasing acidic character.

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28. How many water molecules are involved in coordination in $CuSO_4.5H_2O$?

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29. Work out the following using chemical equation.

In moist air, copper corrodes to produce a green layer on the surface?

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30. What is the most common form of chromium in basic solution ? What ion forms when a basic solution of chromium is acidified ?

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31. Explain how the colour of $K_2Cr_2O_7$ solution depends on pH of the solution.

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32. Name the oxometal anions of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number.

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33. Complete the following reactions :

(i) $Cr_2O_7^{2-} + Sn^{2+} + H^+ \rightarrow$

(ii) $MnO_4^- + Fe^{2+} + H^+ \rightarrow$

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34. Sodium chloride when heated with conc. H_2SO_4 and solid potassium dichromate gives

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35. Give reasons for following in one or two sentences:

CrO_3 is an acid anhydride?

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36. Complete the following chemical equations :

(i) $KMnO_4 \xrightarrow{513K}$

(ii) $MnO_2 + KOH + O_2 \rightarrow$

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37. Why $KMnO_4$ is used in cleaning surgical instruments in hospitals ?

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38. Identify the oxoanion of chromium which is stable in acidic medium

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39. In the transition series, starting from lanthanum $La(Z = 57)$, the next element hafnium $Hf(Z = 72)$ has an atomic number of 72. Why do we observe this jump in atomic number?

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40. One among the lanthanoides, $Ce(III)$, can be easily oxidized to $Ce(IV)$ (At.No. of Ce=58) explain why?

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41. Why do Zr and Hf exhibit similar properties ?

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42. What are the different oxidation states exhibited by the lanthanoids?

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43. What is the basic difference between the electronic configuration of transition and inner transition elements?

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44. The trivalent ion having size in lanthanide series is

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45. Give one example each of lanthanoid ion having +2, +3 and +4 oxidation states.

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46. Can lanthanum ion (Z = 57) exist in +4 oxidation state ? Justify your answer.

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47. Why is chemistry of all lanthanoids identical ?

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48. Why is europium (II) more stable than cerium (II) ?

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49. What are alloys? Name an important alloy which contains some of the lanthanoid metals . Mention its uses.

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Ncert File Intext Question

1. Silver atom has completely filled d orbitals $\left(4d^{10}\right)$ in its ground state. How can you say it is a transition element?

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2. In the series $Sc(Z=21)$ to $Zn(Z=30)$ the enthalpy of atomisation of zinc is the lowest, i.e., 126 kJ mol^{-1}. Why?

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3. Which of the 3d series of the transition metals exhibits the largest number of oxidation states and why?

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4. The $E^0\left(M^{2+}/M\right)$ value for copper is positive $(+0.34V)$. What is possibly the reason for this?

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5. How would you account for the irregular of ionisation enthalpies (first) in the first series of the transition elements?

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6. Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only?

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7. Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why?

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8. Calculate the spin only magentic moment of M^{2+} ion $(Z = 27)$.

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9. Explain why Cu^{+} ion is not stable in aqueous solution ?

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10. Actinoid contraction is greater from element to element than lanthanoid contraction Why?

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Ncert File Textbook Exercise

1. Write down the electronic configuration of :

(a) Cr^{3+}

(b) Cu^{+}

(c) Co^{2+}

(d) Mn^{2+}

(e) Pm^{3+}

(f) Ce^{4+}

(g) Lu^{2+}

(h) Th^{4+}

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2. Why arre Mn^{2+} compounds more stable than Fe^{2+} toward oxidation to their $+3$ state?

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3. Explain briefly how $+2$ state become more and stable in the first half of the first row transition elements with increasing atomic number?

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4. To what extent do the electronic configurations, decide the stability of oxidation states in the first series of the transition elements? Illustrate your answer with examples.

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5. What may be the stable oxidation state of the transition element with the following d electron configurations in the ground state of their atoms : $3d^3$, $3d^5$, $3d^8$and $3d^4$?

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6. Name the oxometal anions of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number.

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7. What is lanthanoid contraction? What are the consequences of lanthanold contraction?

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8. What are the characteristics of th transition elements and why are they called transition elements? Which of the d-block elements may not be regarded as the transition elements?

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9. In What way is the electronic configuration of the transition elements different from the of the non-transition elements?

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10. What are the different oxidation states exhibited by the lanthanoids?

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11. Explain giving reason:

(a) Transition metals and many of their compounds show paramagnetic behaviour.

(b) The enthalpies of atomisation of the transition metals are high.

(c). The transition metals gnerally form coloured compounds.

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12. What are interstitial compounds? Why are such compounds well known for the transition metals?

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13. How is the variability in oxidation states fo transition metals different from that of the non transition metaals?

Illustrate with examples.

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14. Describe the preparation of potassium dichromate from iron chromite ore.What is the effect of increasing pH on a solution of potassium dichromate?

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15. Describe the oxidising action of potassium dichromate and write the ionic equations of reaction with:

(i). Iodide

(ii). Iron (II) solution and

(III). H_2S

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16. Describe the preparation of potassium permanganate. How does the acidified permanganate solution react with (i) iron(II) ions (ii) SO_2 and (iii) oxalic acid? Write the ionic equations for the reactions.

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17. For M^{2+}/M and M^{3+}/M^{2+} systems the $E^{\ominus}$ values for some metals are as follows:

Cr^{2+}/Cr	$-0.9V$	Cr^{3}/Cr^{2+}	-0.4 V
Mn^{2+}/Mn	$-1.2V$	Mn^{3+}/Mn^{2+}	$+1.5$ V
Fe^{2+}/Fe	$-0.4V$	Fe^{3+}/Fe^{2+}	$+0.8$ V

Use this data to comment upon:

(i) the stability of Fe^{3+} in acid solution as compared to that of Cr^{3+} or Mn^{3+} and

(ii) the ease with which iron can be oxidised as compared to a similar process for either chromium or manganese metal.

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18. Predict which of the followingwill be coloured in aqueous solution? $Ti^{3+}, V^{3+}, Cu^{\oplus}, Sc^{3+}, Mn^{2+}, Fe^{2+}$ and Co^{2+} Give reasons for each.

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19. Compare the stability of +2 oxidation state for the elements of the first transition series.

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20. Compare lanthanoids and actinoids with reference to :

(i) the electronic of atoms

(ii) the oxidation states of elements

(iii) general chemical reactivity of elements.

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21. How would you account for the following:

A) Of the d^4 species Cr^{2+} is strongly reducing while manganese(III) is strongly oxidizing.

B) Cobalt(II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidized.

C) The D^1 configuration is very unstable in ions.

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22. What is meant by 'disproportionation'? Give two examples of disproportionation reaction in aqueous solution.

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23. Which metal in the first series of transition metals exhibits+1 oxidation state most frequently and why?

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24. Calculate the number of unpaired electrons in the following gaseous ion: Mn^{3+}, Cr^{3+}, V^{3+} and Ti^{3+}. Which one of these is the most stable in aqueous solution?

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25. Give examples and suggest reasons for the following features of the transition metals.

The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.

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26. Indicate the steps in the preparation of:

(i). $K_2Cr_2O_7$ from chromite ore.

(ii). $KMnO_4$ from pyrolusite ore

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27. What are alloys? Name an important alloy which contains some of the lanthanoid metals . Mention its uses.

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28. What are inner-transition elements? Decide which of the following atomic number are the numbers of the inner transition elements: $29, 59, 74, 95, 102, 104$

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29. The chemistry of the actinoid elements is not so smooth as that of the lanthanoid. Justify this statement by giving some example from the oxidation state of these elements

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30. Which is the last element in the series of the actinods? Write the electronic configuration of this element. Comment on the possible oxidation state of this element.

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31. Use Hund's rule to derive the electronic configuration of Ce^{3+} ion, and calculatel its magntic moment on the basis of spin-only formula.

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32. Name the member of the lanthanoids series which exhibit+4 oxidation states and those which exhibit+2 oxidation state. Try to correlate this types of behavior with the electronic configuration of these elements.

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33. Compare lanthanoids and actinoids with reference to :

(i) the electronic of atoms

(ii) the oxidation states of elements

(iii) general chemical reactivity of elements.

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34. Write the electronic configuration of the elements with the atomic number 61, 91, 101 and 109.

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35. Compare the general characteristics of the first series of the transition metals with those of the second and third series metals in the respective vertical columns. Give special emphasis on the following points:

(i) electronic configurations

(ii) oxidation states

(iii) ionisation enthalpies and

(iv) atomic sizes.

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36. Write down the number of 3d electrons in each of the following ions : $Ti^{2+}, V^{2+}, Cr^{3+}, Mn^{2+}, Fe^{2+}, Co^{2+}, Ni^{2+}$ and Cu^{2+}. Indicate how would you expect the five 3d orbitals to be occupied for these hydrated ions (octahedral).

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37. Comments on the statement that elements of the first transition series

posses many properties different from those of heavier transition elements.

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38. What can be inferred from the magnetic moment values of the following complex species?

Example	Magnetic moment (BM)
$K_4[Mn(CN)_6]$	2.2
$[Fe(H_2O)_6]^{2+}$	5.3
$K_2[MnCl_4]$	5.9
$K_4[Mn(CN)_6]$	

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Ncert File Exemplar Problem Multiple Choice Question Type I

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

A. Cu (I) 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.

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

Which of these elements will have highest density ?

A. Fe

B. Ni

C. Co

D. Cu

Answer: D

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

A. Ag_2SO_4

B. CuF_2

C. ZnF_2

D. Cu_2Cl_2

Answer: B

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5. On addition of small amoung 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.

A. Mn_2O_7

B. MnO_2

C. $MnSO_4$

D. Mn_2O_3

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.

A. $3d^7$

B. $3d^5$

C. $3d^8$

D. $3d^2$

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 ?

$(i) Cu^{+} \rightarrow Cu^{2+} + Cu$

$(ii) 3MnO_4^{2-} + 4H^{+} \rightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$

$(iii) 2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

$(iv) 2MnO_4^{-} + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^{+}$

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

Watch Video Solution

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

Watch Video Solution

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 amphoteric oxide?

$Mn_2O_7, CrO_2, Cr_2O_3, CrO, V_2O_5, V_2O_4$

A. V_2O_5, Cr_2O_3

B. Mn_2O_7, CrO_3

C. CrO, V_2O_5

D. V_2O_5, V_2O_4

Answer: A

Watch Video Solution

13. Gadolinium belongs to 4f series. It's atomic number is 64. which of the following is the correct electronic configuration of gadolinium ?

A. $[Xe]4f^7 5d^1 6s^2$

B. $[Xe]4f^6 5d^2 6s^2$

C. $[Xe]4f^8 6d^2$

D. $[Xe]4f^9 5s^1$

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 the characteristic properties of interstitial compounds?

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

B. They are very hard

C. They retain metallic conductivity

D. They are chemically very reactive

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

Watch Video Solution

16. $KMnO_4$ acts as on 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

Watch Video Solution

17. Which of the following statements is not correct?

A. Copper liberates hydrogen from acids

B. In its 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

Watch Video Solution

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 HCl not used to make the mdeium 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: D

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Ncert File Exemplar Problem Multiple Choice Question Type Ii

1. Generally transition elements and their salts are coloured due to the presence of unpaired electrons in metal ions. Which of the following compounds are coloured?

A. $KMnO_4$

B. $Ce(SO_4)_2$

C. $TiCl_4$

D. Cu_2Cl_2

Answer: A::B

Watch Video Solution

2. Transition elements show magnetic moment due to spin and orbital motion of electrons. Which of the following metallic ions have almost

same spin only magnetic moment?

A. Co^{2+}

B. Cr^{2+}

C. Mn^{2+}

D. Cr^{3+}

Answer: A::D

Watch Video Solution

3. In the form of dichromate, Cr(VI) is a strong oxidising agent in acidic medium but Mo(VI) in $Mo0_3$ and W(VI) in $W0_3$ are not because

A. Cr (VI) is more stable than Mo (VI) and W (VI)

B. Mo (VI) and W (VI) are more stable than Cr (VI)

C. Higher oxidation states of heavier members of Group-6 of transition series are more stable

D. Lower oxidation states of heavier members of Group-6 of transition series are more stable

Answer: B::C

Watch Video Solution

4. Which of the following actinoids show oxidation states upto +7?

A. Am

B. Pu

C. U

D. Np

Answer: B::D

Watch Video Solution

5. General electronic configuration of actinoids is $(n-2)f^{1-14}(n-1)d^{0-2}ns^2$. Which of the following actinoids have one electron in 6d orbital?

A. U (Atomic no. 92)

B. Np (Atomic no.93)

C. Pu (Atomic no. 94)

D. Am (Atomic no. 95)

Answer: A::B

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6. Which of the following lanthanoids show $+2$ oxidation state besides the characteristic oxidation state +3 of lanthanoids?

A. Ce

B. Eu

C. Yb

D. Ho

Answer: B::C

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7. Which of the following ions show higher spin only magnetic moment value?

A. Ti^{3+}

B. Mn^{2+}

C. Fe^{2+}

D. Co^{3+}

Answer: B::C

Watch Video Solution

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

A. Cr

B. Co

C. Cu

D. Ni

Answer: A::B

Watch Video Solution

9. Which of the following will not act as oxidising agents?

A. CrO_3

B. MoO_3

C. WO_3

D. CrO_4^{2-}

Answer: B::C

Watch Video Solution

10. Although $+3$ is the characteristic oxidation state for lanthanoids but cerium also shows $+4$ oxidation state because

A. it has variable ionisation enthalpy

B. it has a tendency to attain noble gas configuration

C. it has a tendency to attain f^0 configuration

D. it resembles Pb^{4+}

Answer: B::C

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Ncert File Exemplar Problem Short Type Question

1. Why does copper not replace hydrogen from acids?

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2. Why E^{-} values for Mn, Ni and Zn are more negative than expected?

Watch Video Solution

3. Why first ionisation enthalpy of Cr is lower than that of Zn?

Watch Video Solution

4. Transition elements show high melting points. Why?

Watch Video Solution

5. When Cu^{2+} ion is treated with KI, a white precipitate is formed. Explain the reaction with the help of chemical equation.

Watch Video Solution

6. Out of Cu_2Cl_2 and $CuCl_2$, which is more stable and why?

Watch Video Solution

7. When a brown compound of manganese (A) is treated with HCl it gives a gas (B). The gas taken in excess, reacts with NH_3 to give an explosive compound (C). Identify compound A, B and C.

Watch Video Solution

8. Although fluorine is more electronegative than oxygen, but the ability of oxygen to stabilise higher oxidation states exceeds that of fluorine.

Why?

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9. Although Cr^{3+} and Co^{2+} ions have same number of unpaired electrons but the magnetic moment of Cr^{3+} is 3.87 B.M. and that of Co^{2+} is 4.87 B.M. Why ?

Watch Video Solution

10. Ionisation enthalpies of Ce, Pr and Nd are higher than Th, Pa and U. Why?

Watch Video Solution

11. Although Zr belongs to 4d and Hf belongs to 5d transition series but it is quite difficult to separate them, Why?

Watch Video Solution

12. Although +3 oxidation stae is thje characteristic oxidation state of lanthanoids but cerium shows +4 oxidation state also. Why ?

Watch Video Solution

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

Watch Video Solution

14. When orange solution containing $Cr_2O_7^{2-}$ ion is treated with an alkali, a yellow solution is formed and when H^+ ions are added to yellow solution, an orange solution is obtained. Explain why does this happen?

Watch Video Solution

15. A solution of $KMnO_4$ on reduction yields either a colourless solution or a brown precipitate or a green solution depending on pH of the solution. What different stages of the reduction do these represent and how are they carried out?

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16. The second and third rows of transition elements resemble each other much more than they resemble the first row. Explain, why?

Watch Video Solution

17. E^{Θ} of Cu is +0.34V while that of Zn is -0.76 V. Explain.

Watch Video Solution

18. The halides of transition elements become more covalent with increasing oxidation state of the metal. Why?

Watch Video Solution

19. While filling up of electrons in the atomic orbitals, the 4s-orbital is filled before the 3d-orbital but reverse happens during the ionisation of the atom. Explain why ?

Watch Video Solution

20. Reactivity of transition element decreases almost regularly from Sc to Cu. Explain.

Watch Video Solution

Ncert File Exemplar Problem Matching Type Question

1. Match the catalyst given in Column I with the processes given in Column II.

	Column I (Catalyst)		Column II (Process)
A.	Ni in the presence of hydrogen	1.	Ziegler-Natta catalyst
B.	Cu_2Cl_2	2.	Contact process
C.	V_2O_5	3.	Vegetable oil to ghee
D.	Finely divided iron	4.	Sandmeyer reaction
E.	$TiCl_4 + Al(CH_3)_3$	5.	Haber's process
		6.	Decomposition of $KClO_3$

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2. Match the compounds/elements given in Column I with uses given in Column II.

	Compound /Element	Use
A.	Lanthanoid oxide	Television screen
B.	Lanthanoid	Production of iron alloy
C.	Misch metall	Lanthanoid metal + iron
D.	Magnesium based alloy is constitute of	Bullets
E	Mixed oxides of lanthanoids are employed	Petroleum cracking

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3. Match the properties given in column I with the metals given in column II

Column I (Property)	Column II (Metal)
(*a*) An element which can show +8 oxidation state	(*i*) Mn
(*b*) *3d* block element that can show upto +7 oxidation state	(*ii*) Cr (*iii*) Os
(*c*) *3d* block element with highest melting point	(*iv*) Fe

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4. Match the statements given in Column I with the oxidation states given in Column II.

	Column I		Column II
A.	Oxidation state of Mn in MnO_2 is	1.	+2
B.	Most stable oxidation state of Mn is	2.	+3
C.	Most stable oxidation state of Mn in oxides is	3.	+4
D.	Characteristic oxidation state of lanthanoids is	4.	+5
		5.	+7

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5. Match the solution given in column I and the colours given in column II

Column I (Aqueous solution of salt)	Column II (Colour)
(*a*) $FeSO_4.7H_2O$	(*i*) Green
(*b*) $NiCl_2.4H_2O$	(*ii*) Light pink
(*c*) $MnCl_2.4H_2O$	(*iii*) Blue
(*d*) $CoCl_2.6H_2O$	(*iv*) Pale green
(*e*) Cu_2Cl_2	(*v*) Pink
	(*vi*) Colourless

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6. Match the properties given in column I with the element given in column II

Column I (Property)	Column II (Element)
(*a*) Lanthanoid which shows +4 oxidation state	(*i*) Pm
(*b*) Lanthanoid which can show +2 oxidation state	(*ii*) Ce
(*c*) Radioactive lanthanoid	(*iii*) Lu
(*d*) Lanthanoid which has $4f^7$ electronic configuration in +3 oxidation state	(*iv*) Eu
(*e*) Lanthanoid which has $4f^{14}$ electronic configuration in +3 oxidation state	(*v*) Gd
	(*vi*) Dy

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7. Match the properties given in column I with the metals given in column II

Column I (Property)	Column II (Metal)
(a) Element with highest second ionisation enthalpy	(i) Co
(b) Element with highest third ionisation enthalpy	(ii) Cr
(c) M in $M(CO)_6$ is	(iii) Cu
(d) Element with highest heat of atomisation	(iv) Zn
	(v) Ni

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Ncert File Exemplar Problem Assertion And Reason Type Question

1. Assertion (A) $Cu(II)$ iodide is not known.

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

A. Both assertion and reason are true, and reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is not true but reason is true.

D. Both assertion and reason are false.

Answer: A

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2. Assertion (A) Separation of Zr and Hf is difficult.

Reason (R) Because Zr and Hf lie in the same group of the Periodic Table.

A. Both assertion and reason are true, and reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is not true but reason is true.

D. Both assertion and reason are false.

Answer: B

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3. Assertion (A) Actinoids form relatively less stable complexes as compared to lanthanoids.

Reason (R) Actinoids can utilise their 5f orbitals alongwith 6d orbitals in bonding but lanthanoids do not use their 4f orbital for bonding.

A. Both assertion and reason are true, and reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is not true but reason is true.

D. Both assertion and reason are false.

Answer: C

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4. Assertion (A) Cu cannot liberate hydrogen from acids.

Reason (R) Because it has positive electrode potential.

A. Both assertion and reason are true, and reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is not true but reason is true.

D. Both assertion and reason are false.

Answer: A

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5. Assertion (A): The highest oxidation state of osmium is $+8$.

Reason (R): Osmium is a 5d-block element.

A. Both assertion and reason are true, and reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is not true but reason is true.

D. Both assertion and reason are false.

Answer: B

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Quick Memory Test A Say True False

1. Mn_2O_7 is a basic oxide.

Watch Video Solution

2. $KMnO_4$ is coloured because maganese in $KMnO_4$ can udergo d -d transitions.

Watch Video Solution

3. Ni (II) compounds are thermodynamically more stable with Pt(II) compounds.

Watch Video Solution

4. Both La^{3+} and Lu^{3+} are diamagnetic .

Watch Video Solution

5. Lanthanide compounds are less basic than actinide compounds.

Watch Video Solution

6. Lanthanoids in +4 oxidation state act as good oxidising agents.

Watch Video Solution

7. In $Cr_2O_7^{2-}$ all Cr-O bonds are equivalent.

Watch Video Solution

8. Ti (III) compounds are coloured while Ti (IV) compounds are colourless.

Watch Video Solution

9. Give reasons in two or three sentences only for the following

The species $[CuCl_4]^{2-}$ exists, while $[CuI_4]^{2-}$ does not .

Watch Video Solution

10. The oxidation state of Cr in CrO_5 is:

Watch Video Solution

Quick Memory Test B Complete The Missing Links

1. In Cro_4^{2-} ion, Cr is ..... hybridised.

Watch Video Solution

2. General electronic configuration of transition metals is

Watch Video Solution

3. Which is the most common oxidation state exhibited by lanthanoids ?

Watch Video Solution

4. The highest oxidation state exhibited by a transition elements is _____.

Watch Video Solution

5. The chromate ion in acidic medium changes to _____

Watch Video Solution

6. The formula of chromite is .....

Watch Video Solution

7. The most abundant transition metal in earth crust is :

Watch Video Solution

8. The spin only magnetic moment for ion having d^8 electronic configuration is ..... B.M.

Watch Video Solution

9. When $K_2Cr_2o_7$ is heated to red hot the products are ....., ... and .....

Watch Video Solution

10. The reaction of NaCl and $K_2Cr_2O_7$ with conc. H_2SO_4 results in the formation of

Watch Video Solution

11. The most common mineral containing lanthanoids is.....

Watch Video Solution

12. In the following transition metals, the maximum number of oxidation states are exhibited by

Watch Video Solution

13. The theoretical magnetic moment of Ti^{3+} ion is ..... B.M.

Watch Video Solution

14. In acidic medium, equivalent weight of $K_2Cr_2O_7$ (molecular weight $= M$) is

Watch Video Solution

15. CrO_3 is an acidic hydride of .....

Watch Video Solution

16. Two lanthanoids ..... and ..... show +4 oxidation states.

Watch Video Solution

17. Write the formula and IUPAC name of prussian blue.

Watch Video Solution

18. The actinoid used for manufacture of fine rods for atomic reactors is .....

Watch Video Solution

19. The last ement in actinide series is

Watch Video Solution

Quick Memory Test C Choose The Correct Alternative

1. The most common oxidation states of cerium are

Watch Video Solution

2. Lanthanoid compounds in general are less/more basic than actinoid compounds.

Watch Video Solution

3. NO_2^- is oxidised to N_2 / NO_3^- by acidified $KMnO_4$

Watch Video Solution

4. As we proceed from $La(OH)_3$ to $Lu(OH)_3$ basic strength increases / decreases.

View Text Solution

View Text Solution

5. Misch metal alloy contains about 95% lanthanoid/actinoid metais.

Watch Video Solution

6. Baeyer's reagent is an alkaline $KMnO_4$/alkaline$K_2Cr_2O_7$ solution.

Watch Video Solution

7. Ionic radius of Ce^{3+} (Z = 58) is less/more than that of Yb^{3+} (Z = 70).

Watch Video Solution

8. The number of unpaired electrons in gadolinium (Z=64) is :

Watch Video Solution

9. Colour of acidic $K_2Cr_2O_7$ solution is orange/yellow.

Watch Video Solution

10. Mn_2O_3 is acidic/basic oxide.

Watch Video Solution

11. Pt^{4+} is less / more stable than Ni^{4+} .

Watch Video Solution

12. Density of Mn is more/ less than Fe.

Watch Video Solution

Revision Exercises Objective Question Multiple Choice Question

1. The element of first transition series which shows maximum number of oxidation states is

A. Mn

B. Cr

C. Fe

D. Cu

Answer: A

Watch Video Solution

2. Number of unpaired electrons in Fe^{3+} (Z = 26) is

A. 4

B. 5

C. 3

D. 2

Answer: B

Watch Video Solution

3. Which of the following has tendency to act as an oxidising agent?

A. Ce^{4+}

B. Sm^{2+}

C. Lu^{3+}

D. Gd^{3+}

Answer: A

Watch Video Solution

4. $KMnO_4$ on heating gives

A. K_2MnO_4, Mn_2O_3

B. K_2MnO_4, MnO, O_2

C. K_2MnO_4, MnO_2, O_2

D. K_2MnO_4, MnO_2, O_3

Answer: C

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

A. I_2

B. IO_3^-

C. IO_4^-

D. I^+

Answer: B

Watch Video Solution

6. The colour of light absobed by an aqueous solution of $CuSO_4$ is

A. Violet

B. Orange red

C. Blue green

D. Yellow

Answer: B

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7. Which transition metal can show highest oxidation state ?

A. Sc

B. Ti

C. Os

D. Zn

Answer: C

Watch Video Solution

8. Which of the following is not an actinoid ?

A. Cerium

B. Californium

C. Uranium

D. Terbium

Answer: D

Watch Video Solution

9. Which of the following would be diamagnetic ?

A. Cu^{2+}

B. Ni^{2+}

C. Cd^{2+}

D. Ti^{3+}

Answer: C

Watch Video Solution

10. Misch metal is an alloy of

A. La

B. Th

C. Ac

D. none of these

Answer: A

Watch Video Solution

11. Maximum magnetic moment is shown by

A. $3d^8$

B. $3d^7$

C. $3d^9$

D. $3d^5$

Answer: D

Watch Video Solution

12. Maximum oxidation number of manganese is in

A. K_2MnO_4

B. MnO_2

C. $KMnO_4$

D. Mn_2O_4

Answer: C

Watch Video Solution

13. Electronic configuration of Fe^{2+} ion is

A. $[Ar]4s^2 3d^4$

B. $[Ar]4s^1 3d^5$

C. $[Ar]3d^6$

D. $[Ar]3d^8$

Answer: C

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14. Electronic configuration of Cr (Z = 24) is

A. $3d^4 4s^2$

B. $3d^6 4s^0$

C. $3d^5 4s^1$

D. none of these

Answer: C

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15. Increasing order of paramagnetism is

A. $Cu^{2+}, Co^{2+}, Mn^{2+}, Ni^{2+}$

B. $Co^{2+}, Cu^{2+}, Mn^{2+}, Ni^{2+}$

C. $Cu^{2+}, Ni^{2+}, Co^{2+}, Mn^{2+}$

D. $Mn^{2+}, Co^{2+}, Ni^{2+}, Cu^{2+}$

Answer: C

Watch Video Solution

16. Copper sulphate dissolved in excess of KCN to give:-

A. $\left[Cu(CN)_4\right]^{3-}$

B. $\left[Cu(CN)_4\right]^{2-}$

C. $CuCN$

D. $\left[Cu(CN)_2\right]$

Answer: A

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17. Which of the following is not a lanthanoid element?

A. Cerium

B. Europium

C. Lutetium

D. Thorium

Answer: D

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18. Which is colourless in H_2O ?

A. Ti^{3+}

B. V^{3+}

C. Cr^{3+}

D. Sc^{3+}

Answer: D

Watch Video Solution

19. Which one is coloured ?

A. Cu_2Cl_2

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

C. $\left[Zn(H_2O)_6\right]^{2+}$

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

Answer: C

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20. Which of the following titanium compounds cannot be prepared ? (Atomic No. of Ti = 22)

A. TiO

B. TiO_2

C. K_2TiO_4

D. $TiCl_2$

Answer: D

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21. During oxidation in alkaline medium using $KMnO_4$ the oxidation number of manganese changes from

A. +7 to +2

B. +2 to +7

C. +7 to +4

D. +7 to +5

Answer: C

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Revision Exercises Objective Question Matching Type Question

1. Match the oxide of manganese (column I) with its nature (column II)

Column I	Column II
(*i*) Mn_2O_7 (*ii*) MnO_2	(A) Acidic (B) Basic (C) Amphoteric

A. (i)-(A), (ii)- (C)

B. (i) -(C), (ii)-(B)

C. (i)-(A), (ii)-(B)

D. (i) - (B), (ii)-(C)

Answer: A

Watch Video Solution

2. Match the hydroxide of lanthanoid (column I) with its basic character (column II)

Column I	Column II
(*i*) $Lu(OH)_3$ (*ii*) $La(OH)_3$	(A) most basic (B) least basic (C) neutral

A. (i)-(A), (ii)-(B)

B. (i)-(C), (ii)-(B)

C. (i)-(B), (ii)-(A)

D. (i)-(C), (ii)-(A)

Answer: C

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3. Match the lanthanoid ion (column I) with number of unpaired electrons (column II)

Column I	Column II
(*i*) Pm^{3+} (Z = 61) (*ii*) Sm^{3+} (Z = 62)	(A) 5 (B) 3 (C) 4 (D) 2

A. $(i)-(A), (ii)-(C)$

B. $(i)-(C), (ii)-(A)$

C. $(i)-(B), (ii)-(A)$

D. $(i)-(B), (ii)-(C)$

Answer: B

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4. Match the property (column I) with the element (column II)

Column I	Column II
(*i*) Has highest ionisation enthalpy among first transition series elements	(A) Cr (B) Mn
(*ii*) Has highest melting point among first transition series elements	(C) Fe (D) Ni

A. $(i)-(A),(ii)-(B)$

B. $(i)-(C),(ii)-(A)$

C. $(i)-(D),(ii)-(A)$

D. $(i)-(B),(ii)-(A)$

Answer: D

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Revision Exercises Passage Based Question

1. Potassium permanganate is prepared by fusing pyrolusite with caustic potash in the presence of air or some oxidising agent which gives a green mass. The green mass is then extracted with water and treated with a current of Cl_2 to form potassium permanganate. In the laboratory, it is prepared by oxidising a manganese (II) salt by peroxosulphate. It acts as an oxidising agent in neutral, alkaline or acidic solutions.

Name the green mass obtained by heating pyrolusite with KOH in the presence of air and its reaction equation.

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2. Potassium permanganate is prepared by fusing pyrolusite with caustic potash in the presence of air or some oxidising agent which gives a green mass. The green mass is then extracted with water and treated with a current of Cl_2 to form potassium permanganate. In the laboratory, it is prepared by oxidising a manganese (II) salt by peroxosulphate. It acts as

an oxidising agent in neutral, alkaline or acidic solutions.

Name two oxidising agents which can be used in place of air for the above reaction.

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3. Potassium permanganate is prepared by fusing pyrolusite with caustic potash in the presence of air or some oxidising agent which gives a green mass. The green mass is then extracted with water and treated with a current of Cl_2 to form potassium permanganate. In the laboratory, it is prepared by oxidising a manganese (II) salt by peroxosulphate. It acts as an oxidising agent in neutral, alkaline or acidic solutions.

Write the disproportionation reaction of manganate ion in acidic medium.

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4. Potassium permanganate is prepared by fusing pyrolusite with caustic potash in the presence of air or some oxidising agent which gives a green

mass. The green mass is then extracted with water and treated with a current of Cl_2 to form potassium permanganate. In the laboratory, it is prepared by oxidising a manganese (II) salt by peroxosulphate. It acts as an oxidising agent in neutral, alkaline or acidic solutions.

Give equation and name the product formed when acidified $KMnO_4$ is added to KI solution.

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5. Potassium permanganate is prepared by fusing pyrolusite with caustic potash in the presence of air or some oxidising agent which gives a green mass. The green mass is then extracted with water and treated with a current of Cl_2 to form potassium permanganate. In the laboratory, it is prepared by oxidising a manganese (II) salt by peroxosulphate. It acts as an oxidising agent in neutral, alkaline or acidic solutions.

What type of hybridisation is involved in MnO_4^- ion and what is its structure?

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6. Lanthanoids and actinoids are f-block elements in which the last electron enters the anti-penultimate energy level. The most common oxidation state of lanthanoids is +3, though +2 and +4 oxidation states are exhibited by some of the elements. In lanthanoid series, there is a progressive decrease in atomic and ionic radii, known as lanthanoid contraction. Unlike lanthanoids, actinoids show a large number of oxidation states.

Write the general electronic configuration of lanthanoids.

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7. Lanthanoids and actinoids are f-block elements in which the last electron enters the anti-penultimate energy level. The most common oxidation state of lanthanoids is +3, though +2 and +4 oxidation states are exhibited by some of the elements. In lanthanoid series, there is a progressive decrease in atomic and ionic radii, known as lanthanoid contraction. Unlike lanthanoids, actinoids show a large number of

oxidation states.

Name two lanthanoids which exhibit +2 oxidation state.

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8. Lanthanoids and actinoids are f-block elements in which the last electron enters the anti-penultimate energy level. The most common oxidation state of lanthanoids is +3, though +2 and +4 oxidation states are exhibited by some of the elements. In lanthanoid series, there is a progressive decrease in atomic and ionic radii, known as lanthanoid contraction. Unlike lanthanoids, actinoids show a large number of oxidation states.

Which out of $La(OH)_3$ and $Lu(OH)_3$ is more basic?

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9. Lanthanoids and actinoids are f-block elements in which the last electron enters the anti-penultimate energy level. The most common oxidation state of lanthanoids is +3, though +2 and +4 oxidation states

are exhibited by some of the elements. In lanthanoid series, there is a progressive decrease in atomic and ionic radii, known as lanthanoid contraction. Unlike lanthanoids, actinoids show a large number of oxidation states.

Name an element of lanthanoid series, which is known to show +4 oxidation state. Is it a strong oxidising agent or reducing agent?

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10. Lanthanoids and actinoids are f-block elements in which the last electron enters the anti-penultimate energy level. The most common oxidation state of lanthanoids is +3, though +2 and +4 oxidation states are exhibited by some of the elements. In lanthanoid series, there is a progressive decrease in atomic and ionic radii, known as lanthanoid contraction. Unlike lanthanoids, actinoids show a large number of oxidation states.

Which is the last element of the actinoid series? Write its electronic configuration.

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Revision Exercises Assertion Reason Question

1. Assertion: Tungsten has very high melting point.

Reason: Tungsten is a covalent compound.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: C

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2. Assertion : Cuprous salts are diamagnetic in nature.

Reason : Cu^+ ion has filled 3d-orbitals.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: A

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3. Assertion : Fe^{2+} has 3de electronic configuration.

Reason : Electrons are lost from 4s-orbital to form Fe^{2+} ion.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: A

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4. Assertion : $La(OH)_3$ is more basic than $Lu(OH)_3$.

Reason : Basic character of hydroxides of lanthanoids decrease on moving from La^{3+} to Lu^{3+}

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: A

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5. Assertion : $FeCl_3$ reacts with KCNS to give blood red colouration.

Reason : $FeCl_3$ reacts with KCNS to form potassium ferro-ferricyanide.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: C

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6. Assertion : Sodium chloride used to clear snow on the roads.

Reason : The alkaline solution of potassium dichromate contains CrO_4^{2-} ions.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: D

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7. Assertion : Cu^+ ion is not stable in aqueous solution.

Reason :Cu^+ contains 3d-filled subshell.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: B

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8. Assertion: There is a continuous decrease in size among lanthanoids.

Reason : Lanthanoids show lanthanoid contraction.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: A

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9. Assertion : Lanthanoids show a limited of ixidation states wheres actanoids show a large number of oxidation states.

Reason : Energy gap between $4f$, $5d$ and $6s$ subshells is small wheras that between $5f$, $6d$ and $7s$ subshell is large.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: C

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10. Assertion : E° value of $Mn^{3+} \mid Mn^{2+}$ is more positive than for $Cr^{3+} \mid Cr^{2+}$.

Reason Cr^{3+} is more stable than Cr^{2+} but Mn^{3+} is less stable than Mn^{2+}.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement

Answer: A

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Revision Exercises Very Short Answer Question

1. What is the number of unpaired electrons in

(i) Fe^{3+} $(ii)Cu^{+}$?

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2. Write two examples of mixed oxides and give their equivalent oxides.

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3. The properties of Zr and Hf are similar because

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4. Which metal in the first series of transition metals exhibits+1 oxidation state most frequently and why?

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5. Which is the most common oxidation state exhibited by lanthanoids ?

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6. Give general electronic configuration of f-block elements.

Watch Video Solution

7. Most common oxidation state of actinoids is ..... .

Watch Video Solution

8. What are lanthanoids?

Watch Video Solution

9. What are actinoids?

Watch Video Solution

10. (i) What are transition elements ?

(ii) Why do transition elements show variable oxidation states ?

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11. What is the structure of chromate ion CrO_4^{2-} ?

Watch Video Solution

12. Draw the structure of permanganate ion ?

Watch Video Solution

13. Identify the correct structure of dichromate ion.

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14. Write the formula of an oxo-anion of chromium (Cr) in which it shows the oxidation state equal to its group number

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15. Write the formula of an oxo-anion of Manganese (Mn) in which it shows the oxidation state equal to its group number

Watch Video Solution

16. The oxidation state of Cr in $K_2Cr_2O_7$ is:

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17. $KMnO_4 \xrightarrow{\Delta} ? + MnO_2 + ?$

Watch Video Solution

18. $K_2Cr_2O_7 \xrightarrow{\Delta} ? + ? + ?$

Watch Video Solution

19. Complete the following:

$2MnO_4^-(aq) + 5H_2O_2(aq) \rightarrow 2Mn^{2+} + 8H_2O + \ldots..$

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20. The transition metals exhibit higher enthalphies of atomisation due to :

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21. MnO_4^- and _____are formed by the disproportionation of MnO_4^{2-} in acidic medium.

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22. Most common oxidation state of actinoids is ..... .

Watch Video Solution

23. In the first transition series of elements, which element shows highest oxidation state?

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24. Why are Cd^{2+} salts white ?

Watch Video Solution

25. What is meant by 'lanthanoid contraction'?

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Revision Exercises Short Answer Question

1. (a) What are transition elements ? Which of the d-block elements are not regarded as transition elements ? (b) In what way the electronic configurations of transition elements are different from those of representative elements ?

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2. (a) What is the difference between the electronic structures of transition and inner transition elements ?

(b) Why are f-block elements placed at the bottom of the periodic table? Give the names of the series present in the block.

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3. Give an explanation for each of the following observations :

(i) The gradual decrease in size (actinoid contraction) from element to element is greater among the actinoids than that among the lanthanoids (lanthanoid contraction).

(ii) The greatest number of oxidation states are exhibited by the members in the middle of a transition series.

(iii) With the same d-orbital configuration $\left(d^4\right)$, Cr^{2+} ion is a reducing agent but Mn^{3+} ion is an oxidising agent.

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4. Give reasons for the following:

(a) Transition metals and many of their compounds act as catalysts.

(b) Scandium (Z = 21) does not exhibit variable oxidation state and yet it is regarded as a transition element.

(c) Write the step involved in the preparation of Na_2CrO_4 from chromite ore.

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5. What is lanthanoid contraction? What is its cause and what ar its consequences ?

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6. What are transition elements? Explain the following properties : (a) Variable oxidation state (b) Coloured ion formation

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

(b) Predict which of the following will be coloured in aqueous solution:

$Sc^{3+}, Fe^{3+}, Ti^{4+}, V^{3+}$

(Atomic nos. of Sc, Fe, Ti and V are 21, 26, 22 and 23 respectively)

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8. (a) Explain why Ce^{4+} is a good oxidising agent whereas Sm^{2+} is a good reducing agent.

(b) You are supplied with a concentrated solution of Na_2CrO_4 . How will you obtain $K_2Cr_2O_7$ from this? Write the equation involved.

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9. How would you account for the following ?

(i) With the same d-orbital configuration $\left(d^4\right)Cr^{2+}$ is reducing agent while Mn^{3+} is an oxidizing agent.

(ii) The actinoids exhibits a larger number of oxidation states than the corresponding members in the lanthanoid series.

(iii) Most of the transition metal ions exhibit characteristic in colours in aqueous solutions.

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10. Explain the following observations giving an appropriate reason for each.

(i) The enthalpies of atomization of transition elements are quite high.

(ii) There occurs much more frequent metal-metal bonding in compounds

of heavy transition metals (i.e, 3^{rd} series).

(iii) Mn^{2+} is much more resistant then Fe^{2+} towards oxidation.

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11. Transition elements are 'd-block elements. (i) Write any four characteristic properties of transition elements, (ii) Cr^{2+} and Mn^{3+} have do configuration. But Cr^{3+} is reducing and Mn^{3+} is oxidising. Why?

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12. (a) Why are Zn^{2+} salts white while Cu^{2+} salts are blue ? (b) What is meant by 'disproportionation' ? Write the disproportionation reaction of Cu^{+} in aqueous solution.

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13. (a) How does permanganate solution react with Fe(II) ions? Write balanced ionic equations for the reaction.

(b) Why do transition metals and many of their compounds act as good catalysts?

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14. What are lanthanoids? Give their general electronic configurations. What is lanthanoid contraction?

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15. (a) Why do transition elements show catalytic properties? (b) Calculate equivalent weight of $KMnO_4$ in neutral medium. (c) What is the cause of lanthanoid contraction?

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16. (a) Write down any three similarities between lanthanoids and actinoids. (b) Out of Co^{2+} and Zn^{2+} which will be paramagnetic and why? (c) Draw the structure of permanganate ion.

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17. (a) Define transition elements. Give the general electronic configuration of the transition elements. (b) (i) Name a transition element which does not exhibit variable oxidation state. (ii) Which of the 3d series of transition metals exhibit the largest number of oxidation states? (iii) Give reason why HCl is not used to acidify $KMnO_4$ solution in volumetric determination of Fe^{2+}

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18. (a) Why is the highest oxidation state of a transition metal exhibited in its oxide or fluoride only? (b) Write a balanced chemical equation for

the reaction of acidified $KMnO_4$ with potassium iodide. (c) Name an important alloy of lanthanoid metals.

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19. (a) Why do the transition elements exhibit higher enthalpies of atomization? (b) Draw the structure of $Cr_2O_7^{2-}$ ion. (c) Why is hydrochloric acid not used in potassium permanganate titrations?

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20. (a) Why do Zr and Hf have similar properties? (b) What happens when $K_2Cr_2O_7$ is treated with H_2SO_4 and NaCl solution ? (c) Why do transition metals form alloys easily?

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21. Give the preparation of potassium permanganate from pyrolusite ore.

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22. (a) What happens when $K_2Cr_2O_7$ is heated strongly? (b) Transition elements form complexes easily. Justify. (c) Why 5d transition series elements have higher ionization enthalpies than 4d transition series elements ?

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23. (a) Describe the preparation of potassium dichromate from chromite ore: (b) How does the acidified solution of potassium permanganate react with (i) oxalic acid (ii) iron (II) ions.

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24. (a) What is lanthanoid contraction? What is the cause of lanthanoid contraction? (b) Explain whether Cu^{2+} is paramagnetic or diamagnetic.

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25. (a) Write the electronic configuration of:

$(i)Co^{2+}(27)(ii)Ce^{4+}(58)(iii)Lu^{2+}(71)$. (b) Explain why Cution is not stable in aqueous solution.

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26. (a) What is the cause of lanthanoid contraction? Discuss. (b) What is Misch metal?

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27. When chromite ore $FeCr_2O_4$ is fuse with NaOH in presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl formas an orange colured crystalline compound (C).

(i) Write the formulae of the compounds (A),(B) and (C).

(ii) Write one use of compounds (C).

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28. Complete the following chemical equations :

(i) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow$

(ii) $Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ \rightarrow$

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29. Give reason for the following :

(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine, it shows the highest oxidation state of +4

(ii) Transition metals show variable oxidation states.

(iii) Actinoids show irregularities in their electronic configurations.

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30. (a) Write the structure of $Cr_2O_7^{2-}$ Give two uses of $K_2Cr_2O_7$.

(b) Write note on interstitial compounds.

(c) Compare the chemistry of actinoids with that of lanthanoids with special reference to: (i) Atomic sizes (ii) Chemical reactivity.

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31. (a) Explain the magnetic behaviour of transition metals.

(b) Write the electronic configuration of Ni(28) and Zn(30).

(c) Write the chemical reaction of $KMnO_4$ with: $(i)KI(ii)H_2S(iii)FeSO_4$

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32. Explain :(i) Variable oxidation states of d-block elements (ii) d-block elements form alloys.

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33. (a) Define transition elements. (b) Give general electronic configuration of f-block elements.(c) Most of transition elements are coloured, why? (d) Transition elements show variable oxidation states, why?

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34. Give reason. (a) Cerium (Ce) exhibits +4 oxidation state.(b) Actinoid contraction is greater from element to element than lanthanoid contraction.

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35. Write any three applications of d and f-block elements.

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36. (i) Which of the following are coloured in aqueous solution ? Give reasons :

$V^{3+}, Cu^{+}, Sc^{3+}, Fe^{3+}$

(ii) Which of the following oxides are amphoteric ?

$Mn_2O_7, CrO_3, Cr_2O_3, V_2O_5$.

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37. (i) Explain why most of the Cu(I) compounds are unstable in aqueous solution.

(ii) What happens when MnO_4^{2-} ion is kept in acid medium? Write balanced equation.

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38. (i) What is the most common oxidation state of the actinoids? (ii) Why is Cu_2I_2 colourless ? Calculate the magnetic moment (spin only) value of the trivalent ion of element with atomic number 22.

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39. Zn^{2+} salt are white while Cu^{2+} salts are blue. Assign reason.

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40. Calculate the number of unpaired electrons in Cr^{3+} and V^{3+} ions.

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41. How will you account for the following: (a) Actinoids exhibit more number of oxidation states than lanthanoids. (b) Atomic radii of second and third transition series elements are almost identical.

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42. (i) What are interstitial compounds ? (ii) Transition metals show good catalytic property. Give any two reasons.

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43. (a) Define transition metals. (b) Why do transition metals form coloured complexes ? (c) Give general electronic configuration of f-block elements.

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44. (a) What is lanthanoid contraction and write its consequences ? (b) Draw the structure of dichromate ion.

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45. (a) Why are Zn, Cd and Hg not regarded as transition metals? (b) Why do transition metals form complexes ? (c) Why are Zn^{2+} salts white in colour?

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46. (a) How will you prepare $KMnO_4$ from pyrolusite ore ? (b) Complete the reaction: $KMnO_4 \xrightarrow{\Delta}$

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47. (a) Why do transition metals act as good catalysts? (b) Why do transition metals form alloys ? (c) What are coinage metals ?

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48. (a) Indicate the steps in the preparation of $K_2Cr_2O_7$ from chromite ore. (b) Complete the reaction: $K_2Cr_2O_7 \xrightarrow{\Delta}$

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49. When MnO_2 is fused with KOH in the presence of KNO_2 as an oxidising agent, it gives a dark green compound (A). Compound (A) disproportionates in acidic solution to give purple compound (B). An alkaline solution of compound (B) oxidises KI to compound (C) whereas an acidified solution of compound (B) oxidises KI to (D). Identify (A), (B), (C), and (D).

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50. Give reasons for the following:

(i) Transition elements and their compounds act as catalysts

(ii) E° value for $\left(Mn^{2+} \mid Mn\right)$ is negative whereas for $\left(Cu^{2+} \mid Cu\right)$ is

positive.

(iii) Actinoids show irregularities in their electronic configuration.

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51. Give reasons for the following:

(i) Transition metals form alloys.

(ii) Mn_2O_3 is basic whereas Mn_2O_7 is acidic.

(iii) Eu^{2+} is a strong reducing agent.

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52. How would you account for the following?

(i) Cr^{2+} is reducing in nature while with the same d-orbital configuration $\left(d^{14}\right) Mn^{3+}$ is an oxidising agent.

(ii) In a transition series of metals, the metal which exhibits the greatest number of oxidation states occurs in the middle of the series.

(iii) Metal-metal bonding is more frequent for the 4d and the 5d series of transition metals than for the 3d series.

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53. How would you account for the following ?

(i) Among lanthanoids, Ln (III) compounds are predominant. However, occasionally in solutions or in solid compounds, +2 and +4 ions are also obtained.

(ii) The $E^{\circ}\left(M^{2+} \mid M\right)$ for copper is positive (0.34V). Copper is the only metal in the first series of transition elements showing this behaviour.

(iii) The metallic radii of the third (5d) series of transition metals are nearly the same as those of the corresponding members of the second series.

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54. Explain the following observations: (i) Many of the transition elements are known to form interstitial compounds. (ii) There is a general increase in density from titanium (Z = 22) to copper (Z = 29). (iii) The members of

the actinoid series exhibit a larger number of oxidation states than the corresponding members of the lanthanoid series.

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55. Why do the transition elements have higher enthalpies of atomisation? In 3d series (Sc to Zn), which element has the lowest enthalpy of atomisation and why?

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56. (a) How would you account for the following:

(i) The chemistry of actinoids is more complicated as compared to lanthanoids.

(ii) Transition metals form complex compounds.

(b) Complete the following equation:

$2MnO_4^- + 6H^+ + 5SO_3^{2-} \rightarrow$

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57. Complete and balance the following chemical equations:

$(a) Fe^{2+} + MnO_4^- + H^+ \rightarrow$

$(b) MnO_4^- + H_2O + I^- \rightarrow$

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58. Give reason for the folloiwng :

(a) E°_{value} for Mn^{3+}/Mn^{2+} couple is much more positive than that of Fe^{3+}/Fe^{2+} couple.

(b) Iron has higher enthalpy of atomization then that of copper.

(c) Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.

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Revision Exercises Long Answer Question

1. How do you prepare :

(i) k_2MnO_4 to MnO_2?

(ii) $Na_2Cr_2O_7$ to $NaCrO_4$?

(b) Account for the following :

(i) Mn^{2+} is more stable then Fe^{2+} towards oxidation to + 3 state.

(ii) The enthelpy of atomization is lowest for Zn in 3d series of the transition elements.

(iii) Actinoid elements show wide range of oxidation states.

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2. (i) Name the element of 3d transition series which shows maximum number of oxidation

states. Why does it show so ?

(ii)Which transition metal of 3d series ha positive $E^{\circ}\left(M^{2+}/M\right)$ value and why ?

(iii) Out of Cr^{3+} and Mn^{3+}, which is a stronger oxidizing agent and why ?

(iv) Name a member of the lanthanoid series which is well known to exhibit + 2 oxidation state.

(v) Complete the following equation : $MnO_4^- + 8H^+ + 5e^- \rightarrow$.

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3. (i) Why do lanthanoids have very similar chemical reactivity?

(ii) Why are Mn^{2+} compounds more stable than Fe^{2+} compounds towards oxidation to their +3 oxidation slales?

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4. (i) Why do transition metals form a large number of alloys?

(ii) Write the steps with chemical reactions involved in the preparation of $K_2Cr_2O_7$ from chromite ore.

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5. (a) What is Lanthanoid contraction? Give the cause of lanthanoid contraction. (b) Why do transition metals form many coloured ions?

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6. (a) Out of Cu^+ and V^{2+} which will be coloured and why? (Atomic number of V is 23 and Cu is 29).

(b) Why is + 3 oxidation state of Fe (Z = 26) more stable than its + 2 oxidation state?

(c) Is Au (Z = 79) a transition metal or not? Explain.

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7. (a) Account for the following :

(i) Transition metals form large number of complex compounds

(ii) The lowest oxide of transition metal is basic whereas the highest oxide is amplhoteric or acidic

(iii) E° value for the Mn^{3+}/Mn^{2+} couple is highly positive $(+1.57V)$

as compare to Cr^{3+}/Cr^{2+}

(b) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

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8. (a) (i) How is the variability in oxidation states of transition metals different from that of the p-block elements? (ii) Out of Cu^{+} and Cu^{2+}, which ion is unstable in aqueous solution and why? (iii) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with an alkali. Why?

(b) Chemistry of actinoids is complicated as compared to lanthanoids. Give two reasons.

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9. (i) Give the general electronic configuration of d-block elements, (ii) Silver atom has completely filled d-orbitals $\left(4d^{10}\right)$ in its ground state. Yet, it is considered as transition element. Why? (iii) Cu^{+} ion is not stable in

aqueous solution. Explain. (iv) Actinoids contraction is greater from element to element than lanthanoid contraction. Why?

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10. (i) Which of the first row transition metal exhibit +7 oxidation state? (ii) How would you account for the irregular variation of 1st and 2nd ionisation enthalpies in the 1st series of transition elements ? (iii) What are interstitial compounds ? (iv) Give two uses of potassium permanganate.

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11. (a) Why are Mn^{2+} compounds more stable than Fe^{2+} towards oxidation to their +3 state. (b) What are interstitial compounds ? Why are such compounds well-known for transition metals ? (c) Write electronic configuration of Pm^{3+}

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12. (a) Write ionic equations for the reaction of acidified potassium permanganate with following:

(i) Oxalic acid, (ii) H_2S, (iii) Sulphite ion.

(b) Describe the reactivity of actinoids.

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13. (a) Silver atom has completely filled 'd' orbitals $\left(4d^{10}\right)$ in its ground state. How can you say that it is a transition element ? (b) Actinoids exhibit a large number of oxidation states in comparison to corresponding members of Lanthanoid series. Why?

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14. (a) Members of second and third transition series exhibit similar atomic radii. Explain. (b) Account for the following: (i) Transition metals

and their many compounds act as good catalysts. (ii) Actinoids has greater tendency to form complexes in comparison to Lanthanoids.

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15. (a) Give two differences between Lanthanoids and Actinoids. (b) How many unpaired electrons are present in Fe^{3+} and Zn^{2+} (c) Why is $La(OH)_3$ stronger base while $Lu(OH)_3$ is weaker base?

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16. (a) Give preparation of potassium permanganate $(KMnO_4)$. (b) What is lanthanoid contraction, give its cause. (c) Transition metals show catalytic properties. Explain.

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17. (a) Give reasons for the following :

(i) Mn^{3+} is a good oxidising agent.

(ii) $E^{\circ}_{M2+/M}$ values are not regular for first row transition metals (3d series).

(iii) Although 'F' is more electronegative then 'O', the highest Mn fluoride is MnF_4 whereas the highest oxide is Mn_2O_7.

Complete the following equations :

(ii) $2CrO_4^{2-} + 2H^+ \rightarrow$

(ii) $KMnO_4 \xrightarrow{\text{heat}}$

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18. (a) Why do transition elements show variable oxidation states?

(i) Name the element showing maximum number of oxidation states among the first series of transition metals from Sc (Z = 21) to Zn (Z = 30).

(ii) Name the element which shows only + 3 oxidation state.

(b) What is lanthanoid contraction? Name an important alloy which contains some of the lanthanoid metals.

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19. (a) Complete the following equation :

(i) $CrO_4^{2-} + 2OH \rightarrow$

(ii) $MnO_4^- + 4H^+ + 3e^- \rightarrow$

(b) Account for the following :

(i)Zn is not considered as transition element

(ii) Transition metals form a large number of complexes

(iii) The E° value for the $\frac{Mn^{3+}}{Mn^{2+}}$ couple is much more positive than for $\frac{Cr^{3+}}{Cr^{2+}}$couple.

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20. (i)with reference to structural variability and chemical reactivity write the differences between lanthanoids and actinoids

(ii) Mame a member of the lanthanoid series which is well known to exhibit +4 oxidation state

(iii) Complete the following equation :$MnO_4^- + 8H^+ + 5e^- \rightarrow$

(iv) out of Mn^{3+} and Cr^{3+} which is ore paramagnetic and why? Atomic nos : Mn =25 Cr =24

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21. (a) Account for the following :

(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.

(ii) Cr^{2+} is a strong reducing agent.

(iii) Cu^{2+} salts are coloured while Zn^{2+} salts are white.

(b) Complete the following equations :

(i) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta}$

(ii) $Cr_2O_7^{2-} + 14H^+ 6I^- \rightarrow$

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22. The elements of 3d transition series are given as :

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following :

(i) Write the element which shows maximum number of oxidation states. Give reason.

(ii) Which elements has the highest m.p?

(iii) Which element is a strong oxidizing agent in +3 oxidation state and why ?

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23. (a) Following are the transition metal ions of 3d series:

$Ti^{4+}, V^{2+}, Mn^{3+}, Cr^{3+}$

(Atomic numbers: $Ti = 22, V = 23, Mn = 25, Cr = 24$)

Answer the following:

(i) Which ion is most stable in an aqueous solution and why?

(ii) Which ion is a strong oxidising agent and why?

(iii) Which ion is colourless and why?

(b) Complete the following equations:

(i) $2MnO_4^- + 16H^+ + 5S^- \rightarrow$

(ii) $KMnO_4 \xrightarrow{heat}$

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24. (a) Account for the following:

(i) Manganese shows maximum number of oxidation states in 3d series?

(ii) E° value for $Mn^{3+} \mid Mn^{2+}$ couple is much more positive than that of $Cr^{3+} \mid Cr^{2+}$.

(iii) Ti^{4+} is colourless whereas V^{4+} is coloured in an aqueous solution.

(b) Write the chemical equations for the preparation of $KMnO_4$ from MnO_2. Why does purple colour of acidified permanganate solution decolourise when it oxidise Fe^{2+} to Fe^{3+} .

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Higher Order Thinking Skills

1. Give reasons in two or three sentences only for the following

"The species $[CuCl_4]^{2-}$ exists, while $[CuI_4]^{2-}$ does not" .

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2. The second ionisation enthalpies of both Cr and Cu are higher than those of the next element. Explain.

Watch Video Solution

3. First ionisation energy of copper is higher than those of alkali metals, while second and third ionisation energies are lower. Explain.

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4. Mercurous ion is written as Hg_2^{2+} whereas cuprous ion is written as Cu^+. Explain.

Watch Video Solution

5. In the titration of Fe^{2+} ions with $KMnO_4$ in acidic medium, why is dilute H_2SO_4 used and not dilute HCl?

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6. Why hydrated copper sulphate is blue while anhydrous copper sulphate is white?

Watch Video Solution

7. Which of two : cuprous chloride or cupric chloride is coloured and why?

Watch Video Solution

8. A mixed oxide of iron and chromium, $FeO.\ Cr_2O_3$ is fused with sodium carbonate in the presence of air to form a yellow compound (A). On acidification, the compound (A) forms an orange coloured compound (B) which is a strong oxidising agent. Identify

(i) the compounds (A) and (B)

(ii) write balanced chemical equations for each step.

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9. Calculate the magnetic moment (spin only) of manganese in $K_4\left[Mn(NCS)_6\right]$.

Watch Video Solution

10. $HgCl_2$ and $SnCl_2$ cannot coexist together in an aqueous solution.

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11. In the transition series, starting from lanthanum $La(Z = 57)$, the next element hafnium $Hf(Z = 72)$ has an atomic number of 72. Why do we observe this jump in atomic number?

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12. The 4d and 5d series of transition metals have more frequency metal-metal bonding in their compounds than do the 3d metals. Explain.

Watch Video Solution

13. Between Na^+ and Ag^+ which is stronger Lewis acid and why?

Watch Video Solution

14. Identify A to E. Pyrolusite on heating with KOH in the presence of air gives a dark green compound (A). The solution of (A) on treatment with H_2SO_4 gives a purple coloured compound (B), which gives the following reactions:

(a). KI on reaction with alkaline solution of (B) changes into a compound (C).

(b). The colour of the compound (B) disappears on treatment with the acidic solution of $FeSO_4$.

(c). With conc. H_2SO_4 compound (B) gives (D) which can compose to yield (E) and oxygen.

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15. When a white crystalline compound X is heated with $K_2Cr_2O_7$ and concentrated H_2SO_4 a reddish brown gas A is evolved. On passing A into caustic soda solution, a yellow coloured solution B is obtained. Neutralizing the solution B with acetic acid on subsequent addition of lead acetate, a yellow precipitate C is formed. When X is heated with NaOH solution, a colourless gas is evolved and on passing this gas into K_2HgI_4 , solution, a reddish brown precipitate D is formed. Identify A, B, C, D and X. Write the equations of the reactions involved.

View Text Solution

16. (a) A blackish brown coloured solid 'A' when fused with an alkali metal hydroxide in the presence of air, produces a dark green colored compound 'B' which upon electrolytic oxidation in alkaline medium gives

a dark purple coloured compound 'C'. Identify A,B and C and write the reactions involved.

(b) What happesn when acidic solution of green compound (B) is allowed to stand for sometime? Give the equation involved. What is this type of reaction called ?

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Competition File Multiple Choice Question A Multiple Choice Question With Only One Correct Answer

1. The correct electronic configuration of copper atom is:

A. $[Ar]3d^9 4s^2$

B. $[Ar]3d^{10} 4s^1$

C. $[Ar]3d^8 4s^2$

D. $[Ar]3d^{10} 4s^2$

Answer: B

Watch Video Solution

2. Which of the following ions does not give coloured solution ?

A. Fe^{2+}

B. Zn^{2+}

C. Cr^{3+}

D. Mn^{2+}

Answer: B

Watch Video Solution

3. Which metal has the lowerst melting point?

A. Cs

B. Hg

C. Mn

D. Cu

Answer: B

Watch Video Solution

4. Oxidation number of osmium (Os) in OsO_4 is

A. $+6$

B. $+7$

C. $+5$

D. $+8$

Answer: D

Watch Video Solution

5. The highest oxidation state shown by manganese in its compounds is

A. $+7$

B. $+6$

C. $+5$

D. $+8$

Answer: A

Watch Video Solution

6. The colour of d-block elements is due to:

A. nd-(n + 1)s transition

B. nd-(n + 1)p transition

C. nd-nd transition

D. nd-(n + 1)d transition.

Answer: C

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7. The number of unpaired electron in Ni^{2+} is

A. 0

B. 2

C. 4

D. 8

Answer: B

Watch Video Solution

8. The magnetic moment of a transition metal ion has been found to be 3.87 BM. It is probably

A. Fe^{3+}

B. Ti^{2+}

C. Cr^{3+}

D. Ni^{2+}

Answer: C

Watch Video Solution

9. Which one of the elements with the following outer orbital configuration may exhibit the larger number of oxidation states ?

A. $3d^5 4s^1$

B. $3d^5 4s^2$

C. $3d^2 4s^2$

D. $3d^3 4s^2$

Answer: C

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10. Which of the following has positive $M^{2+}(aq)$ standard reduction electrode potential ?

A. Cu

B. Zn

C. Fe

D. Mn

Answer: A

View Text Solution

11. Which of the following ions has smallest radius?

A. Mn^{2+}

B. Ni^{2+}

C. Ti^{2+}

D. V^{2+}

Answer: B

Watch Video Solution

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

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

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

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

D. CrO_4^{2-}

Answer: D

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13. When potassium dichromate is heated with potassium hydroxide and the solution obtained is acidified, the colour becomes

A. yellow

B. green

C. orange

D. blue

Answer: C

Watch Video Solution

14. In a reaction, K_2MnO_4 is converted into $KMnO_4$. The change in the oxidation number of Mn is :

A. 0

B. $+1$

C. -1

D. $+7$

Answer: B

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15. Mn_3O_4 is a mixed oxide of

A. MnO_2, MnO_3

B. MnO, MnO_2

C. MnO, Mn_2O_3

D. MnO_2, Mn_2O_3

Answer: B

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16. The equivalent weight of $KMnO_4$ in (a) neutral medium, (b) acidic medium and (c) alkaline medium is $M/..$ (where M is mol.wt. of $KMnO_4$)

A. mol. Wt./3

B. mol. Wt./3

C. mol. Wt./2

D. mol. Wt.

Answer: A

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17. Which of the following is an acidic oxide ?

A. Mn_2O_7

B. Mn_3O_4

C. MnO

D. Mn_2O_3

Answer: A

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18. The number of electrons involve in the equation $CrO_4^{2-} \rightarrow Cr_2O_7^{2-}$

Then value of x is equal to

A. OH^-

B. H_2O

C. H^+

D. O_2

Answer: C

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19. The oxidation state of Cr in $Cr_2O_7^{2-}$ is

A. sp^3d

B. sp^3d^2

C. sp^3

D. sp^2

Answer: C

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20. In strongly alkaline medium, MnO_4^-

$MnO_4^- + e^- \rightarrow MnO_4^{2-}$

In this medium, equivalent weight of $KMnO_4$ is reduced as:

A. 31.6

B. 52.67

C. 79

D. 158

Answer: D

Watch Video Solution

21. In acidic medium, equivalent weight of $K_2Cr_2O_7$ (molecular weight $= M$) is

A. M

B. M/2

C. M/3

D. M/6

Answer: D

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22. $(NH_4)_2Cr_2O_7$ (ammonium dichromate) is used in fire works. The green coloured powder blown in air is:

A. CrO_3

B. Cr_2O_3

C. Cr

D. $CrO(O_2)$

Answer: B

Watch Video Solution

23. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is

A. $2/5$

B. $3/5$

C. $4/5$

D. 1

Answer: A

Watch Video Solution

24. Number of electrons transferred in each case when $KMnO_4$ acts as an oxidising agent to give $MnO_2, Mn^2, Mn(OH)_3$ and MnO_4^{2-} are respectively:

A. $3, 5, 4$ and 1

B. $4, 3, 1$ and 5

C. $1, 3, 4$ and 5

D. $5, 4, 3$ and 1

Answer: A

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25. The basic character of the transition metal monoxide follows the order

A. VO gt Cro gt TiO gt FeO

B. CrO gt VO gt FeO gt TiO

C. TiO gt FeO gt VO gt CrO

D. TiO gt VO gt CrO gt FeO.

Answer: D

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26. At pH = 11 , $Cr_2O_7^{2-}$ ion changes to

A. CrO_3

B. CrO_4^{2-}

C. Cr^{3+}

D. CrO_2^{2+}

Answer: B

Watch Video Solution

27. Which of the following is the strongest base ?

A. $Dyl(OH)_3$

B. $La(OH)_3$

C. $Lu(OH)_3$

D. $Yb(OH)_3$

Answer: B

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

A. of diagonal relationship

B. of lanthanoid contraction

C. of actinoid contraction

D. both belong to f-block of elements

Answer: B

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29. The outer electronic configuration of Gd (At.No. 64) is

A. $4f^7 5d^1 6s^2$

B. $4f^8 6s^2$

C. $4f^9 6s^1$

D. $4f^7 5d^2 6s^1$

Answer: A

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30. Choose the stable oxidation states of cerium (Ce).

A. $+4$

B. $+3$

C. $+2$

D. $+5$

Answer: A

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31. In which of the following pairs, the atomic size is almost the same ?

A. La - Ce

B. Nb - Tb

C. Zr - Hf

D. Nb - Zr

Answer: B

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32. The lanthanide contraction is responsible for the fact that

A. Zr and Y have about the same radius

B. Zr and Nb have similar oxidation state

C. Zr and Hf have about the same radius

D. Zr and Zn have the same oxidation state.

Answer: C

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33. The electronic configuration of terbium (IV) (At. No. 65) is

A. $[Xe]4f^5 6s^2$

B. $[Xe]4f^7 6s^0$

C. $[Xe]4f^8 6s^0$

D. $[Xe]4f^7 6s^2$

Answer: B

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34. Which of the following statement is not correct?

A. $La(OH)_3$ is less basic than $Lu(OH)_3$

B. In lanthanoid series, ionic radius decreases from La^{3+} to Lu^{3+} ion.

C. La is actually an element of transition series rather than lanthanoids

D. Atomic radius of Zr and Hf are same because of lanthanoid contraction .

Answer: A

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35. The correct order of ionic radii Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is $(AT.\ No: Y = 39, La = 57, Eu = 63, Lu = 71)$

A. $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$

B. $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$

C. $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$

D. $La^{3+} < Eu^{3+} < Lu^{+} < Y^{3+}$

Answer: B

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Competition File Multiple Choice Question B Multiple Choice Question From Competitive Examination

1. Which one of the elements with the following outer orbital configuration may exhibit the larger number of oxidation states ?

A. $3d^5 4s^1$

B. $3d^5 4s^2$

C. $3d^2 4s^2$

D. $3d^3 4s^2$

Answer: B

Watch Video Solution

2. The correct order of ionic radii Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is $(AT.\ No: Y = 39, La = 57, Eu = 63, Lu = 71)$

A. $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$

B. $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$

C. $La^{3+} < Eu^{3+} < Lu^{+} < Y^{3+}$

D. $Eu^{3+} < La^{3+} < Lu^{3+} < Y^{3+}$

Answer: D

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3. $KMnO_4$ is a strong oxidising agent in acidic medium. To provide acidic medium H_2SO_4 is used instead of HCl. This is because

A. H_2SO_4 is a stronger acid than HCl

B. HCl is oxidized by $KMnO_4$ to Cl_2

C. H_2SO_4 is a dibasic acid

D. rate is faster in the presence of H_2SO_4

Answer: B

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4. Manganese achieves its maximum oxidation state in its compound :

A. $+4$

B. $+5$

C. $+6$

D. $+7$

Answer: D

Watch Video Solution

5. Which of the following ions will exhibit colour in aqueous solution ?

A. $Lu^{3+}(Z=71)$

B. $Sc^{3+}(Z=21)$

C. $La^{3+}(Z=57)$

D. $Ti^{3+}(Z=22)$

Answer: D

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6. Which of the following pairs has the same size ?

A. Zr^+, Hf^{4+}

B. Zn^{2+}, Hf^{4+}

C. Fe^{2+}, Ni^{2+}

D. Zr^{4+}, Ti^{4+}

Answer: A

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7. Among the oxides, $Mn_2O_7(I), V_2O_3(II), V_2O_5(III), CrO(IV)$ and Cr_2O_3(V) the basic oxides are

A. I and II

B. II and III

C. III and IV

D. II and IV

Answer: D

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8. The acidic, basic or amphoteric nature of Mn_2O_7, V_2O_5 and CrO are respectively

A. acidic, acidic and basic

B. basic, amphoteric and acidic

C. acidic, amphoteric and basic

D. acidic, basic and amphoteric

Answer: C

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9. Acidified $K_2Cr_2O_7$ solution turns green when Na_2SO_3 is added to it. This is due to the formation of

A. $Cr_2(SO_4)_3$

B. CrO_4^{2-}

C. $Cr_2(SO_3)_3$

D. $CrSO_4$

Answer: A

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10. For the four successive transition elements (Cr, Mn, Fe, and Co), the stability of $+2$ oxidation state will be there in which of the following order ?

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

A. Mn gt Fe gt Cr gt Co

B. Fe gt Mn gt Co gt Cr

C. Co gt Mn gt Fe gt Cr

D. Cr gt Mn gt Co gt Fe

Answer: A

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11. Which of the following statements is not true ?

A. On passing H_2S through acidified $K_2Cr_2O_7$ solution, a milky colour is observed.

B. $Na_2Cr_2O_7$ is preferred over $K_2Cr_2O_7$ in volumetric analysis.

C. $K_2Cr_2O_7$ solution in acidic medium is orange

D. $K_2Cr_2O_7$ solution becomes yellow on increasing the pH beyond 7.

Answer: B

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12. Which of the following does not give oxygen on heating ?

A. K_2CrO_7

B. $(NH_4)_2Cr_2O_7$

C. $KClO_3$

D. $Zn(ClO_3)_2$

Answer: B

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13. Which of the following lanthanoid ions is diamagnetic ?

(At nos . `Ce = 58 , Sm = 62, Eu = 63 , Yb =70)

A. Eu^{2+}

B. Yb^{2+}

C. Ce^{2+}

D. Sm^{2+}

Answer: B

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14. Reason of lanthanoid contraction is

A. negligible screening effect of 'f'-orbitals

B. increasing nuclear charge

C. decreasing nuclear charge

D. decreasing screening effect.

Answer: A

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15. The reaction of aqueous $KMnO_4$ with H_2O_2 gives

A. Mn^{4+} and O_2

B. Mn^{2+} and O_2

C. Mn^{2+} and O_3

D. Mn^{4+} and MnO_2

Answer: B

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16. Magnetic moment $2.83BM$ is shown by which of the following ions?

A. Ti^{3+}

B. Ni^{2+}

C. Cr^{3+}

D. Mn^{2+}

Answer: B

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17. Among the transition metals of 3d series, that one that has the highest negative M^{2+}/M standard electrode potential is

A. Cr

B. Mn

C. Zn

D. Ni

Answer: C

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18. Gadolinium belongsd to 4f series. It's atomic number is 64. which of the following is the correct electronic configuration of gadolinium ?

A. $[Xe]4f^7 5d^1 6s^2$

B. $[Xe]4f^6 5d^2 6s^2$

C. $[Xe]4f^8 6d^2$

D. $[Xe]4f^{9}5s^{1}$

Answer: A

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19. Because of lanthnoid contraction, which of the following pairs of elements have nearly same atomic radii ? (Number in the parenthesis are atomic numbers)

A. Zr(40) and Hf(72)

B. Zr(40) and Ta(73)

C. Ti(22) and Zr(40)

D. Zr(40) and Nb(41)

Answer: A

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20. The electronic configuration of Eu (Atomic No. 63), Gd (Atomic No. 64) and Tb (Atomic No. 65) are:

A. $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

B. $[Xe]4f^7 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

C. $[Xe]4f^7 6s^2$, $[Xe]4f^8 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

D. $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^5 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

Answer: B

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21. Which one of the following statements related to lanthanons is incorrect ?

A. Europium shows +2 oxidation state

B. The basicity decreases as the ionic radius decreases from Pr to Lu.

C. All the lanthanoids are much more reactive than aluminium.

D. Ce(+4) solutions are widely used as oxidising agent in volumetric analysis.

Answer: C

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22. Name the gas that can readily decolourise acidified $KMnO_4$ solution:

A. SO_2

B. NO_2

C. P_2O_5

D. CO_2

Answer: A

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23. The reason for greater range of oxidation state in actinoids is attributed to:

A. actinoid contraction

B. 5f, 6d and 7s levels having comparable energies

C. 4f and 5d levels being close in energies

D. the radioactive nature of actinoids

Answer: B

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24. Which one of the following ions exhibits d-d transition and paramagnetism as well ?

A. CrO_4^{2-}

B. $Cr_2O_7^{2-}$

C. MnO_4^-

D. MnO_4^{2-}

Answer: D

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25. Match the metal ions given in Column I with the spin magnetic moments of the ions given in Column II and assign the correct code :

	Column I		Column II
1.	Co^{3+}	i.	$\sqrt{8}$ BM
2.	Cr^{3+}	ii.	$\sqrt{35}$ BM
3.	Fe^{3+}	iii.	$\sqrt{3}$ BM
4.	Ni^{2+}	iv.	$\sqrt{24}$ BM
		v.	$\sqrt{15}$ BM

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26. The magnitude and permanganate ions are tetrahedral due to

A. The π-bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese

B. There is no π-bonding

C. The π-bonding involves overlap of p-orbitals of oxygen with p-orbitals of manganese

D. The π-bonding involves overlap of d-orbitals of oxygen with d-orbitals of manganese.

Answer: A

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27. Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl

A. reduces permanganate to Mn^{2+}

B. oxidises oxalic acid to carbon dioxide and water

C. gets oxidised by oxalic acid to chlorine

D. furnishes H^+ ions in addition to those from oxalic acid.

Answer: A

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28. Mark the correct statements(s)

(1) Manganeses exhibits $+7$ oxidation state

(2) Zinc forms coloured ions

(3) $[CoF_6]^{3-}$ is diamagnetic

(4) Sc forms $+4$ oxidation state

(5) Zn exhibits only $+2$ oxidation state

A. 1 and 2

B. 1 and 5

C. 2 and 4

D. 3 and 4

Answer: B

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29. The maximum oxidation state exhibited by actinide ions is

A. $+5$

B. $+4$

C. $+7$

D. $+8$

Answer: C

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30. $KMnO_4$ gets reduced to

A. K_2MnO_4 in neutral medium

B. MnO_2 in acidic medium

C. Mn^{2+} in alkaline medium

D. MnO_2 in neutral medium

Answer: D

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31. The bonds present in the structure of dichromate ion are

A. four equivalent Cr-O bonds only

B. Six equivalent Cr-O bonds are one O-O bond

C. six equivalent Cr-O bonds and one Cr - Cr bond

D. eight equivalent Cr-O bonds

Answer: C

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

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

B. All the members exhibit +3 oxidation state

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

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

Answer: D

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

A. Ferrous compounds are relatively more ionic than the corresponding ferric compounds.

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

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

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

Answer: C

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34. When H_2O_2 is shaken with an acidified solution of $K_2Cr_2O_7$ in the presence of ether , the ethereal layer turns blue due to the formation of

A. Cr_2O_3

B. CrO_4^{2-}

C. $Cr_2(SO_4)_3$

D. CrO_5

Answer: D

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35. Four successive members of the first series of transition metals are listed below. For which one of the of standard potential $\left(E^{\circ}_{M^{2+}/M}\right)$ value has a positive sign ?

A. Co (Z = 27)

B. Cr (Z = 24)

C. Mn (Z = 25)

D. Fe (Z = 26)

Answer: A

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

A. Sc lt Ti lt Cr lt Mn : number of oxidation states

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

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

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

Answer: B

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37. Which series of reactions correctly represents chemical rections related to iron and its compounds ?

A. $Fe \xrightarrow{dil.H_2SO_4} FeSO_4 \xrightarrow{H_2SO_4.O_2} Fe_2(SO_4)_3 \xrightarrow{heat} Fe$

B. $Fe \xrightarrow{O_2, heat} FeO \xrightarrow{dil.H_2SO_4} FeSO_4 \xrightarrow{heat} Fe$

C. $Fe \xrightarrow{Cl_2.heat} FeCl_3 \xrightarrow[air]{heat} FeCl_2 \xrightarrow{Zn} Fe$

D. $Fe \xrightarrow{O_2, heat} Fe_3O_4 \xrightarrow{CO, 600^\circ C} FeO \xrightarrow{CO.700^\circ C} Fe$

Answer: D

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38. The colour of $KMnO_4$ is due to

A. L $\rightarrow$ M charge transfer transition

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

C. $M \rightarrow L$ charge transfer transition

D. d-d transition

Answer: A

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39. Which one of the following ions has same numbr of unpaired electrons as those present in V^{+3} ions?

A. Ti^{3+}

B. Fe^{2+}

C. Ni^{2+}

D. Cr^{3+}

Answer: C

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40. Among the following pairs the maximum, oxidation states is shown by

A. U and Np

B. Np and Pu

C. Pu and Am

D. U and Pa

Answer: B

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41. The atomic number of cerium (Ce) is 58. The correct electronic confguration of Ce^{3+} ions is :

A. $[Xe]4f^1$

B. $[Kr]4f^1$

C. $[Xe]4f^{13}$

D. $[Kr]4d^1$

Answer: A

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42. Choose the wrong statement in the following:

A. TiO_2 is used in the pigment industry

B. MnO_2 is used in dry battery cells

C. V_2O_5 catalyses the oxidation of SO_2 in the manufacture of sulphuric acid

D. The 'silver' UK coins are made of Ag/Ni alloy

Answer: D

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43. In aqueous solution Cr^{2+} is stronger reducing agent than Fe^{2+}. This is because

A. Cr^{2+} ion is more stable than Fe^{2+}

B. Cr^{3+} ion with d configuration has favourable crystal field stabilisation energy

C. Cr^{3+} has half-filled configuration and hence more stable

D. Fe^{3+} in aqueous solution is more stable than Cr^{3+}

Answer: B

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44. The bivalent metal ion having maximum paramagnetic behaviour among the first transition series elements is

A. Mn^{2+}

B. Cu^{2+}

C. Sc^{2+}

D. Cu^{+}

Answer: A

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45. When a brown compound of manganese (A) is treated with HCl it gives a gas (B). The gas taken in excess, reacts with NH_3 to give an explosive compound (C). Identify compound A, B and C.

A. $A = MnO_2, B = Cl_2, C = NCl_3$

B. $A = MnO, B = Cl_2, C = NH_4Cl$

C. $A = Mn_3O_4, B = Cl_2, C = NCl_3$

D. $A = MnO_3, B = Cl_2, C = NCl_2$

Answer: A

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46. Why Mn^{2+} compounds are more stable than Fe^{2+} compounds towards oxidation to their + 3 state ?

A. Mn^{2+} is more stable with high 3rd ionisation energy

B. Mn^{2+} is bigger in size

C. Mn^{+} has completely filled d-orbitals

D. Mn^{2+} does not exist

Answer: A

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47. The correct basicity order of the following lanthanide ions is -

A. $La^{3+} > Lu^{3+} > Ce^{3+} > Eu^{3+}$

B. $Ce^{3+} > Lu^{3+} > Eu^{3+}$

C. $Lu^{3+} > Ce^{3+} > Eu^{3+} > La^{3+}$

D. $La^{3+} > Ce^{3+} > Eu^{3+} > Lu^{3+}$

Answer: D

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48. When MnO_2 is fused with KOH and KNO_3 , a coloured compound is formed. Choose the right compound with the appropriate colour.

A. K_2MnO_4 , green

B. $KMnO_4$ purple

C. Mn_2O_3 , brown

D. Mn_3O_4 black

Answer: A

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49. In the following reaction, ZnO is respectively acting as a/an

(i) $ZnO + Na_2O \rightarrow Na_2ZnO_2$

(ii) $ZnO + CO_2 \rightarrow ZnCO_3$

A. acid and acid

B. acid and base

C. base and acid

D. base and base

Answer: B

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50. Identify the cases(s) where there in change in oxidation number.

A. Acidified solution of CrO_4^{2-}

B. SO_2 gas bubbled through an acidic solution of $Cr_2O_7^{2-}$

C. Alkaline solution of $Cr_2O_7^{2-}$

D. Ammoniacal solution of CrO_4^{2-}

Answer: B

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51. Of the following outer electronic configurations of atoms, the highest oxidation state is achieved by which one of them ?

A. $(n-1)d^8ns^2$

B. $(n-1)d^5ns^2$

C. $(n-1)d^3ns^2$

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

Answer: B

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52. Which of the following pair is an amphoteric oxide ?

A. V_2O_5, Cr_2O_3

B. Mn_2O_7, Cr_2O_3

C. CrO, V_2O_5

D. V_2O_5, Vr_2O_4

Answer: A

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53. $KMnO_4$ acts as on 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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54. Incorrect statement with reference to Ce (Z = 58).

A. Ce^{4+} is a reducing agent.

B. Ce in +3 oxidation state is more stable than in +4.

C. Atomic size of Ce is more than that of Lu.

D. Ce shows common oxidation states of +3 and +4.

Answer: A

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55. When a mixture of solid $NaCl$ and solid $K_2Cr_2O_7$ is heated with concentrated H_2SO_4 deep red vapours are obtained.This is due to the formation of:

A. The vapours give a yellow solution with NaOH

B. The vapours contain CrO_2Cl_2 only

C. The vapours contains CrO_2Cl_2 and Cl_2.

D. The vapours when passed into lead acetate in acetic acid gives a yellow precipitate.

Answer: C

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56. Which of the following statement is wrong?

A. In highest oxidation states, the transition metals show acidic character.

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

C. Metals in highest oxidation states are more stable in oxides than in fluorides.

D. All elements of 3d series exhibit variable oxidation states.

Answer: D

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57. Maximum oxidation state of uranium and plutonium are respectively :

A. $+6$

B. $+4$

C. $+5$

D. $+7$

Answer: D

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58. What is the shape and magnetic nature of permanganate ion?

A. Tetrahedral, diamagnetic

B. Pyramidal, diamagnetic

C. Planar, paramagnetic

D. Tetrahedral, paramagnetic

Answer: A

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59. The highest value of the calculated spin-only magnetic moment (in BM) among all the transition metal complexes is :

A. 5.92

B. 3.87

C. 6.93

D. 4.9

Answer: A

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60. The element that usucally dose NOT show variable oxidation states is :

A. V

B. Ti

C. Sc

D. Cu

Answer: C

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61. $A \xrightarrow{4KOH\,.\,O_2} \underset{\text{green}}{2B} + 2H_2O$

$3B \xrightarrow{4HCl} \underset{\text{purple}}{2C} + MnO_2 + 2H_2O$

$2B \xrightarrow{H_2O,\,KI} 2A + 2KOH + D$

In the above sequence of reactions, A and D respectively, are :

A. KIO_3 and MnO_2

B. KI and K_2MnO_4

C. MnO_2 and $KMnO_4$

D.

Answer: C

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62. Which of the following statements about the interstitial compounds is incorrect?

A. They have high melting points

B. They are chemically reactive

C. They have metallic conductivity

D. They are very hard

Answer: B

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63. Thermal decomposition of a Mn compound (X) at 513 K results in compound Y, MnO_2 and a gaseous product. MnO_2 reacts with NaCl and concentrated H_2SO_4 to give a pungent gas Z. X, Y and Z respectively, are :

A. K_2MnO_4, $KMnO_4$ and SO_2

B. K_2MnO_4, $KMnO_4$ and Cl_2

C. K_3MnO_4, K_2MnO_4 and Cl_2

D. $KMnO_4$, K_2MnO_4 and Cl_2

Answer: D

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64. The correct order of the first ionization enthalpies is :

A. Mn lt Ti lt Zn lt Ni

B. Ti lt Mn lt Ni lt Zn

C. Zn ltNi lt Mn lt Ti

D. Ti lt Mn lt Zn lt Ni

Answer: B

View Text Solution

65. The effect of lanthanoid contraction in the lanthanoid series of elements by and large means :

A. decrease in both atomic and ionic radii

B. increase in atomic radii and decrease in ionic radii

C. increase in both atomic and ionic radii

D. decrease in atomic radii and increase in ionic radii

Answer: A

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66. The maximum number of possible oxidation states of actinoides are shown by:

A. berkelium (Bk) and californium (Cf)

B. nobelium (No) and lawrencium (Lr)

C. actinium (Ac) and thorium (Th)

D. neptunium (Np) and plutonium (Pu)

Answer: D

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67. in $Sc^{3+}, Ti^{2+}, Ti^{3+}, V^{2+}$ increasing order of spin only magnetic moment is:

A. $Sc^{3+} < Ti^{3+} < Ti^{2+} < V^{2+}$

B. $Ti^{3+} < Ti^{2+} < Sc^{3+} < V^{2+}$

C. $Sc^{3+} < Ti^{3+} < V^{2+} < Ti^{2+}$

D. $V^{2+} < Ti^{2+} < Ti^{3+} < Sc^{3+}$

Answer: A

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68. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is:

A. 3

B. 4

C. 5

D. 6

Answer: D

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69. Among the following , the coloured compound is

A. $CuCl$

B. $K_3\left[Cu(CN)_4\right]$

C. CuF_2

D. $\left[Cu(CH_3CN)_4\right]BF_4$

Answer: C

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70. The complex showing a spin -magnetic momnet of $2.82BM$ is .

A. $Ni(CO)_4$

B. $[NiCl_4]^{2-}$

C. $Ni(PPh_3)_4$

D. $\left[Ni(CN)_4\right]^{2-}$

Answer: B

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71. The colour of light absobed by an aqueous solution of $CuSO_4$ is

A. orange-red

B. blue-green

C. yellow

D. violet

Answer: A

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Competition File Multiple Choice Question C Multiple Choice Question With More Than One Correct Answer

1. Which of the following pairs of elements have almost similar atomic radii ?

A. Nb - Ru

B. Zr - Hf

C. Mo - W

D. Pd - Ag

Answer: B::C

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2. Which of the following ions are colourless ?

A. Ti^{3+}

B. Cu^{2+}

C. Cd^{2+}

D. Sc^{3+}

Answer: C::D

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3. Which of the following ions has same number of unpaired electrons as that of V^{3+} ion

A. Ni^{2+}

B. Ti^{3+}

C. V^{3+}

D. Fe^{3+}

Answer: A::C

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4. Which of the following statements is/are 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 +3 state.

D. Cr in $Cr_2O_7^{2-}$ ion involves sp^3d^3 hybridisation

Answer: C::D

View Text Solution

5. Which of the following statements (s) is (are) correct with reference to ferrous and ferric ions

A. Fe^{3+} gives brown colour with potassium ferricyanide

B. Fe^{2+} gives blue precipitate with potassium ferricyanide

C. Fe^{3+} gives red colour with potassium thiocyanate

D. Fe^{2+} gives brown colour with ammonium thiocyanate

Answer: B::C

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6. Reduction of the metal centre in aqueous permanganate ion involves

A. 3 electrons in neutral medium

B. 5 electrons in neutral medium

C. 3 electrons in alkaline medium

D. 5 electrons in acidic medium.

Answer: A::C::D

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

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

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

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

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

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

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

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

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

Answer: A::B::C

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8. Which of the following statements is/are correct, when a mixture of $NaCl$ and $K_2Cr_2O_7$ is gently warmed with concentrated H_2SO_4?

A. A deep red vapour is evolved

B. The vapour when passed through NaOH solution, gives a yellow solution.

C. Chlorine gas is also evolved.

D. Chromyl chloride is formed

Answer: A::B::D

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9. The correct option(s) to distinguish nitrate salts of Mn^{2+} and Cu^{2+} taken separately is (Are)

(1) Mn^{2+} shows the characteristic green colour in the flame test

(2) only Cu^{2+} shows the the formation of precipitate by passing H_2S in acidic medium

(3) only Mn^{2+} shows the formation of precipitate by passing H_2S in faintly basic medium

(4) $Cu^{2+}\left|\text{Cu has higher reduction potential then } Mn^{2+}\right|$ (measured under similar conditions)

A. Mn^{2+} shows the characteristic green colour in the flame test

B. only Cu^{2+} shows the formation of precipitate by passing H_2S in acidic medium

C. only Mn^{2+} shows the formation of precipitate by passing H_2S in faintly basic medium

D. $Cu^{2+} \mid Cu$ has higher reduction potential than $Mn^{2+} \mid Mn$ (measured under similar conditions).

Answer: B::D

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10. Fusion of MnO_2 with KOH in the presence of O_2 produces a salt W. Alkaline solution of W upon electrolytic oxidation yields another salt X. The manganese containing ions present in W and X, respectively, are Y and Z. Correct statement(s) is (are)

A. in both Y and Z, π-bonding occurs between p-orbitals of oxygen and d-orbitals of manganese

B. both Y and Z are coloured and have tetrahedral shape

C. in aqueous acidic solution, Y undergoes disproportionation reaction to give Z and MnO_2

D. Y is diamagnetic in nature while Z is paramagnetic.

Answer: A::B::C

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Competition File Multiple Choice Question D Multiple Choice Question Bases On The Given Passage Comprehension

1. Potassium dichromate acts as a strong oxidising agent in the acidic medium. When heated with a metal chloride and conc. sulphuric acid, it gives orange red fumes. On passing these fumes through sodium hydroxide, it gives a yellow solution (X) and this acidified solution gives yellow precipitate (Y) with lead acetate. On heating potassium dichromate with KOH, it forms a yellow solution (Z) which on acidification changes to orange colour. Acidified solution of dichromate ion gives deep blue colour with H_2O_2 due to the formation of (P)

The orange red fumes obtained on heating potassium dichromate with a metal chloride and conc. H_2SO_4 is due to the formation of

A. CrO_3

B. CrO_5

C. CrO_2Cl_2

D. $CrOCl_2$

Answer: C

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2. Potassium dichromate acts as a strong oxidising agent in the acidic medium. When heated with a metal chloride and conc. sulphuric acid, it gives orange red fumes. On passing these fumes through sodium hydroxide, it gives a yellow solution (X) and this acidified solution gives yellow precipitate (Y) with lead acetate. On heating potassium dichromate with KOH, it forms a yellow solution (Z) which on acidification changes to orange colour. Acidified solution of dichromate ion gives deep

blue colour with H_2O_2 due to the formation of (P)

The yellow solution (X) is

A. K_2CrO_4

B. Na_2CrO_4

C. $CrCl_3$

D. $Cr(OH)_3$

Answer: B

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3. Potassium dichromate acts as a strong oxidising agent in the acidic medium. When heated with a metal chloride and conc. sulphuric acid, it gives orange red fumes. On passing these fumes through sodium hydroxide, it gives a yellow solution (X) and this acidified solution gives yellow precipitate (Y) with lead acetate. On heating potassium dichromate with KOH, it forms a yellow solution (Z) which on acidification changes to orange colour. Acidified solution of dichromate ion gives deep

blue colour with H_2O_2 due to the formation of (P)

The yellow precipitate (Y) corresponds to

A. PbS

B. $PbCO_3$

C. $PbCrO_4$

D. $PbSO_4$

Answer: C

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4. Potassium dichromate acts as a strong oxidising agent in the acidic medium. When heated with a metal chloride and conc. sulphuric acid, it gives orange red fumes. On passing these fumes through sodium hydroxide, it gives a yellow solution (X) and this acidified solution gives yellow precipitate (Y) with lead acetate. On heating potassium dichromate with KOH, it forms a yellow solution (Z) which on acidification changes to orange colour. Acidified solution of dichromate ion gives deep

blue colour with H_2O_2 due to the formation of (P)

The yellow solution (Z) on acidification gives

A. K_2CrO_4

B. $K_2Cr_2O_7$

C. K_2SO_4

D. $(CH_3COO)_2Pb$

Answer: B

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5. Potassium dichromate acts as a strong oxidising agent in the acidic medium. When heated with a metal chloride and conc. sulphuric acid, it gives orange red fumes. On passing these fumes through sodium hydroxide, it gives a yellow solution (X) and this acidified solution gives yellow precipitate (Y) with lead acetate. On heating potassium dichromate with KOH, it forms a yellow solution (Z) which on acidification changes to orange colour. Acidified solution of dichromate ion gives deep

blue colour with H_2O_2 due to the formation of (P)

The oxidation state of Cr in compound P

A. $+10$

B. $+8$

C. $+6$

D. $+5$

Answer: C

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6. Potassium dichromate acts as a strong oxidising agent in the acidic medium. When heated with a metal chloride and conc. sulphuric acid, it gives orange red fumes. On passing these fumes through sodium hydroxide, it gives a yellow solution (X) and this acidified solution gives yellow precipitate (Y) with lead acetate. On heating potassium dichromate with KOH, it forms a yellow solution (Z) which on acidification changes to orange colour. Acidified solution of dichromate ion gives deep

blue colour with H_2O_2 due to the formation of (P)

The blue colour of compound P fades due to the formation of

A. Cr^{3+} and O_2

B. CrO_4^{2-} and Cr^{3+}

C. $Cr_2O_7^{2-}$ and Cr^{3+}

D. CrO_3

Answer: A

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7. The f-block elements are those in which the differentiating electron enters the (n-2)f orbital. There are two series of f-block elements corresponding to filling of 4f and 5f-orbitals called lanthanides and actinides respectively. They show different oxidation states depending upon the stability of f^0, $f^7$and f^{14} configurations, though the principal oxidation state is +3. There is a regular decrease in size of lanthanide ions with increase in atomic number and it is known as lanthanide

contraction. As a result of this, the basic character of oxides and hydroxides decreases from first element (La) to last element (Lu). All the actinides are radioactive and therefore, it is difficult to study their chemical nature.

Terbium has the electronic configuration : `[Xe]5f^(9) 6s^2 . It will show oxidation states of

A. +3, +4

B. +2, +3, +4,

C. +3, +4, +5

D. +2, +3, +4, +5

Answer: A

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8. The f-block elements are those in which the differentiating electron enters the (n-2)f orbital. There are two series of f-block elements corresponding to filling of 4f and 5f-orbitals called lanthanides and

actinides respectively. They show different oxidation states depending upon the stability of f^0, $f^7$and f^{14} configurations, though the principal oxidation state is +3. There is a regular decrease in size of lanthanide ions with increase in atomic number and it is known as lanthanide contraction. As a result of this, the basic character of oxides and hydroxides decreases from first element (La) to last element (Lu). All the actinides are radioactive and therefore, it is difficult to study their chemical nature.

The atomic numbers of three lanthanide elements X,Y and Z are 65,68 and 70 respectively. The basic character of their hydroxides will decrease as

A. X gt Y gt Z

B. X gt Z gt Y

C. Z gt Y gt X

D. Z gt Y gtX

Answer: A

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9. The f-block elements are those in which the differentiating electron enters the (n-2)f orbital. There are two series of f-block elements corresponding to filling of 4f and 5f-orbitals called lanthanides and actinides respectively. They show different oxidation states depending upon the stability of f^0, $f^7$and f^{14} configurations, though the principal oxidation state is +3. There is a regular decrease in size of lanthanide ions with increase in atomic number and it is known as lanthanide contraction. As a result of this, the basic character of oxides and hydroxides decreases from first element (La) to last element (Lu). All the actinides are radioactive and therefore, it is difficult to study their chemical nature.

Ce (Z = 58) and Yb (Z = 70) exhibit stable +4 and +2 oxidation states respectively. This is because

A. Ce^{4+} and Yb^{2+} acquire f^7 configuations

B. Ce^{4+} and Yb^{2+} acquire f^0 configurations

C. Ce^{4+} and Yb^{2+} acquire f^0 and f^{14} configurations

D. Ce^{4+} and Yb^{2+} acquire f^7 and f^{14} configurations

Answer: C

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10. The f-block elements are those in which the differentiating electron enters the (n-2)f orbital. There are two series of f-block elements corresponding to filling of 4f and 5f-orbitals called lanthanides and actinides respectively. They show different oxidation states depending upon the stability of f^0, $f^7$and f^{14} configurations, though the principal oxidation state is +3. There is a regular decrease in size of lanthanide ions with increase in atomic number and it is known as lanthanide contraction. As a result of this, the basic character of oxides and hydroxides decreases from first element (La) to last element (Lu). All the actinides are radioactive and therefore, it is difficult to study their chemical nature.

Which of the following statements is not true ?

A. $La(OH)_3$ is more basic than $Lu(OH)_3$

B. All f-block elements are radioactive in nature

C. The principal oxidation state of lanthanides is +3

D. The size of trivalent lanthanide ions decrease in 4f block series.

Answer: B

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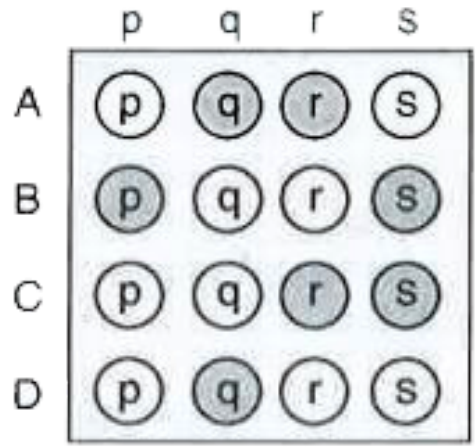
Competition File Multiple Choice Question Matrix Match Type Question

1. Each question contains statements given in two columns, which have to be matched. Statements in Column I are labelled as A, B, C and D whereas statements in Column II are labelled as p, q, r and s. Match the entries of Column I with appropriate entries of Column II. Each entry in Column I may have one or more than one correct option from Column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example. If the correct matches are A-4, A-r, B-p, B-, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



Match the element in column I with the property mentioned in column II

Column I		Column II	
(A)	Actinium	(*p*)	show oxidation state of +4
(B)	Terbium	(*q*)	show oxidation state of +3
(C)	Ytterbium	(*r*)	show oxidation state of +2
(D)	Uranium	(*s*)	are radioactive in nature

A. (q) , (s)

B. (p), (q)

C. (q), (r)

D. (p),(q),(s)

Answer:

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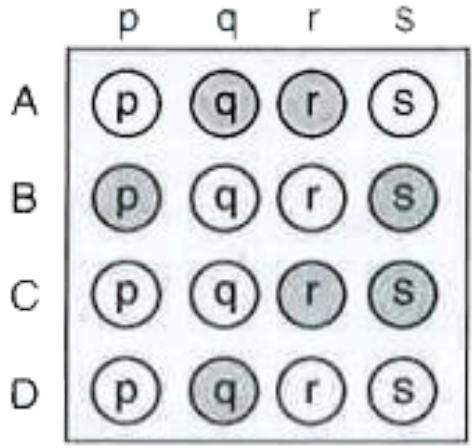
2. Each question contains statements given in two columns, which have to be matched. Statements in Column I are labelled as A, B, C and D whereas statements in Column II are labelled as p, q, r and s. Match the entries of Column I with appropriate entries of Column II. Each entry in Column I may have one or more than one correct option from Column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example. If the correct matches are A-4, A-r, B-p, B-, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



Match the element in column I with the property mentioned in column II

Column I		Column II	
(A)	Uranium	(p)	forms colourless compounds
(B)	Lutetium	(q)	used for making incandescent gas mentles.
(C)	Thorium	(r)	forms oxo ions
(D)	Cerium	(s)	belongs to 5f series

A. (r), (s)

B. (p)

C. (p),(q),(s)

D. (p),(q)

Answer:

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Competition File Integer Type Question

1. Acidified $KMnO_4$ oxidises H_2O_2 to H_2o and O_2 . The coefficient of H_2O_2 in the balanced chemical reaction of $KMnO_4$ with H_2O_2 in the

presence of dil H_2SO_4 is

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2. The number of electrons present in the 4f-subshell of Gd (Z = 64) is

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3. The number of amphoteric oxides among $Cr_2O_3, V_2O_5, CrO, Mn_2O_7, NiO, Fe_2O_3, Mn_3O_4, VO_2, Cu_2O, MnO_2, C$ is

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4. The number of paramagnetic ions among $Ti^{3+}, Cr^{3+}, TI^{4+}, Fe^{2+}, Co^{2+}, Zn^{2+}, Cu^{+}, V^{3+}, Mn^{2+}$ is

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5. The magnetic moment of a transition metal ion is found to be 4.90 BM. The number of unpaired electrons present in the ion is

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

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7. in neutral or faintly alkaline solution, 8 moles of permanganate anion quantitatively oxidize thiosulphate anions to produce X moles of a sulphur containing product. The magnitude of X is

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Unit Practice Test

1. In alkaline medium, $KMnO_4$ oxidises iodide ion to

A. I_2

B. I^+

C. IO_4^-

D. IO_3^-

Answer:

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2. The electronic configuration of gadolinium (At. No 64) is:

A. $[Xe]4f^8 5d^0 6s^2$

B. $[Xe]4f^9 5d^0 6s^1$

C. $[Xe]4f^7 5d^1 6s^2$

D. $[Xe]4f^7 5d^0 6s^2$

Answer:

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3. Identify the product and the colour when MnO_2 is fused with solid KOH in the presence of oxygen (O_2)

A. $KMnO_4$ purple

B. Mn_2O_3 ,brown

C. K_2MnO_4 , green

D. MnO, blue

Answer:

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4. Assertion (A) Separation of Zr and Hf is difficult.

Reason (R) Because Zr and Hf lie in the same group of the Periodic Table.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer:

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5. Assertion: The purple colour of $KMnO_4$ is due to the charge transfer transition.

Reason: Manganese in $KMnO_4$ has +7 oxidation state

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer:

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6. The trivalent ion having size in lanthanide series is

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7. The general electronic configuration of lanthanide is

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8. Indicate the steps in the preparation of:

(i). $K_2Cr_2O_7$ from chromite ore.

(ii). $KMnO_4$ from pyrolusite ore

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9. What is meant by 'disproportionation'? Give two examples of disproportionation reaction in aqueous solution.

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10. Complete the following reaction equations:

$(i) MnO_4^- + Fe^{2+} + H^+ \rightarrow$

$(ii) MnO_4^- + I^- + H_2O \rightarrow$

$(iii) S_2O_3^{2-} + Cr_2O_7^{2-} + H^+ \rightarrow$

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11. Explain the following: (a) Europium (II) is more stable than cerium (II) (b) Zr and Hf exhibit similar properties. (c) Scandium forms no coloured ions, yet it is regarded as a transition metal.

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12. (a) Why do transition metals and their compounds are found to be good catalysts? (b) The 5d series of transition metals have more frequent metal-metal bonding in their compounds than do the 3d and 4d metals. Explain. (c) Why do transition metals form complexes? (d) Explain why Cu^+ ion is not stable in aqueous solution. (e) Why is europium (II) more stable than cerium (II)?

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