



CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

D-AND -F BLOCK ELEMENTS

Ncert In Text Questions

1. Silver atom has completely filled d orbitals ($4d^{10}$) 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 ?

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4. The $E^0(M^{2+} / M)$ 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 magnetic moment of M^{2+} ion ($Z = 27$).

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9. Explain why Cu^+ ion is not stable in aqueous solutions ?

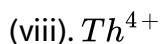
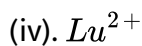
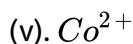
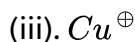
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10. Actinoid contraction is greater from element to element than lanthanoid contraction Why?

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Ncert Exercise

1. Write down the electronic configuration of:



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2. Why are 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 elements with the following d electron configurations in the ground state of their atoms: $3d^3$, $3d^5$, $3d^4$?

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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 lanthanoid contraction?

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8. What are the characteristics of the 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 that 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 with reason.

(a) Transition metal and many of their compounds show paramagnetic

behavior.

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

(c) The transition metals generally 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 of transition metals different from that of the non transition metals?

Illustrate with examples.

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14. Describe the preparation of potassium dichromate from chromite ore.

What is the effect of increasing pH on 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

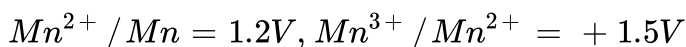
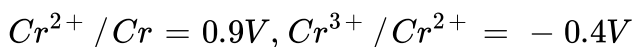
(ii). Iron (II) solution and

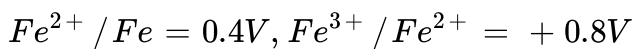
(iii). H_2S



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16. For M^{2+} / M and M^{3+} / M^{2+} system, the E° value of some metals are given :





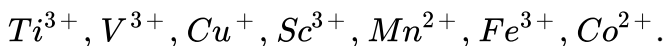
Use this data to comment upon :

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

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

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17. Predict which of the following will be coloured in aqueous solution ?



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18. Compare the chemistry of actinoids with that of the lanthanoids with special reference to:

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19. 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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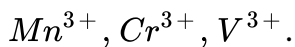
20. What is meant by 'disproportionation'? Give two examples of disproportionation reaction in aqueous solution.

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

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22. Calculate the number of unpaired electrons in the following gaseous ions :



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23. Give examples and suggest reason for the following features of the transition metals Chemistry.

(ii). A transition metal exhibits highest oxidation state in oxides and fluorides.

(iii). The highest oxidation state is exhibited in oxoanions of a metal.

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

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26. 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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27. 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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28. Which is the last element in the series of the actinoids? Write the electronic configuration of this element. Comment on the possible oxidation state of this element.

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

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31. Compare the chemistry of actinoids with that of the lanthanoids with special reference to:

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

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

- (i) electronic configuration
- (ii) oxidation states
- (iii) ionisation enthalpies
- (iv) atomic sizes.

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34. Write down the number of 3d electrons in each of the following ions:

Ti^{2+} , $V(2+)$, Cr^{3+} , Mn^{2+} , Fe^{2+} , Fe^{3+} , 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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35. Comment on the statement that elements of first transition series possess many properties different from those of the heavier transition elements.



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

Example	Magnetic moment (BM)
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$K_4[Mn(CN)_6]$	2.2
-----------------	-----

$[Fe(H_2O)_6]^{2+}$	5.3
---------------------	-----

$K_2[MnCl_4]$	5.9
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Short Answer Type Questions

1. Why does not copper liberate hydrogen from acids. ?

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2. Why E° value of Mn , Ni and Zn are more negative than expected ?

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

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4. Transition elements show high melting points. Why?

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5. Out of Cu_2Cl_2 , which is more stable and why ?

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6. 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 as explosive compound [C]. Identify compound A, B and C.

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

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8. Although fluorine is more electronegative than oxygen, but the ability of oxygen to stabilize 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 ?

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

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

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

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

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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?

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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 element. Explain why ?

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17. E° of Cu is +0.34 V while that of Zn is -0.736 V. Explain.

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

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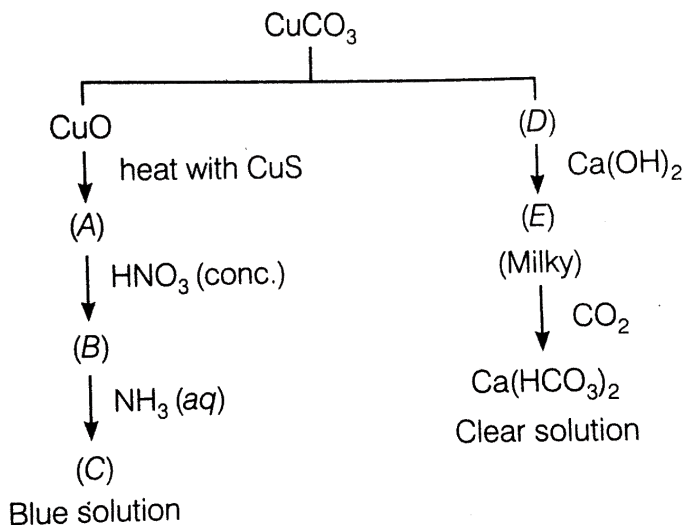
19. While filling up electron in the atomic orbitals, 4s orbital is filled before 3d orbital but reverse happens during the ionisation of the atom. Explain why?

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

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1. Identify A to E and also explain the reaction involved.



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2. When a chromite ore (A) is fused with sodium carbonate in free excess of air and the product is dissolved in water, a yellow solution of compound (B) is obtained. After treatment of this yellow solution with sulphuric acid, compound (C) can be crystallised from the solution. When compound (C) is treated with KCl, orange crystals of compound (D) crystallise out. Identify A to D and also explain the reactions.

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3. When an oxide of manganese (A) is fused with KOH in the presence of an oxidising agent and dissolved in water, it gives a dark green solution of compound (B). Compound (B) disproportionates in neutral or acidic (C)) oxidises potassium iodide solution to a compound (D) and compound (A) is also formed. Identify compounds A to D and also explain the reactions involved.

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4. On the basis of lanthanoid contraction, explain the following:

- (i) Nature of bonding in La_2O_3 and Lu_2O_3 .
- (ii) Trends in the stability of oxo salts of lanthanoids from La to Lu.
- (iii) Stability of the complexes of lanthanoids.
- (iv) Radii of 4d and 5d block elements.
- (v) Trends in acidic character of lanthanoids oxides.

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5. Answer the following questions

(i) Which element of the first transition series has highest second ionisation enthalpy?

(ii) Which element of the first transition series has highest third ionisation enthalpy?

(iii) Which element of the first transition series has lowest enthalpy of atomisation?

(b) Identify the metal and justify your answer.

(i) Carbonyl $M(CO)_5$

(ii) MO_3F



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6. Mention the type of compounds formed when small atoms like H, C and N get trapped inside the crystal lattice of transition metals. Also give physical and chemical characteristics of these compounds.



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7. (a) Transition metals can act as catalysts because these can change their oxidation state. How does Fe (III) catalyse the reaction between iodide and persulphate ions?

(b) Mention any three processes where transition metals act as catalysts.

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8. A violet compound of manganese (A) decomposes on heating to liberate oxygen and compounds (B) and (C) of manganese are formed. Compound (C) reacts with KOH in the presence of potassium nitrate to give compound (B). On heating compound (C) with conc. H_2SO_4 and NaCl, chlorine gas is liberated and a compound (D) of manganese alongwith other products is formed. Identify compounds A to D and also explain the reaction involved.

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Additional Important Question

1. The atomic radii of transition elements in a period are.

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2. The second and third members in each group of the transition elements have similar metallic radii. Assign reason.

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3. Mercury is a liquid metal because

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4. Transition metals of 3d-series do not react readily with dilute acids to liberate hydrogen although they have high negative reduction potential values. Assign reason.



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5. Which of the following element form interstitial compounds?



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6. ZnO is white cold and yellow when heated, it is due to the development of



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7. Calculate equivalent weight of Cu in CuO and Cu_2O . At.wt. of $Cu = 63.6$.



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8. Out of Co^{2+} and Ni^{2+} ions, which has lower magnetic moment ?

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9. Copper (I) is diamagnetic while copper (II) is paramagnetic . Explain.

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

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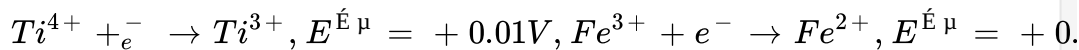
11. Out of Fe^{2+} and Fe^{3+} ions, which is more stable ?

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12. Anhydrous ferric chloride is prepared by:

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



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14. Why is chemistry of all lanthanoids identical ?

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15. The element scandium ($Z=21$) does not exhibit variable oxidation state and yet it is regarded as a transition element. Explain.

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16. Why is the E^{\ominus} value for the Mn^{3+} / Mn^{2+} couple much positive than for Cr^{3+} / Cr^{2+} or Fe^{3+} / Fe^{2+} ? Example



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17. With $3d^4$ configuration, Cr^{2+} acts as a reducing agent but Mn^{3+} acts as an oxidising agent. Explain.



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



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19. Copper (I) is diamagnetic while copper (II) is paramagnetic . Explain.



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20. Why do chromium group elements have the highest melting point in their respective series ?

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21. Why do transition metals form coloured complexes ?

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22. Among transition metals, the highest oxidation state is exhibited in oxoanions of a metal. Explain.

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23. Ce^{4+} is used as an oxidising agent in volumetric analysis. Why ?

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

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25. Zr and Hf have identical sizes. Elaborate.

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26. The lowest oxidation state of manganese is basic while the highest is acidic. Explain.

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27. Mn(II) shows maximum paramagnetic character amongst the divalent ions of the first transition series. Discuss.

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28. Give reason for the following :

(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 than that of copper.

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

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Question From Board Examination

1. What is the effect of increasing pH on the colour of $K_2Cr_2O_7$ solution ?

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2. Why is third ionisation enthalpy of manganese exceptionally high ?

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3. Why are all salts of scandium white ?

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4. What happens when H_2O_2 is shaken with acidified $K_2Cr_2O_7$ solution ?

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5. H_2S gas is passed through an acidic solution of $K_2Cr_2O_7$. The solution turns milky, why?

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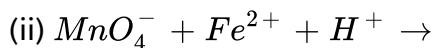
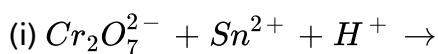
6. How is chemical volcano formed ?

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7. Transition metals tend to be unreactive with increasing atomic numbers in a series. Why?

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8. Complete the following reactions :



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

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10. The colour of $K_2Cr_2O_7$ solution changes with the change in pH of the medium. Why?



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11. Why is +2 oxidation state of manganese quite stable while the same is not true for iron? [$Mn = 25$, $Fe = 26$].



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12. Write the electronic configuration of the element with atomic number 102.



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



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14. Why are Zn , Cd and Hg quite soft and have low melting points ?

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15. Lanthanoid contraction is caused due to:

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16. What may the possible oxidation state of transition metals with the following electronic configurations in the ground state of their atoms ?

(i) $3d^3 4s^2$ (ii) $3d^5 4s^2$ (iii) $3d^6 4s^2$.

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17. Discuss the relative stability in aqueous solution of +2 oxidation states among the elements: Cr, Mn, Fe and Co

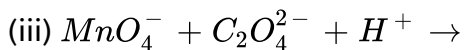
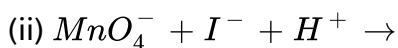
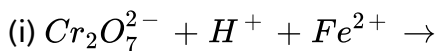
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18. How many unpaired electrons are present in Mn^{2+} ion? How do they influence magnetic behaviour of Mn^{2+} ion?



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19. Complete the following chemical equations for reactions in aqueous solution.



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20. There is a greater range of variable oxidation states among the actinoids than among the lanthanoids, Why?

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21. Why is there a general increase in density of elements from titanium (Z=22) to copper (Z=29) ?

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22. There occurs much more frequently metal-metal bonding in the compounds of heavy transition elements (3d series). Assign reason.

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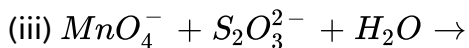
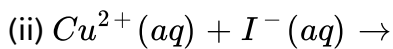
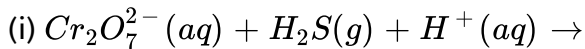
23. Why is Cu^+ ion not stable in aqueous solution ?

or

Why is Cu^+ is not known in aqueous solution ?

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24. Complete the following :



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



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26. Among the divalent cations in the first transition series, manganese exhibits maximum paramagnetic character. Explain.



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27. La^{3+} ($Z = 57$) and Lu^{3+} ($Z = 71$) do not show any colour in solution. Assign reason.

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28. Transition element act as good catalysts because

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29. The atomic radii of the metals of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second (4d) series. Explain.

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30. Explain why zinc is not regarded as a transition element.

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31. Explain why is Ce^{4+} ion a strong oxidising agent ?

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32. Describe the oxidising property of $KMnO_4$ in neutral or faintly alkaline medium for its reactions with iodide and thiosulphate ions.

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33. Assing the reason for the following :

- (i) Transition metals generally form coloured compounds.
- (ii) Manganese exhibits highest oxidation state of +7 among the 3d series of transition elements.

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34. In the transition series of metals, the metal which exhibits the greatest number of oxidation states occurs in the middle of the series.

Explain.

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35. Metal-Metal bondin is more extensive in the 4d and 5d series of transition elements than the 3d series. Explain.

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36. Why does Mn(III) undergo disproportionation reaction easily ?

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37. How would you account for the following ?

(i) Many of the transition elements are known to form interstitial

compound ?

(ii) The metallic radii of third (5d) series of transition metals are virtually the same as those of the corresponding group member of second (4d) series.

(iii) Lanthanoids form primarily +3 ions while the actinoids usually have higher oxidation state in their compounds, +4 or even +6 being typical.

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38. The colour of the transition metal ions is due to

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

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40. $K_2Cr_2O_7$ is a good oxidising agent in acidic medium. Explain.

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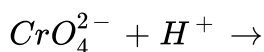
41. Why is potassium permanganate thermally unstable at 513 K.

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42. The inter convertibility of chromate ion and dichromate ion in aqueous solution depends upon pH of the solution . Explain.

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43. Complete the following equation :



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44. Give reasons for the following :

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

(ii) $E_{M^{2+}/M}^{\circ}$ values are not regular for first row transition metals (3d series).

(iii) Although 'F' is more electronegative than 'O', the highest fluoride of Mn is MnF_4 while the highest oxide is Mn_2O_7 .

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45. Predict which of the following will be coloured in aqueous solution ?

Ti^{3+} , V^{3+} , Cu^{+} , Sc^{3+} , Mn^{2+} , Fe^{3+} , Co^{2+} .

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46. (a) Explain the structure of dichromate ion.

(b) Why are cadmium salt white ?

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47. COMPARISON OF LANTHANOIDS & ACTINOIDS

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48. Explain the following :

(i) Cu^+ is colourless and Cu^{2+} is coloured.

(ii) Zn shows only +2 oxidation state in its compounds.

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49. What do you mean by (a) Chromyl Chloride test (b) Actinoids?

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50. Why do transition metals form coloured complexes ?

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51. How would you prepare

(i) K_2MnO_4 and MnO_2 ? (ii) $Na_2Cr_2O_7$ from Na_2CrO_4 ?

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52. Why is enthalpy of atomisation is the lowest for Zn in 3d series of transition elements ?

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

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54. Which of the following actinoids is well known to exhibit +2 oxidation state ?

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55. Why do actinoid elements show wide range of oxidation states ?

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

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57. (i) Write an oxidising reaction of $K_2Cr_2O_7$ in the acidic medium.

(ii) Write one oxidising reaction of $KMnO_4$ in the basic medium.

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58. Silver atom has completely filled d orbitals ($4d^{10}$) in its ground state.

How can you say it is a transition element?



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59. Explain actinoid contraction .



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60. Why do transition elements show variable oxidation state?



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61. Explain the following properties of transition elements.

(i) Variable oxidation states (ii) Complex formation



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62. Describe the preparation of potassium dichromate from chromite ore.

What is the effect of increasing pH of potassium dichromate solution ?

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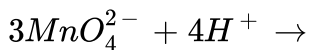
63. (a) What is Lanthanoids contraction ?

(b) What are Interstitial compounds ? Give one example

(c) Calculate the spin only magnetic moment of M^{2+} (*aq*) ion [$Z=29$].

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64. Complete the following :



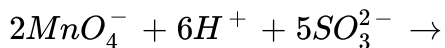
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65. How will you account for the following :

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

(ii) Transition metal form complex compounds.

(b) Complete the following equations :



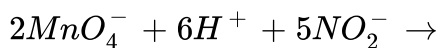
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66. (a) How would you account for the following :

(i) Actinoids contraction is greater than Lanthanoids contraction.

(ii) Transition metals form coloured compounds.

(b) Complete the following :



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67. (i) Account for the fact that Eu^{2+} is a strong reducing agent.

(ii) Why has Zn lowest enthalpy of atomization in 3d series ?

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68.	$E_{M^{2+}/M}^{\circ}$	Cr	Mn	Fe	Co	Ni	Cu
		-0.91	-1.18	-0.44	-0.28	-0.25	+0.34

From the given data of E° values, answer the following questions :

- Why is $E_{(Cu^{2+}/Cu)}^{\circ}$ value exceptionally positive ?
- Why is $E_{(M^{2+}/M)}^{\circ}$ value highly negative as compared to other elements ?
- Which is a stronger reducing agent , Cr^{2+} or Fe^{2+} ? Give reason.

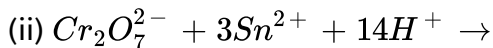
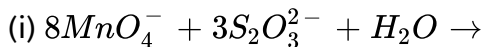
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69. When chromite ore $FeCr_2O_4$ is fuse with NaOH in presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl forms an orange coloured crystalline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

- Write the formula of the compounds (A),(B) and (C).
- Write one use of compounds (C).

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70. Complete the following chemical equations :



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71. 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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72. (a) Account for the following :

(i) Mn_2O_7 is acidic whereas MnO is basic.

(ii) Though copper has completely filled d-orbital (d^{10}) yet it is considered as a transition metal.

(iii) Actinoids show wide range of oxidation states.

(b) Write the preparation of potassium permanganate from pyrolusite ore (MnO_2).



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73. The element of 3d transition series are given as :

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following :

(i) Which element has the highest melting point and why ?

(ii) Which element is a strong oxidizing agent in +5 oxidation state and why ?

(ii) Which element is soft and why ?



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74. Explain the following :

(i) Most of the transition elements show variable oxidation states.

(ii) Most of the compounds of transition elements are coloured.

(iii) Many transition elements and their compounds are paramagnetic .

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75. (i) Write the electronic configuration of Cu^+ and Cu^{2+} ions ($Z=29$).

State which one is more paramagnetic.

(ii) What happens when (give equations only).

(a) In acidic medium , $KMnO_4$ reacts with $FeSO_4$.

(b) In basic medium, $KMnO_4$ reacts with ethylene.

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76. (i) What are interstitial compounds ? Give their general characteristics.

(ii) Transition metals are well known to form complex compound. Why ?

Explain with an example.

(iii) Explain the oxidation state of actinoids.

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77. (i) What are transition elements ?

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

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78. How will you obtain pure potassium permanganate ($KMnO_4$) crystals from its ore pyrolusite? Give the steps involved in the reactions. .

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79. Give balanced chemical equation for the following :

(i) Silver nitrate is added to dilute sodium thiosulphate solution.

(ii) Potassium dichromate is treated with acidified ferrous sulphate solution.

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80. Identify the following :

- (i) Oxoanion of chromium which is stable in acidic medium .
- (ii) The lanthanoid element that exhibits +4 oxidation state.

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

Metal ion:	Sc^{3+}	Cr^{2+}	Ni^{2+}	Ti^{3+}
Magnetic 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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82. How is the variability in oxidation state of transition metals different from these of p-block elements ?



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83. What are coinage metals ? Give example .



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



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85. The element cerium forms Ce^{4+} ion in aqueous solution. Explain.



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Higher Order Thinking Skill Hots

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

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2. In which of the following there is a change in oxidation number ?

(a) An aqueous solution of CrO_4^{2-} is acidified.

(b) SO_2 gas is passed through acidified $Cr_2O_7^{2-}$ solution.

(c) $Cr_2O_7^{2-}$ solution is made alkaline.

(d) CrO_2Cl_2 is dissolved in NaOH.

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3. (i) An aqueous solution of a compound (A) is acidic towards litmus and

(A) sublimes at about $300^\circ C$.

(ii) (A) on treatment with an excess of NH_4SCN gives a red coloured compound (B) and on treatment with a solution of $K_4[Fe(CN)_6]$ gives a blue coloured compound (C).

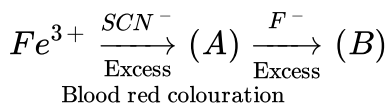
(iii) (A) on heating with excess of $K_2Cr_2O_7$ in the presence of concentrated H_2SO_4 evolves deep red vapours of (D).

(iv) On passing the vapour of (D) into a solution of NaOH and then adding the solution of acetic acid and lead acetate, a yellow precipitate of compound (E) is obtained.

Identify (A) to (E) and give chemical equations for the reactions.

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4. Complete the following :



Find the spin magnetic moment of B.

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5. A mixed oxide of iron and chromium $FeO \cdot Cr_2O_3$ is fused with sodium carbonate in the presence of air to form a yellow coloured compound (A).

On acidification, the compound (A) forms an orange coloured compound

(B) which is a strong oxidising agent. Identify (i) the compound A and B

(ii) Write balanced chemical equation for each step.

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6. A mixture of potassium dichromate crystal and conc. H_2SO_4 was added to each of the following four tubes. It was followed by strong heating.



Identify the tubes in which the following changes will be observe. Support your answer with the help of chemical equations.

(a) formation of violet vapours (b)formation of yellow precipitate

(c) formation fo brown liquid (d) appearance of vinegar smell.

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7. Gas (A) and gas(B) both turn $K_2Cr_2O_7/H^+$ green. Gas (A) alos turbs lead acetate paper black. When gas (A) is passed into gas (B) in ann

aqueous solution, yellowish white turbidity appears. Identify gas (A) and (B) and explain the reactions.

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8. (a) A blackish brown coloured solid 'A' when fused with an alkali metal hydroxide in the presence of air, produces a dark green coloured 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 happens when acidic solution of green compound (B) is allowed to stand for some time? Give the equation involved. What is this type of reaction called?

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9. Explain why a green solution of potassium manganate turns purple and a brown solid is precipitated when CO_2 gas is bubbled into the solution.

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10. Some reaction of the ore A of the metal M are given below:



Identify the ore and write the reactions involved.

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11. To measure the quantity of $MnCl_2$ dissolved in an aqueous solution, it was completely converted to $KMnO_4$ using the reaction

$MnCl_2 + K_2S_2O_8 + H_2O \rightarrow KMnO_4 + K_2SO_4 + HCl$ (equation not balanced).

Few drops of concentrated HCl were added to this solution and gently warmed. Further, oxalic acid (225 mg) was added in portions till the colour of the permanganate ion disappeared. Calculate the quantity of $MnCl_2$ (in mg) present in the initial solution.

(Atomic weights in $g\ mol^{-1}$: Mn=55, Cl=35.5)

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Ncert Exemplar Multiple Choice Questions

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

What is its atomic number?

A. 25

B. 26

C. 27

D. 24

Answer: B



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

A. Cu(II) is more stable

B. Cu(II) is less stable

C. Cu(I) and Cu(II) are 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 transitions element are given below. Which of these elements will have highest density ?

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

A. Fe

B. Ni

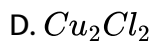
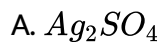
C. Co

D. Cu

Answer: D

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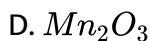
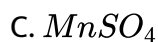
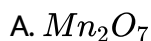
4. Generally transition elements form coloured salts due to the presence of unpaired electrons. Which of the following compounds will be coloured in solid state?



Answer: B

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



Answer: A



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



B. $3d^5$

C. $3d^8$

D. $3d^2$

Answer: B



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7. Which of the listed oxidation states is common for all lanthanoids ?

A. +2

B. +3

C. +4

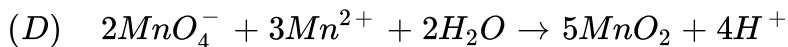
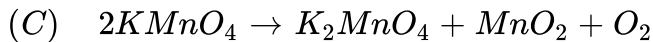
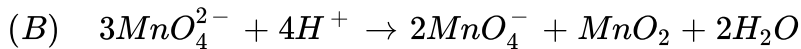
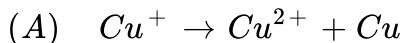
D. +5

Answer: B



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8. Which of the following reactions are disproportionation reactions?



A. (i),(iii)

B. (i),(ii),(iii)

C. (ii),(iii),(iv)

D. (i),(iv)

Answer: B



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

A. CO_2 is formed as the product

B. Reaction is exothermic

C. MnO_4^- catalyses the reaction.

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

Answer: D

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

A. U

B. Np

C. Tm

D. Fm

Answer: C

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

A. $2/5$

B. $3/5$

C. $4/5$

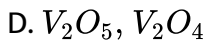
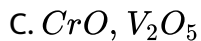
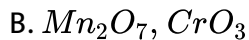
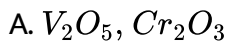
D. $1/5$

Answer: B

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12. Which of the following is amphoteric oxide?

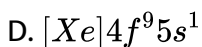
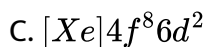
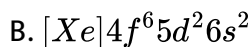
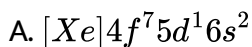
Mn_2O_7 , CrO_3 , Cr_2O_3 , CrO , V_2O_5 , V_2O_4



Answer: A

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



Answer: A

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?

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

II. They are very hard.

III. They retain metallic conductivity.

IV. They are chemically very reactive.

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

B. They are vary hard.

C. They retain metallic conductivity

D. They are chemically very reactive.

Answer: D

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 BM
- B. 3.87 BM
- C. 3.47 BM
- D. 3.57 BM

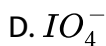
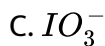
Answer: B



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

- A. I_2
- B. IO^-



Answer: C

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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



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

A. fluorine is more electronegative than oxygen

B. fluorine does not possess d-orbitals.

C. fluorine stabilises lower oxidation state.

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

Answer: D

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

- A. both belong to d-block
- B. both have same number of electrons
- C. both have similar atomic radii
- 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 medium acidic in oxidation reactions of $KMnO_4$ in acidic medium ?

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

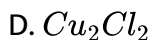
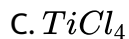
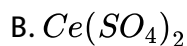
Answer: B



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Multiple Choice Questions 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?



Answer: A:B

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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?



Answer: A::D



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3. In the form of dichromate, Cr(VI) is a strong oxidising agent in acidic medium but Mo(VI) in MoO_3 and W(VI) in WO_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



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

A. Am

B. Pu

C. U

D. Np

Answer: B::D



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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

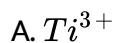
C. Yp

D. Ho

Answer: B::C

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



Answer: B::C



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



D. Ni

Answer: A::B

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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

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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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Matchin Type Questions

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



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2. Match the compound/elements given in Column O with uses given in Column II.



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



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



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5. Match the solutions given in Column I and the colours given in Column

II.



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6. Match the property given in Column I with the element given in Column

II.



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7. Match the properties given in Column I with the metals given in

Column II.



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Assertion And Reason Type Questions

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 the 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 the 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 the 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 the 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 the assertion.
- C. Assertion is not true but reason is true.
- D. Both assertion and reason are false

Answer: B

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Assignment

1. In the transition series with an increase in atomic number, the atomic radius does not change very much. Why is it so?

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2. Assing the reason for the following :

(i) Transition metals exhibit enthalpy of atomisation.

(ii) Transition metals form interstitial compounds .

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3. What is ionisation enthalpy? Explain why Ni(II) compounds are more stable than Pt(II) compounds while Pt(IV) compounds are more stable than Ni(IV) compounds

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4. Copper (I) is diamagnetic while copper (II) is paramagnetic . Explain.

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5. (a) What are transition elements ? Discuss their magnetic properties ?

(b) Describe the oxidation states and variable valencies of element of 3d series.

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6. (a) Is copper a transition metal? If yes then why ?

(b) Why are Cr, Mn and W are hard and have high melting point ?

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7. Why elements of group 12 are not considered as transition elements ?



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8. (a) What is the basic difference between the electronic configuration of transition and inner transition elements ?

(b) Describe the general trends in the following properties of 3d transition elements .

(i) Atomic size

(ii) Oxidation state

(iii) Formation of coloured ions.



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9. How will you account for the following : (i) All scandium salt are white.

(ii) The first ionisation enthalpy of the 5d transition elements are higher than those of 3d and 4d transition elements in respective group.



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10. (a) What is Lanthanoid contraction ? What are its important effects ?

(b) Account for the following : (i) Zn^{2+} salts are white while Ni^{2+} salts are coloured.

(ii) Ionisation enthalpies of 5d series elements are higher than the corresponding 3d series elements

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11. Transition metals are coloured due to the following electronic transition

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

(i) Cobalt (II) is stable in aqueous solution but in the presence of strong ligands, it is easily oxidised.

(ii) The transition metals form interstitial compounds.

(iii) Silver halides find use in photography.

(b) What is lanthanoid contraction ? Mention its main consequences.



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13. How will you account for the following :

(i) Cobalt (II) is stable in aqueous solution but in the presence of a complexing agent, it is easily oxidized.

(ii) Out of d^4 species, Cr^{2+} is strongly reducing while Mn^{2+} is strongly oxidising .



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14. Explain why Zn^{2+} salts are colourless while Ni^{2+} salts are coloured ?



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



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16. Why are Zn, Cd and Hg quite soft and have low melting points ?

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

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18. Why *Zn*, *Cd* and *Hg* are not considered as typical transition elements ?

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19. Describe the trends in the following properties of the first series of transition elements :

(i) Oxidation states

(ii) Atomic sizes.

(iii) Magnetic behaviour of dipositive gaseous ions (M^{2+}).

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20. Explain the following observation about the transition elements.

(i) There is in general an increase in density of the element from titanium ($Z=22$) to copper ($Z=29$).

(ii) There occurs much more frequent metal-metal bonding in compounds of heavy transition elements (3d series)

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21. Among the divalent cations in the first transition series, manganese exhibits maximum paramagnetic character. Explain.

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22. Describe the general characteristics of transition elements with special reference to the following :

(i) Formation of coloured salts .

(ii) Variable oxidation states

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23. Name the elements of 3d series. Give their electronic configuration.

Explain why transition metals exhibit variable oxidation states.

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24. How would you account for the following :

(i) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4), Mn^{2+} is oxidising in nature.

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

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25. State the reason for the following :

(i) Cu (I) ion is not stable in an aqueous solution.

(ii) Unlike Cr^{3+} , Mn^{2+} , Fe^{3+} and the subsequent other M^{2+} ions of the 3d series, the 4d and 5d series metals generally do not form stable oxidation states.

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26. Explain the following :

(i) Cu^+ is colourless and Cu^{2+} is coloured.

(ii) Zn shows only +2 oxidation state in its compounds.

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27. Why do transition metals form coloured complexes ?

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28. Silver atom has completely filled d orbitals ($4d^{10}$) in its ground state.

How can you say it is a transition element?

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

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30. What are Interstitial compounds ? Give an example.

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31. Explain the following :

(i) Most of the transition elements show variable oxidation states.

(ii) Many transition elements and their compounds are paramagnetic .

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32. (i) What are interstitial compounds ? Give their general characteristics.
- (ii) Transition metals are well known to form complex compound. Why ? Explain with an example.
- (iii) Explain the oxidation state of actinoids.



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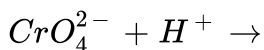
33. (i) What are transition elements ?
- (ii) Why do transition elements show variable oxidation states ?



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Chemistry Of Some Transition Metal Compounds

1. Complete the following equation :





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2. How would you prepare

(i) K_2MnO_4 and MnO_2 ? (ii) $Na_2Cr_2O_7$ from Na_2CrO_4 ?



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3. (i) Write an oxidising reaction of $K_2Cr_2O_7$ in the acidic medium.

(ii) Write one oxidising reaction of $KMnO_4$ in the basic medium.



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F Block Element

1. Give three important uses of lanthanoids and actinoids.



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2. What is lanthanoid contraction? What is its cause and what are its consequences ?

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3. Why is the separation of lanthanoids difficult ?

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4. The element cerium forms Ce^{4+} ion in aqueous solution. Explain.

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

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6. What is lanthanoid contraction?

 [Watch Video Solution](#)

7. Why do Zr and Hf exhibit similar properties ?

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8. (a) Why is $La(OH)_3$ is more basic than $Lu(OH)_3$?

(b) Why are the properties of third transition series quite similar to second transition series.

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9. What is meant by lanthanoids contraction ? What effect does it have on the chemistry of element which follow lanthanoids ?

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10. Why is chemistry of all lanthanoids identical ?

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11. 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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12. The actinoids exhibit, more member of oxidation states in general than the lanthanoids. This is because

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13. How will you account for the following ?

(i) The metallic radii of the third (5d) series of transition metals are virtually the same as those of the corresponding group members of the second (4d) series.

(ii) Lanthanoids form primarily +3 ions while actinoids usually have higher oxidation states in their compounds .

Among the lanthanoids, Ln(III) compounds are predominant. However, occasionally in solution or in solid state +2 and +4 ions are obtained.

Explain.



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14. Give details of Actinoids



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15. What is Lanthanoid contraction? Name an alloy which contains some of the lanthanoids elements.



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



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17. Explain actinoid contraction .



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18. Why do actinoid exhibit irregularity in their electronic configuration.



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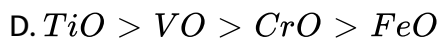
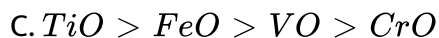
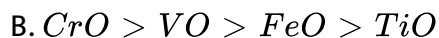
19. The chemistry of the early actinoids is more complicated than the corresponding lanthanoids



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Select The Correct Answer

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



Answer: D



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2. Lanthanoid contraction is due to increase in

A. shielding by 4f electron

- B. atomic number
- C. effective nuclear charge
- D. size of 4f orbital

Answer: C

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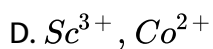
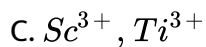
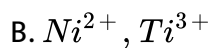
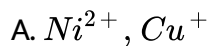
3. Among the following pairs of ions the lower oxidation state in aqueous solution is more stable than the other in

- A. Ti^+ , Ti^{3+}
- B. Cu^+ , Cu^{2+}
- C. Cr^{2+} , Cr^{3+}
- D. V^{2+} , VO^{2+}

Answer: A

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4. Which of the following pairs is coloured in aqueous solution?

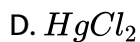
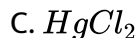
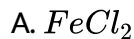


Answer: B



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5. Which of the following is a highly corrosive salt?

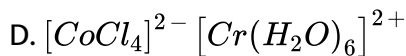
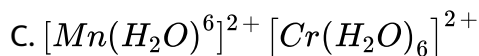
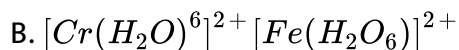
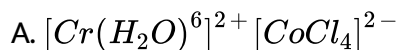


Answer: D



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6. The pair in which species have the same magnetic moment is:



Answer: B



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7. Identify the incorrect statement among the following:

A. Lanthanoid contraction is the accumulation of successive shrinkages

B. As a result of lanthoid contraction the properties of 4d series of transition elements have no similarities with the 5d series of transition elements.

C. Shielding power of 4d electrons is quite weak.

D. There is a decrease in radii of the atoms or ions as one proceeds from La to Lu/

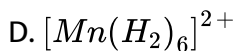
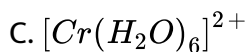
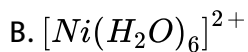
Answer: B



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8. The d-electronic configuration of Cr^{2+} , Mn^{2+} , Fe^{2+} and Ni^{2+} are, $3d^4$, $3d^5$, $3d^6$ and $3d^8$ respectively. Which of the following aqua complexes will exhibit the minimum paramagnetic behavior?

A. $[Fe(H_2O)_6]^{2+}$

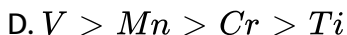
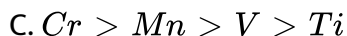


Answer: B



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9. The correct order of decreasing second ionisation enthalpy of $Ti(22)$, $V(23)$, $Cr(24)$ and $Mn(25)$ is

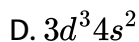
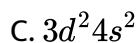
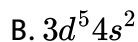
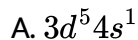


Answer: C



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

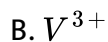


Answer: B



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11. Which of the following transition metal ion is not coloured?

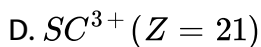
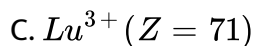
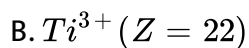
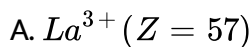




Answer: A

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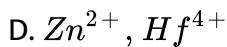
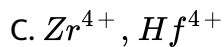
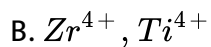
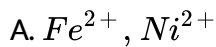
12. Which of the following ions will exhibit colour in aqueous solution ?



Answer: B

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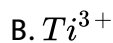
13. Which of the following pairs has the same ionic are:



Answer: C

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14. Which of the following species has maximum magnetic moment?



Answer: D

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15. 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. K_2MnO_4 (dark green)

C. MnO_2 (Colourless)

D. Mn_2O_3 (brown)

Answer: B



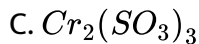
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16. Acidified $K_2Cr_2O_7$, solution turns green when Na_2SO_3 is added to it.

Thus is due to the formation of

A. $Cr(SO)_4)_3$

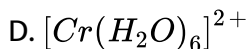
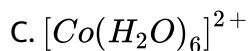
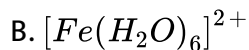
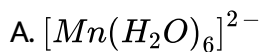
B. CrO_4^{2-}



Answer: A

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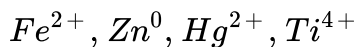
17. The d-electron configurations of Cr^{2+} , Mn^{2+} , Fe^{2+} and Co^{2+} are d^4 , d^5 , d^6 and d^7 respectively. Which one of the following will exhibit minimum paramagnetic behaviour?



Answer: C

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18. Which of the following species is/are paramagnetic?



A. Fe^{2+} only

B. Zn^0 and Ti^{4+}

C. Fe^{2+} and Hg^{2+}

D. Zn^0 and Hg^{2+}

Answer: A



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19. The titanium (atomic number 22) compound that does not exist is

A. TiO

B. TiO_2

C. K_2TiF_6

D. $TiCl_3$

Answer: C

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20. Which of the statement is not true?

- A. On passing H_2S 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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21. Which one of the following does not correctly represent the correct order of the property indicated against it

- A. $Ti < V < Cr < Mn$, Increasing number of oxidation states
- B. $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$: increasing magnetic moment
- C. $Ti < V < Cr < Mn$: increasing melting points
- D. $Ti < V < Mn < Cr$: increasing 2nd ionization enthalpy

Answer: C



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

- A. Co(Z=27)
- B. Ni(Z=28)

C. Cu($Z=29$)

D. Fe($Z=26$)

Answer: C

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23. Catalytic activity of the transition metals and their compounds can be ascribed to:

- A. their magnetic behavior
- B. their unfilled d-orbitals
- C. their ability to adopt variable oxidation states
- D. the chemical ractivity

Answer: C

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24. The expression for effective magnetic moment (μ_{eff}) is

A. $\mu_{eff} = \sqrt{n(n + 2)BM}$

B. $\mu_{eff} = \sqrt{2(n + 2)BM}$

C. $\mu_{eff} = \sqrt{n(2n + 2)BM}$

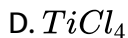
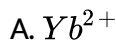
D. $\mu_{eff} = \sqrt{n(n + 1)BM}$

Answer: A



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25. Which of the following lanthanoid ion is diamagnetic?

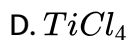
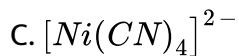
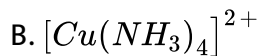


Answer: A



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26. A magnetic moment of 1.73 B.M. will be shown by one among the following:



Answer: B



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27. Which of the following oxidation states is the most common among the lanthanoids ?

A. +3

B. +4

C. +2

D. +5

Answer: A

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28. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives

A. Mn^{2+} and O_2

B. Mn^2 and O_3

C. Mn^{4+} and MnO_2

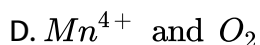
D. Mn^{4+} and O_2

Answer: A

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29. Magnetic moment 2.83 BM is given by which of the following ions?

At. nos. Ti=22, Cr=24, Mn=25, Ni=28



Answer: C



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

A. Both belong to same group

B. Diagonal relationship

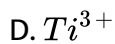
C. Lanthanoid contraction

D. Having similar chemical properties

Answer: C

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31. Magnetic moment 2.84 BM is given by



Answer: C

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32. The number of d-electron in Fe^{2+} ($Z = 26$) is not equal to the number of electron in which one of the following?

A. d-electron in Fe ($Z=26$)

B. p-electron in Ne ($Z=10$)

C. s-electron in Mg($Z=12$)

D. p-electrons in Cl($Z=17$)

Answer: D



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33. Which of the following transition metals of 4d series has the lowest melting point?

A. Ti($Z=22$)

B. V($Z=23$)

C. Cr($Z=24$)

D. Mn($Z=25$)

Answer: D



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34. Which of the following ions has the same number of unpaired electrons as present in V^{3+} ?

A. Ti^{3+}

B. Fe^{3+}

C. Ni^{2+}

D. Cr^{3+}

Answer: C



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

- A. Ti
- B. Cu
- C. Mn
- D. Ni

Answer: A

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37. For the first row transition metals, the E° values are

E°	<i>V</i>	<i>Cr</i>	<i>Mn</i>	<i>Fe</i>	<i>Co</i>	<i>Ni</i>	<i>Cu</i>
(M^{2+} / M)	-1.18	0.90	-1.18	-0.44	-0.28	-0.25	+0.34

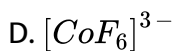
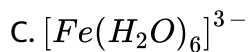
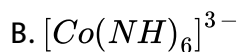
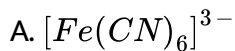
What is the reason for the non regularity in the above values?

- A. non regular variation of ionization enthalpies
- B. different number of electrons present in M^{2+} ions
- C. non-regular variation of ionic radii
- D. the variation in densities of transition metals.

Answer: A

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38. Which one of the following complex has maximum magnetic moment value?



Answer: C



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39. Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution?

A. SO_2 is reduced

B. Green $Cr_2(SO_4)_3$ is formed

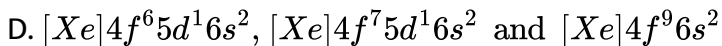
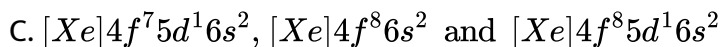
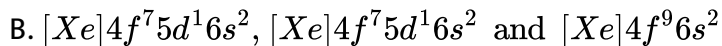
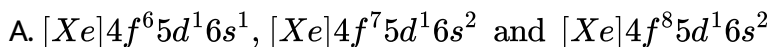
C. The solution turns blue

D. The solution is decolourised.

Answer: B

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



Answer: B

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

- A. Europium shows +2 oxidation state
- B. The basic as the ionic radius decreases from Pr to Lu
- C. All the lanthanons are almost as reactive as aluminium
- D. $Ce(+4)$ solution are widely used as oxidising agent in volumetric analysis.

Answer: C

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42. Which pair of the following 4d series elements has the same number of electrons in 4d sub-shell?

- A. Mo and Te
- B. Nb and Mo

C. Pd and Ag

D. Rh and Pd

Answer: C

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43. In which of the following actinoid elements, 6d sub-shells is vacant?

A. Pa

B. Np

C. Lr

D. Pu

Answer: D

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44. The reason for the greater range of oxidation states of actinoids is attributed to

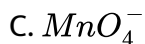
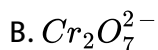
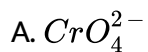
- A. actinoid contraction
- B. 5f, 6d and 7s levels having comparable energies
- C. 4f and 5d levels being close in energies
- D. the radioactive nature of actinoids.

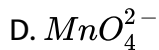
Answer: B



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45. Which of the following ions exhibits d-d transitions and paramagnetism as well?





Answer: D

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46. 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:



- A.

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>iv</i>	<i>v</i>	<i>ii</i>	<i>i</i>
- B.

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>i</i>	<i>ii</i>	<i>iii</i>	<i>iv</i>
- C.

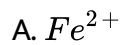
<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>iv</i>	<i>i</i>	<i>ii</i>	<i>iii</i>
- D.

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>iii</i>	<i>v</i>	<i>i</i>	<i>ii</i>

Answer: A

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47. Which is least stable in aqueous medium?



Answer: A



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48. Oxidation state of iron in ferric is

A. +2

B. +5

C. +3

D. +6

Answer: C

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Neet Special

1. How many grams of $K_2Cr_2O_7$ are required to oxidise 20.0g of Fe^{+2} ion in $FeSO_4$ to Fe^{3+} ions if the reaction is carried out in the acidic medium?

Molar mass of $K_2Cr_2O_7$ and $FeSO_4$ are 294 and 152 respectively.

A. 6.45g

B. 7.45g

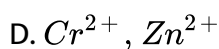
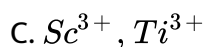
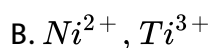
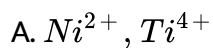
C. 8.45g

D. 9.45g

Answer: A

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2. In which of the following pairs, both ions are coloured in aqueous solution?



Answer: B



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3. Choose the correct matching of transition metal with magnetic moment give:

Transition Metal Magnetic moment (B.M)

(A) Titanium (III) (1) 4.9

(B) Vanadium (II) (2) 1.73

(C) Iron (II) (3) 3.87

A. A-2, B-3, C-1

B. A-1,B-3,C-2

C. A-3,B-1,C-2

D. C-1,B-3,C-2

Answer: A

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4. Which is/are not the true statement(s) about $KMnO_4$?

A. Its solution is unstable in acidic medium

B. It gets reduced to MnO_2 in neutral medium

C. MnO_4^- changes to Mn^{2+} in basic medium

D. It is a self indicator in $FeSO_4$ and oxalic acid titrations.

Answer: C

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5. The reaction of $KMnO_4$ and HCl results in:

- A. Oxidation of Mn in $KMnO_4$ and production of Cl_2
- B. reduction of Mn in $KMnO_4$ and production of H_2
- C. oxidation of Mn in $KMnO_4$ and production of H_2
- D. reduction of Mn in $KMnO_4$ and production of Cl_2

Answer: D



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

- A. $VO < CrO > TiO > FeO$
- B. $CrO > VO > FeO > TiO$
- C. $TiO > FeO > VO > CrO$
- D. $TiO > VO > CrO > FeO$

Answer: D

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

- A. the 5f orbital extend farther from the nucleus than the 4f orbitals
- B. the 5f orbital are more buried than the 4f orbital
- C. there is a similarity between 4f and 5f orbitals in their angular part of the wave functions
- D. The actinoids are more reactive than the lanthanoids.

Answer: D

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8. Which of the following statements is not correct ?

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

B. In lanthanoid series, ionic radius of Ln^{3+} ion decreases.

C. La is an elements of transition series rather than Lanthanoid series

D. Atomic radii of Zr and Hf are same because of Lanthanoid contraction.

Answer: A

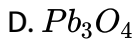
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9. A red coloured solid is insoluble in water. However, it becomes soluble if some KI is added to water. Heating red solid in a test tube results in the liberation of some violet coloured fumes and droplets of a metal appear on the cooler parts of the test tube. The red solid is

A. $(NH_4)_2Cr_2O_7$

B. HgI_2

C. HgO



Answer: B

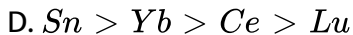
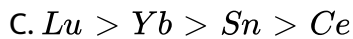
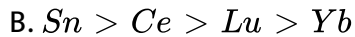
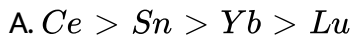


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Jee Main Other Engineering Entrance Examination

1. Which is the correct order of ionic sizes ?

At. Nos. Ce= 58, Sn=50 ,Yb=70 and Lu=71)



Answer: A



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2. Which one of the following nitrates will leaves behind a metal on strong heating?

- A. Copper nitrate
- B. Manganese nitrate
- C. Silver nitrate
- D. Ferric nitrate

Answer: C



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3. The atomic number of V , Cr , Mn and Fe are respectively 23, 24, 25 and 26. Which one of these may be expected to have the highest second ionization enthalpy?

- A. Cr
- B. Mn

C. Fe

D. V

Answer: A

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

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

Answer: A

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5. Lanthanoid contraction means :

- A. small atomic sizes of lanthanoid elements
- B. small ionic size of lanthanoid ions.
- C. smaller atomic size of lanthanoids as compared to transition element in the same period
- D. decrease in atomic and ionic radii of the element of lanthanoid series in moving from left to the right.

Answer: D

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6. Because of lanthanoid contraction :

- A. separation of the elements is possible

- B. there is a very small difference in the atomic size of the transition metals of 5th and 6th period and present in the same group.
- C. there is a gradual decrease in the basic strengths of the hydroxides of lanthanoids
- D. All are correct.

Answer: D

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7. Which is not the characteristics of the transition metals ?

- A. They show variable oxidation states
- B. They form coloured compounds
- C. They have low enthalpy of atomisation
- D. They acts as good catalysts

Answer: C



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8. The most common oxidation state of lanthanoids are :

A. +1, + 2

B. +2, + 4

C. +2

D. +2, + 3, + 4

Answer: D



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9. Transition metals show variable oxidation states because of :

A. participation of nd electrons along with np electrons

B. participation of (n-1)d and ns electrons

C. participation of (n-1)d and np electrons

D. None of these is correct

Answer: B



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10. On adding NaOH solution to the aqueous solution of $K_2Cr_2O_7$, the colour of the solution changes from :

A. orange to yellow

B. yellow to orange

C. orange to red

D. yellow to pink.

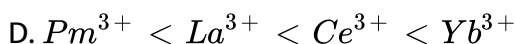
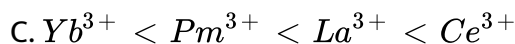
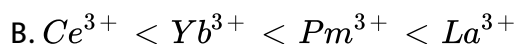
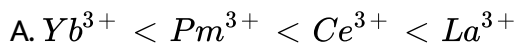
Answer: A



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

-



Answer: A



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12. When $KMnO_4$ acts as an oxidising agent and ultimately forms MnO_4^{2-} , MnO_2 , Mn_2O_3 , and Mn^{2+} , then the number of electrons transferred in each case, respectively, are

A. 4,3,1,5

B. 1,5,3,7

C. 1,3,4,5

D. 3,5,7,1

Answer: C



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

A. 1.40\AA ...

B. 1.06\AA ...

C. 0.85\AA ...

D. 1.60\AA ...

Answer: C



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14. What happens when a solution of potassium chromate is treated with an excess of dil. Nitric acid?

- A. $Cr_2O_7^{2-}$ and OH^- are formed
- B. CrO_4^{2-} is reduced to +3 state of Cr
- C. CrO_4^{2-} is oxidized to +7 state of Cr.
- D. Cr^{3+} and $Cr_2O_7^{2-}$ are formed.

Answer: A



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15. The oxidation state of chromium in the final product formed in the reaction between KI and acidified potassium dichromate solution is

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

D. +3

Answer: D

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16. Identify the incorrect statement among the following.

A. 4f and 5f orbitals are equally shielded

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

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

D. The chemistry of various lanthanoids is quite similar.

Answer: A

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17. The spin-only magnetic moment [in units of Bohr magneton, (μ_B of Ni^{2+}) in aqueous solution would be (atomic number of $Ni = 28$)

A. 2.84

B. 4.9

C. zero

D. 1.73

Answer: A



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

A. the 5f orbital extend further from the nucleus than the 4f orbitals.

B. the 5f orbitals are more buried than the 4f orbitals

- C. there is a similarity between 4f and 5f orbitals in their angular part of the wave function.
- D. the actinoids are more reactive than the lanthanoids.

Answer: A

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19. 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. oxidises oxalic acid to carbon dioxide and water
- B. gets oxidised by oxalic acid to chlorine
- C. furnishes H^+ ions in addition to those from oxalic acid
- D. reduces permanganate to Mn^{2+}

Answer: D

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

- A. Because of the large size of the Ln(III) ions the bonding in its compounds is predominantly ionic in character.
- B. The ionic sizes of Ln(III) decrease in general with increasing atomic number
- C. Ln(III) compounds are generally colourless
- D. Ln(III) hydroxides are mainly basic in character.

Answer: C

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21. Mark the correct statement (s).

- (1) Manganese 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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22. The correct order of $E_{M^{2+}/M}^\circ$ Values with negative sign for the four successive elements *Cr*, *Mn*, *Fe* and *Co* is:

A. $Cr > Mn > Fe > Co$

B. $Mn > Cr > Fe > Co$

C. $Cr > Fe > Mn > Co$

D. $Fe > Mn > Cr > Co$

Answer: B

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23. 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 members exhibit +3 oxidation state.

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

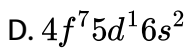
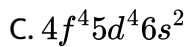
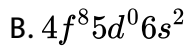
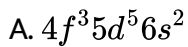
D. A vaiiability of 4f electrons results in the formation of the compounds in +4 state for all the members in the series.

Answer: D



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



Answer: D



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25. Consider the following statements:

(I) $\text{La}(\text{OH})_3$ is the least basic among the hydroxides of lanthanoids.

(II) Zr^{4+} and Hf^{4+} possess almost same ionic radii.

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

which of the above statement is/ are true?

A. (I) and (II)

B. (II) and (III)

C. (II) Only

D. (I) and (II)

Answer: B



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26. The bonds present in the statement is/are true?

A. four equivalent Cr-O bonds only.

- B. six equivalent Cr-O bonds and one O-O bond
- C. Eight equivalent Cr-O bonds and one Cr-Cr bond.
- D. six equivalent Cr-O bonds and one Cr-O-Cr bonds

Answer: D

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

- A. Ferrous oxide is more basic in nature than the ferric oxide
- B. Ferrous compounds are relatively more ionic than the corresponding ferric compounds
- C. Ferrous compounds are less volatile than the corresponding ferric compounds

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

Answer: D

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28. Four successive members of first row transition element are listed below. Which one of them is expected to have highest $E_{\frac{M^{3+}}{(M^{2+})^{\ominus}}}$ value?

A. Co (Z = 27)

B. Cr (Z = 24)

C. Mn (Z = 25)

D. Fe (Z = 26)

Answer: A

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

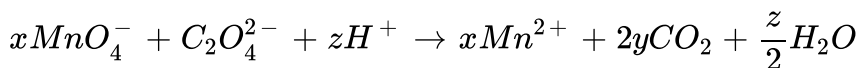
- A. $Sc < Ti < Cr < Mn$: number of oxidation states
- B. $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour
- C. $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: Ionic size
- D. $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous

Answer: B



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30. Consider the following reaction



The value of x, y and z in the reaction are respectively

A. 5, 2 and 8

B. 5, 2 and 16

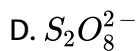
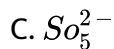
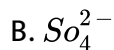
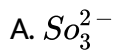
C. 2,5 and 8

D. 2,5 and 16

Answer: D

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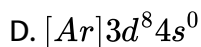
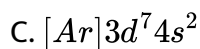
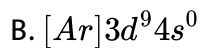
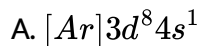
31. In neutral or faintly alkaline medium, thiosulphate is quantitatively oxidized by $KMnO_4$ to



Answer: B

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32. What is the electronic configuration of Cu^+ ion?

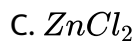
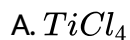


Answer: B



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33. Select the colored compound amongst the following :



Answer: B



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34. The ability of d-block elements to form complexes is due to

A. large size and high nuclear charge

B. small size and low nuclear

C. small size and high nuclear charge

D. none of these.

Answer: C



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35. Which one of these is not know?

A. $CuCl_2$

B. CuI_2

C. CuF_2

D. $CuBr_2$

Answer: B



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36. The correct statement is

- A. the earlier members of lanthanoid series resemble calcium in their chemical properties.
- B. the extent of actinoid contraction is almost the same as lanthanoid contraction.
- C. in general, lanthanoid and actinoids do not show variable oxidation states.
- D. Ce^{4+} in aqueous solution is not known.

Answer: A



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37. Which is not true for describing the catalytic activity of transition metals?

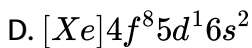
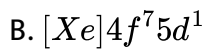
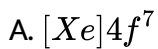
- A. Their ability to adopt multiple oxidation states
- B. Their ability to form bonds between reactant molecule and atoms of the surface of catalysts.
- C. Increasing the concentration of reactants at the catalyst surface
- D. Strengthening the bonds in the reacting molecules.

Answer: D



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38. The electronic configuration of Gd^{2+} is :

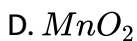
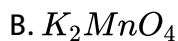


Answer: B



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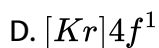
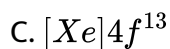
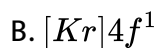
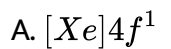
39. Upon heating potassium permanganate, which of the following compounds is not obtained?



Answer: A

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



Answer: A

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41. 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: D

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42. Which of the following statements is incorrect for $KMnO_4$?

A. It is an oxidising agent

B. It is used as a bleaching agent in textile industry

C. It is used as an antiseptic

D. It is a dark purple coloured amorphous solid .

Answer: D

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43. In which of the following d-d transition involves absorption in the ultraviolet region ?

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

A. +6

B. +5

C. +8

D. +7

Answer: C

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45. Which of the following metal ions has a calculated magnetic moment value of $\sqrt{24}$ BM ?



Answer: B



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46. Which of the following statement regarding lanthanides is false?

A. All lanthanoids are solid at room temperature.

B. Their usual oxidation state is +3.

C. They can be separated from one another by ion-exchange method.

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

Answer: D

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



Answer: A

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

- A. Mn^{2+} is more stable with high 3^{rd} ionisation energy
- B. Mn^{2+} is bigger in size
- C. Mn^{2+} has completely filled d-orbitals
- D. Mn^{2+} does not exist.

Answer: A



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49. Which of the following statement is wrong regarding lanthanoids?

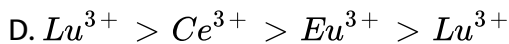
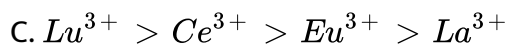
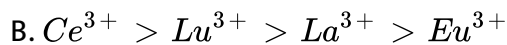
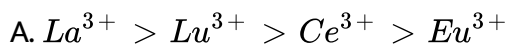
- A. Ln (II) compounds are predominantly ionic in character.
- B. Ln(III) hydroxides are mainly basic in nature.
- C. The ionic size of Ln(II) ions decreases with increasing atomic number.

D. Ln(II) compounds are generally colourless.

Answer: D

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50. The correct basicity order of the following lanthanoid ions is



Answer: D

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

- 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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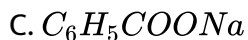
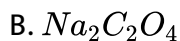
52. Identify the cases(s) where there is change in oxidation number.

- A. Acidified solution of $Cr_2O_4^{2-}$
- 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

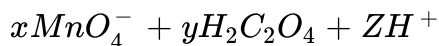
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53. Sodium salt of an organic acid 'X' produces effervescence with conc. H_2SO_4 . 'X' reacts with the acidified aqueous $CaCl_2$ solution to give a white precipitate which decolourises acidic solution of $KMnO_4$. 'X' is

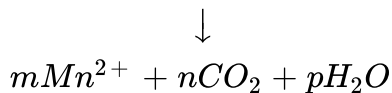


Answer: B

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54. For redox reaction



The value of x,y,m and n are:

A. 10,2,5,2

B. 2,5,2,10

C. 6,4,2,4

D. 3,5,2,10

Answer: B

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55. 1 mole of $FeSO_4$ (Atomic mass of $Fe = 55.84 \text{ gmol}^{-1}$) is oxidised to $Fe_2(SO_4)_3$. The equivalent mass of Fe^{2+} ions is:

A. 55.84

B. 27.92

C. 83.76

D. 111.68

Answer: A



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Jee Joint Entrance Examinatin Advanced Comprehension 1

1. A mixture consist of a yellow solid [A] and colourless solid [B] which given lilac colour in flame. The miture given a black precipiate [C] on passing H_2S gas. The precipitate [C] is soluble in aqua regien and on evaporating and on adding $SnCl_2$, gives greyish black precipitate [D]. The misture solution on reacing with NH_4OH gives a brown precipiates. The sodium extract of the mixture with $CCL_4 / FeCl_3$ given violet layer. The extract also given yellow precicitate with $AgNO_3$ solution which is insoluble in NH_3 .

The yellow solied [A] in the mixture is :

- A. Stannous chloride
- B. Mercuric chloride
- C. Mercuric iodide
- D. Arsenic chloride.

Answer: C

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2. A mixture consist of a yellow solid [A] and colourless solid [B] which given lilac colour in flame. The miture given a black precipiate [C] on passing H_2S gas. The precipitate [C] is soluble in aqua regia and on evaporating and on adding $SnCl_2$, gives greyish black precipitate [D]. The mixture solution on reacting with NH_4OH gives a brown precipitates. The sodium extract of the mixture with $CCl_4/FeCl_3$ given violet layer. The extract also given yellow precipitate with $AgNO_3$ solution which is insoluble in NH_3 .

The black precipitate [c] is of :

A. Mercurous sulphide

B. Mercuric sulphide.

C. Bismuth sulphide

D. Lead sulphide.

Answer: B

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3. A mixture consist of a yellow solid [A] and colourless solid [B] which given lilac colour in flame. The miture given a black precipiate [C] on passing H_2S gas. The precipitate [C] is soluble in aqua regia and on evaporating and on adding $SnCl_2$, gives greyish black precipitate [D]. The mixture solution on reacting with NH_4OH gives a brown precipitates. The sodium extract of the mixture with $CCl_4/FeCl_3$ given violet layer. The extract also given yellow precipitate with $AgNO_3$ solution which is insoluble in NH_3 .

The greyish black precipitate [D] is of

- A. mercury
- B. silver
- C. lead
- D. None of these

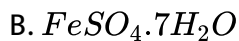
Answer: A

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Comprehension 2

1. An inorganic compound [A] yellowish green in colour loses its water of crystallisation upon heating . When heated further, it changes to blackish brown powder [B] and also gives two oxides of sulphure. The powder [B] on boiling with hydrochloric acid gives a yellowish solution which gives a bloodred colouration on reacting with potassium thiocyanate.

The yellowish green compound [A] is



Answer: B

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2. An inorganic compound [A] yellowish green in colour loses its water of crystallisation upon heating. When heated further, it changes to blackish brown powder [B] and also gives two oxides of sulphur. The powder [B] on boiling with hydrochloric acid gives a yellowish solution which gives a bloodred colouration on reacting with potassium thiocyanate.

The yellow solution is of

A. ferrous chloride

B. manganese sulphate

C. ferric chloride

D. aluminium sulphate.

Answer: C



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Comprehension 3

1. When an orange coloured crystalline compound [A] was heated with common salt and concentrated sulphuric acid, an orange red coloured gas [B] was evolved. The gas [B] on passing through NaOH solution gave a yellow solution [C]. The solution on reacting with an aqueous solution of lead acetate gave a yellow precipitate.

The crystalline compound [A] is:

A. Cobalt nitrate

B. manganese sulphate

C. Potassium dichromate.

D. Ammonium dichromate.

Answer: C

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2. When an orange coloured crystalline compound [A] was heated with common salt and concentrated sulphuric acid, an orange red coloured gas [B] was evolved. The gas [B] on passing through NaOH solution gave a yellow solution [C]. The solution on reacting with an aqueous solution of lead acetate gave a yellow precipitate.

This gas [B] is :

A. Chlorine

B. bromine

C. chromyl chloride

D. nitrogen peroxide.

Answer: C



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3. When an orange coloured crystalline compound [A] was heated with common salt and concentrated sulphuric acid, an orange red coloured gas [B] was evolved. The gas [B] on passing through NaOH solution gave a yellow solution [C]. The solution on reacting with an aqueous solution of lead acetate gave a yellow precipitate.

The yellow solution [C] contains mainly

- A. Sodium sulphate
- B. Sodium chromate
- C. Sodium dichromate
- D. Potassium chromate.

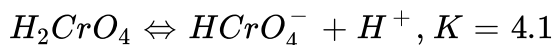
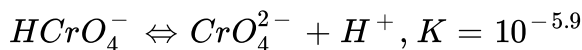
Answer: B



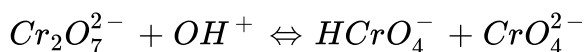
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Comprehension 4

1. In basic solution above $pH6$, CrO_3 forms the tetrahedral yellow chromate ion, CrO_4^{2-} . Between $pH 2$ and 6 , $HCrO_4^-$ and the orange red dichromate ion, $Cr_2O_7^{2-}$, are in equilibrium. At pH values below 1 , the main species is H_2PCrO_4 . The equilibria are



In addition, these are base-hydrolysis equilibria



The pH dependent equilibria are quite labile and on addition of cations that form insoluble chromates (e.g., Ba^{2+} , Pb^{2+} and Ag^+), the chromates and not the dichromates are precipitated.

Which of the following statement is correct ?

A. Acid solutions of dichromate are strong oxidants

B. In alkaline solution, the chromate ion is strong oxidant

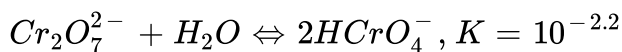
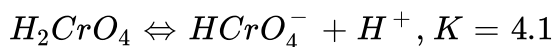
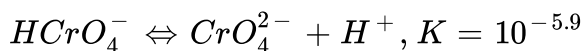
C. Acid solution of dichromate are poor oxidants

D. Both (a) & (b)

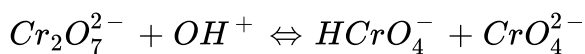
Answer: A

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2. In basic solution above $pH6$, CrO_3 forms the tetrahedral yellow chromate ion, CrO_4^{2-} . Between $pH 2$ and 6 , $HCrO_4^-$ and the orange red dichromate dichromate ion, $Cr_2O_7^{2-}$, are in equilibrium. At pH values below 1 , the main species is H_2PCrO_4 . The equilibria are



In addition, these are base- hydrolysis equilibria



The pH dependent equilibria are quite labile and on addition of cations that form insoluble chromates (e.g., Ba^{2+} , Pb^{2+} and Ag^+), the chromates and not the dichromates are precipitated.

The equilibria,

(a) $Cr_2O_7^{2-} \rightleftharpoons 2CrO_4^{2-}$ is shifted to right in

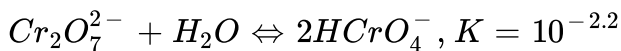
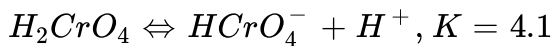
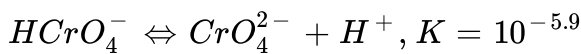
- A. An acidic medium
- B. A basic medium
- C. A neutral medium
- D. It does not exist.

Answer: B

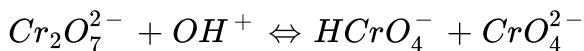


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3. In basic solution above $pH6$, CrO_3 forms the tetrahedral yellow chromate ion, CrO_4^{2-} . Between pH 2 and 6, $HCrO_4^-$ and the orange red dichromate ion, $Cr_2O_7^{2-}$, are in equilibrium. At pH values below 1, the main species is H_2PCrO_4 . The equilibria are



In addition, these are base-hydrolysis equilibria



The pH dependent equilibria are quite labile and on addition of cations that form insoluble chromates (e.g., Ba^{2+} , Pb^{2+} and Ag^+), the chromates and not the dichromates are precipitated.

In the redox reaction involving $Cr_2O_7^{2-}$ and Fe^{2+} ions, the number of electrons absorbed per chromium atom is

A. 1

B. 3

C. 4

D. 6

Answer: B



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Comprehension 5

1. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous $NaCl$ to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

The metal rod M is

A. Fe

B. Cu

C. Ni

D. Co

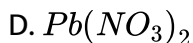
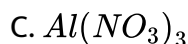
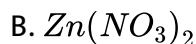
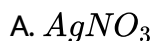
Answer: B



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2. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous $NaCl$ to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

The compound N is



Answer: A



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3. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous $NaCl$ to the blue solution gives a white precipitate O. Addition of

aqueous NH_3 dissolves O and gives an intense blue solution.

Q. The final solution contains.

- A. $[Pb(NH_3)_4]^{2+}$ and $[CoCl_4]^{2-}$
- B. $[Al(NH_3)_4]^{3+}$ and $[Cu(NH_3)_4]^{2+}$
- C. $[Ag(NH_3)_2]^+$ and $[Cu(NH_3)_4]^{2+}$
- D. $[Ag(NH_3)_2]^+$ and $[Ni(NH_3)_6]^{2+}$

Answer: C



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Comprehension 6

1. Transition elements show variable oxidation states. This is due to their valence electrons which are found in two different orbitals i.e., ns and (n-1) d. Up to (+II) oxidation state ns electrons are involved, but in higher oxidation states, electrons of (n-1) d sub-shells are also involved.

The most common oxidation state shown by 1st row of transition elements is

- A. (+II)
- B. (+III)
- C. (+IV)
- D. all of these.

Answer: A



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2. Transition elements show variable oxidation states. This is due to their valence electrons which are found in two different orbitals i.e., ns and $(n-1)d$. Up to (+II) oxidation state ns electrons are involved, but in higher oxidation states, electrons of $(n-1)d$ sub-shells are also involved.

The transition metal which shows the highest oxidation state is

- A. Mn

B. Pt

C. Fe

D. Ni.

Answer: A



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3. Transition elements show variable oxidation states. This is due to their valence electrons which are found in two different orbitals i.e., ns and $(n-1)d$. Up to $(+II)$ oxidation state ns electrons are involved, but in higher oxidation states, electrons of $(n-1)d$ sub-shells are also involved.

the cause of variable oxidation states among transition elements is that

A. they all exist in more than one oxidation states among transition elements is that

B. they all form complex compounds

C. the valence electrons in them are found in two different sub-shells

D. they all have paired sub-shells.

Answer: C

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Straight Objective Type Mcqs Single Correct Option

1. On strong heating, $AgNO_3$ produces the gases

A. N_2O and NO

B. N_2O and O_2

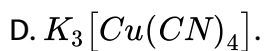
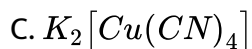
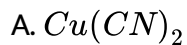
C. NO and N_2O

D. N_2O and NO

Answer: B

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2. $CuSO_4$ reacts with KCN to form

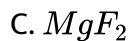
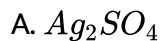


Answer: D



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3. Which of the following compounds is expected to be coloured?



Answer: B

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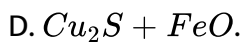
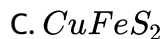
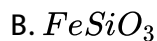
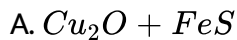
4. The addition of high proportions of manganese makes steel useful in making rails or railroads because manganese is useful in making rails or railroads because manganese

- A. gives hardness to steel
- B. helps in the formation of oxides of iron
- C. can remove oxygen from sulphur
- D. can show high oxidation state of +7.

Answer: A

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5. The chemical composition of slag formed during the smelting process in the extraction of copper is :-

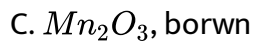
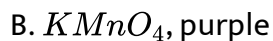
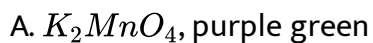


Answer: B



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



D. Mn_3O_4 , black.

Answer: A

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7. The spin magnetic moment of cobalt in the compound $Hg[Co(SCN)_4]$ is

A. $\sqrt{3}$

B. $\sqrt{8}$

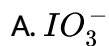
C. $\sqrt{15}$

D. $\sqrt{24}$.

Answer: C

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



Answer: A



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9. Which ore contains both iron and copper?

A. cuprite

B. chalcocite

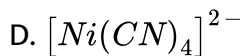
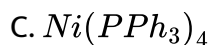
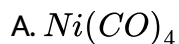
C. chalcopyrite

D. malachite

Answer: C

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10. The complex showing a spin -magnetic moment of $2.82BM$ is .

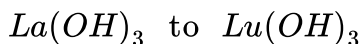


Answer: B

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11. Consider the following statements in respect of lanthanoids.

1. The basic strength of hydroxides of lanthanoids increases from



The lanthanoid ions Lu^{3+} , Yb^{2+} and Ce^{4+} are diamagnetic. Which of the statements given above is/are correct ?

- A. 1 only
- B. 2 only
- C. Both 1 and 2
- D. Neither 1 nor 2.

Answer: B



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

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

D. NiS and HgS

Answer: A



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13. The colour of light absorbed by an aqueous solution of $CuSO_4$ is

A. orange red

B. bluish green

C. yellow

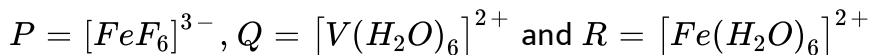
D. violet.

Answer: A



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14. Consider the following complex ions P , Q and R



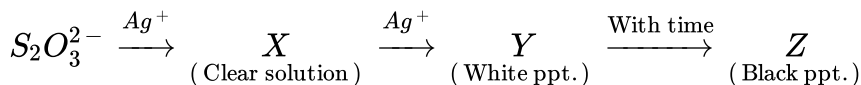
The correct order of the complex ions, according to their spin only magnetic moment values (in BM) is .

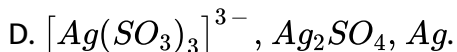
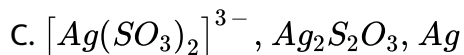
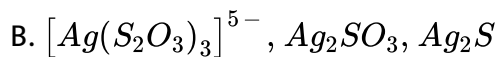
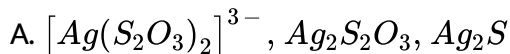


Answer: B

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15. In the following sequence in aqueous solution, the species X, Y and Z, respectively, are





Answer: A

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16. Which of the following combination will produce H_2 gas ?

A. Fe metal and Conc. HNO_3

B. Cal metal and Conc. HNO_3

C. Au metal and NaCN(aq) in the presence of air

D. Zn metal and NaOH(aq)

Answer: D

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Multiple Correct Options Type Mcqs

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

A. $NO(g)$

B. V_2O_5

C. Mo

D. Platinised asbestos.

Answer: B::D

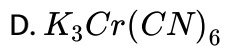
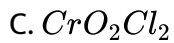


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2. Among these, identify the species with an atom in +6 oxidation state: .

A. $KMnO_4$

B. K_2MnO_4



Answer: B::C



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3. Transition metals with $4s^1$ configuration are :

A. Cr

B. Mn

C. Ni

D. Cu

Answer: A::D



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4. Complex forming tendency of transition metals depending upon :

- A. availability of a number of d-orbitals
- B. high ionisation enthalpy
- C. small size of cation or high charge density
- D. variable oxidation states.

Answer: A::C



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5. Potassium manganate (K_2MnO_4) is formed when

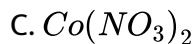
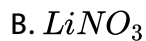
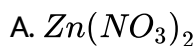
- A. Chlorine is passed into aqueous $KMnO_4$ is formed when
- B. manganese dioxide is fused with potassium hydroxide in air
- C. formaldehyde reacts with potassium permanganate in presence of
a strong alkali

D. potassium permanganate reacts with conc. Sulphuric acid.

Answer: B::C

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



Answer: C::D

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7. Which of the following alloys contain (s) Cu and Zn?

A. Bronze

B. Brass

C. Gun metal

D. Type metal.

Answer: B::C



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8. Which of the following statement are correct when a mixture of $NaCl$ and $K_2Cr_2O_7$ is gently warmed with conc. H_2SO_4 ?

A. Deep red vapours are evolved

B. The vapours when passed through NaOH solution, give yellow solution of Na_2CrO_4

C. Chlorine gas is evolved

D. Chromyl chloride is formed.

Answer: A::B::D

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9. For the given aqueous reactions, which of the statement(s) is (are) true

?



A. The first reaction is a redox reaction

B. White precipitate is $Zn_3[Fe(CN)_6]_2$

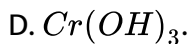
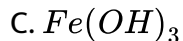
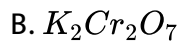
C. Addition of filtrate to starch solution gives bluecolour

D. White precipitate is soluble in NaOH solution.

Answer: A::C::D

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10. The compounds which are coloured only due to charge transfer are :



Answer: A::B



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11. Choose the correct statement.

A. First ionisation energy of Cu is higher than that of K.

B. Second ionisation energy of Cu is lower than that of K.

C. Third ionisation energy of Cu is higher than that of K.

D. Third ionisation energy of Cu is lower than that of K.

Answer: B::D

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12. Which of the following atomic numbers are those of inner transition (f-block) elements ?

A. 59

B. 95

C. 102

D. 104

Answer: A::C::D

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13. Cupric compounds are more stable than their cuprous counterparts in solid state. This is because

- A. the endothermic character of the 2nd I P of Cu is not so high
- B. size of Cu^{2+} is less than Cu^+
- C. Cu^{2+} has stabler electronic configuration as compared to Cu^+
- D. the lattice energy released for cupric compounds is much higher than Cu^+ .

Answer: B::D

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14. 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 oxidising agent

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

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

Answer: A::B::C

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15. Which of the following statement (s) is (are) correct when a mixture of $NaCl$ and $K_2Cr_2O_7$ is gently warmed with conc. H_2SO_4 ?

A. Deep red vapours are evolved

B. The vapours when passed through $NaOH$ solution, give a yellow solution.

C. Chlorine gas is evolved

D. Chromyl chloride is formed.

Answer: A::B::D

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16. The correct option(s) to distinguish nitrate salts of Mn^{2+} and Cu^{2+} taken separately is (are)

A. Mn^{2+} show the characteristic green colour in the flame test

B. Only Cu^{2+} show the formation of precipitate by passing H_2S in acidic medium

C. Only Mn^{2+} show the formation of precipitate by passing H_2S in faintly basic medium

D. Cu^{2+}/Cu has higher reduction potential than Mn^{2+}/Mn (measured under similar conditions).

Answer: B::D

Assertion Reason Type Questions

1. Assertion : An aqueous solution of ferric chloride is acidic due to hydrolysis.

Reason : Ferric chloride is a covalent compound and exists as a dimer.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B

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

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

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: A



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3. Statement-1: Equivalent mass of $KMnO_4$ is equal to one-third of its molecular mass when it acts as an oxidising agent in an alkaline medium.

Statement-2: Oxidation number of Mn is +7 in $KMnO_4$.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B



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4. Assertion : Cuprous salts are diamagnetic in nature.

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

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: A



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5. Assertion : Mercuric chloride becomes red on adding KI solution.

Reason : Mercuric chloride undergoes hydrolysis forming basic chloride.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: C

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6. Assertion: Ce^{4+} is used as an oxidising agent in volumetric analysis.

Reason: Ce^{4+} has the tendency to attain +3 oxidation state.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

Answer: A

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

A. If both assertion and reason are correct and reason is correct explanation for assertion.

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

C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

Answer: C

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8. Assertion : $FeSO_4 \cdot 7H_2O$ always contains traces of Fe^{3+} ions.

Reason : This is due to oxidation of Fe^{2+} to Fe^{3+} ions.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: A

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9. Assertion: Mn atom loses ns electrons first during ionisation as compared to $(n - 1)$ d electrons

Reason: The effective nuclear charge experienced by $(n - 1)$ d electrons is greater than that by ns electrons.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: A

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10. Assertion: $K_2Cr_2O_7$ is used as primary standard in volumetric analysis.

Reason: It has a good solubility in water.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: C

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11. Assertion : Change in colour of the acidic solution of breath is used as a test for drunken driver.

Reason : Change in colour is due to complexation of alcohol with potassium dichromate.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.

C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

Answer: C

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12. Assertion: Manganese shows a number of oxidation states.

Reason: The difference of energy between 3d and 4s subshells is large.

A. If both assertion and reason are correct and reason is correct explanation for assertion.

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

C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

Answer: C

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13. Assertion: Actinoids show greater number of oxidation states than lanthanoids. Reason: Actinoids are radioactive.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B

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14. Assertion : $KMnO_4$ is a coloured compound.

Reason : Colour of $KMnO_4$ is due to charge transfer.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: A

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15. Assertion : $KMnO_4$ is an oxidising agent in neutral, acidic and alkaline medium.

Reason : Equivalent mass of $KMnO_4$ in acidic medium is $31 \hat{A}6$.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B



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16. Assertion : Ionisation of transition metals involves loss of ns electron before $(n - 1)d$ electrons.

Reason : Filling of ns -orbitals takes place before $(n - 1)d$ orbitals.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B

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17. The free gaseous Cr atom has six unpaired electrons.

Half-filled s-orbital has greater stability.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

Answer: C

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18. Assertion (A): Potassium dichromate is preferred to $Na_2Cr_2O_7$ for use in volumetric analysis (titrations)

Reason (R): $Na_2Cr_2O_7$ is hygroscopic whilst the $K_2Cr_2O_7$ is not

Which of the following is correct ?

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: A

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19. Assertion : The separation of lanthanoids is difficult.

Reason : Lanthanoids exhibit the common oxidation states of +2, +3, +4.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B

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20. 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

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: C



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21. Assertion: If a strong acid is added to a solution of potassium chromate it changes its colour from yellow to orange.

Reason: The colour change is due to the oxidation of potassium chromate.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: C



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22. Statement I : Zn^{2+} is diamagnetic

Statement II : The electrons are lost from 4s orbital to form Zn^{2+}

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: B

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23. Assertion : Reduction potential of Mn (+ 3 to + 2) is more positive than that of Fe (+ 3 to + 2).

Reason : Ionisation potential of Mn is more than that of Fe.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: C

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Integer Answer Type Questions

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

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2. Calculate the total decrease in O. N. when potassium dichromate changes to chromium sulphate.



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3. How many electrons are accepted when $KMnO_4$ acts as an oxidising agent in the presence of dilute sulphuric acid?

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4. The most common and most stable oxidation state for all the elements of titanium family is

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5. What is the number of unpaired d-electrons which the element Mn can have in the compound. $K_4[Mn(CN)_6]$?

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6. Find the oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 .

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7. Number of water molecules in Mohr's salt is

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8. What is the change in oxidation state of Cr" in " $K_2Cr_2O_7$ when it acts as an oxidising agent.

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9. What is the percentage impurity is 22 carat gold ?

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10. Ammonium hydroxide is added in excess to an aqueous solution of $CuSO_4$ blue in colour to form a deep blue complex compound. What is the C.N. of copper in the complex?

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11. The number of moles of acidified $KMnO_4$ required to convert one mole of sulphite ion into sulphate ion is, x/y . The value of $X + y = 0$ is

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12. In neutral or faintly alkaline solution, 8 moles of permanganate anions to produce X moles of a sulphur containing product. The magnitude of X is

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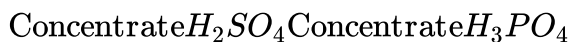
13. The number of moles of $KMnO_4$ reduced by 1mol of KI in alkaline medium is

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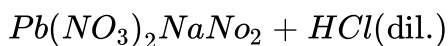
14. Acidified potassium dichromate reacts with potassium iodide and oxidises it to I_2 . The oxidation state of chromium in the products of reaction is + x. The value of x is :

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15. Total number of reagents give below reacted with $KI_{(aq)}$ to produce I_2 :



Cl_2 water acidify bleaching powder





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Brain Storming Multiple Choice Questions Mcqs

1. In Which case (s), there is change in oxidation number ?

- A. Aqueous solution of CrO_4^{2-} is acidified
- B. SO_2 gas is passed through acidified $Cr_2O_7^{2-}$ solution
- C. $Cr_2O_7^{2-}$ solution is made alkaline
- D. CrO_2Cl_2 is dissolved in NaOH.

Answer: B



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2. Which of the following elements shows maximum number of different oxidation states in its compounds ?

A. Eu

B. La

C. Gd

D. Am.

Answer: D

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3. Identify the incorrect statement ?

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

B. In Lanthanoid series, the ionic radius of M^{3+} decreases

C. La is a transition metal rather than a member of Lanthanoid series

D. Atomic radii of Zr and Hf are the same due to lanthanoid contraction.

Answer: A



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4. There are three unpaired electrons in $[Co(H_2O)_6]^{2+}$ and calculated value of magnetic moment is $3 \hat{A} \cdot 87$ BM which is quite different from the experimental value of $4 \hat{A} \cdot 40$ BM. This is because of :

- A. increase in number of unpaired electrons
- B. some contribution of the orbital motion of the electron to the magnetic moment
- C. Change in orbital spin of the electron
- D. d-d transition.

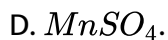
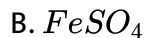
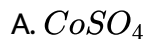
Answer: B



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5. An inorganic compound on strong heating gave a blackish brown powder and two oxides of sulphur. The powder was dissolved in HCl when

a yellow solution was obtained. It gave a blood red colouration with thiocyanide ions. The inorganic compound is likely to be



Answer: B



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6. The number of moles of $K_2Cr_2O_7$ reduced by 1 mol of Sn^{2+} ions is

A. $1/3$

B. 3

C. $1/4$

D. 4

Answer: A



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7. A metal gives two different chlorides 'A' and 'B'. The chloride 'A' gives a white precipitate with NH_4OH solution while 'B' gives a black precipitate. With KI solution, 'A' gives a red precipitate which dissolves in excess of KI solution. The two chlorides are :

A. $HgCl_2$ and $HgCl$

B. $HgCl_2$ and Hg_2Cl_2

C. Hg_2Cl_2 and $HgCl_2$

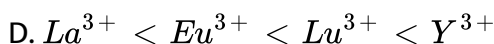
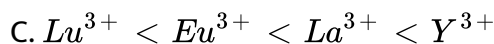
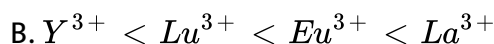
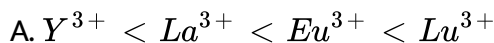
D. None of these.

Answer: B



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



Answer: B



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9. Four successive members of the first row transition elements are listed below with their atomic number. Which one of them is expected to have the highest third ionisation enthalpy ?

A. Vanadium ($Z = 23$)

B. Chromium ($Z = 24$)

C. Manganese ($Z = 25$)

D. Iron ($Z = 26$).

Answer: C

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10. The radii of the elements from chromium ($Z = 24$) to copper ($Z = 29$) are very close to one another. This is due to :

A. lanthanoid contraction

B. the fact that successive addition of d-electrons screen the outer 4s electrons from the inward pull of the nucleus

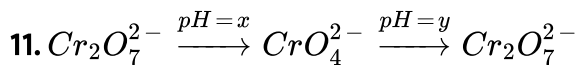
C. increase in radii due to increase in n is compensated by decrease in radii due to increase in Z

D. atomic radii do not remain constant but decrease in a normal gradation.

Answer: B



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x and y can be :

A. 4 and 5

B. 4 and 8

C. 8 and 4

D. 8 and 9

Answer: C



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12. Ti^{2+} is purple while Ti^{4+} is colourless because

A. there is no crystal field effect in Ti^{4+}

B. Ti^{2+} has $3d^2$ configuration

C. Ti^{4+} has $3d^2$ configuration

D. Ti^{4+} is a very small cation when compared to Ti^{2+} and does not absorb any radiation.

Answer: B

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

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

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

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

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

Answer: D



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