



## CHEMISTRY

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### THE d AND f-BLOCK ELEMENTS

#### Example

1. Out of  $Cr^{2+}$  and  $Cr^{3+}$ , which one is stable in aqueous solution?



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2. The common oxidation state shown by lanthanoids are.

A. +5

B. +2

C. +3

D. +1

**Answer:**



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3. \_\_\_\_\_ is the most stable oxidation state of Mn.



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4. Lanthanoid contraction is due to the.

- A. increase in effective nuclear charge
- B. increase in atomic number
- C. decrease in atomic number
- D. none of these

**Answer:**



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5. The maximum oxidation state shown by Mn in its compound is.

A. +8

B. +5

C. +6

D. +7

**Answer:**



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6. Name transition element which does not exhibit variable oxidation state.



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7. In the first transition series, the highest boiling and melting point is of.

A. Ni

B. Cr

C. Fe

D. V

**Answer:**



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**8.** One of the important use of ferrous sulphate is.

- A. manufacture of chalks
- B. manufacture of hydrogen sulphide
- C. manufacture of bide, blackink
- D. manufacture of sulphuric acid

**Answer:**



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9. Which is most reactive metal ?

A. Ni

B. Ag

C. Cr

D. Fe

Answer:



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10. " $Fe^{3+}$  Is stronger reducing agent than  $Cr^{2+}$ ".

State whether this statement is true or false?



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11. Observe the relationship between the first two terms and fill in the blanks:-  $MnO_4^-$  + 7,  $CrO_4^{2-}$  : \_\_\_\_\_.



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12. On electrolysis  $K_2MnO_4$  gets oxidised to \_\_\_\_\_.



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13. Choose the correctly matched pair.



A.  $V_2O_5$  : Amphoteric

B. NiO : Amphoteric

C. ZnO : Basic

D.

**Answer:**



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**14.** The common oxidation state shown by lanthanides in their compound is \_\_\_\_\_.



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15. "Zinc forms coloured Ions and complexes". State whether this statement is true-or false.



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16. The magnetic moment  $\mu$  , of transition metals is related to "the number of. unpaired electrons,n as \_\_\_\_\_ .



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17. The maximum oxidation state exhibited by actinide ions is \_\_\_\_\_.





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18. Lanthanide contraction is due to increase in \_\_\_\_\_.



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19. Across lanthanide series, the basicity of the lanthanide hydroxides \_\_\_\_\_.



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**20.** To an aq. Solution containing anions a few drops of acidified  $KMnO_4$  are added Which one of the following anions if present will not decolourise the  $KMnO_4$  solution?



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**21.** Compare magnetic moments of  $Mn^{2+}$  and  $Ti^{4+}$ .



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**22.** Some transition metal ions are listed below.

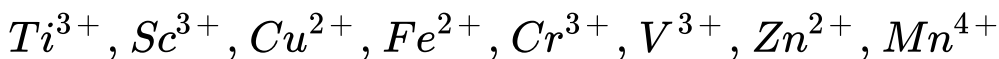
$Ti^{3+}$ ,  $Sc^{3+}$ ,  $Cu^{2+}$ ,  $Fe^{2+}$ ,  $Cr^{3+}$ ,  $V^{3+}$ ,  $Zn^{2+}$ ,  $Mn^{4+}$

:- Identify those complex ions which are colourless in solution. Justify your answer.



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**23.** Some transition metal ions are listed below.



:- Predict the ion having maximum magnetic moment and also calculate its magnetic moment.



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**24.** How does the acidified permanganate solution react with following:- HI.



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**25.** How does the acidified permanganate solution react with following:-  $Fe^{2+}$ .



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**26.** Transition elements show various oxidation states and many of the transition metal ions are attracted by a magnetic field. Name the two types of magnetic behaviour.



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**27.** A few drops of NaOH solution are added to orange red potassium dichromate solution, colours changes to yellow:- Name the yellow coloured compound formed.



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**28.** A few drops of NaOH solution are added to orange red potassium dichromate solution, colours changes to yellow:- To this yellow coloured solution, dilute HCl is added. Orange red colour reappears. Give the chemistry behind this.



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29. Explain giving reason:- the enthalpies of atomisation of the transition metals are high.



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30. Account for the following:-Transition elements form a number of interstitial compounds.



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31. What happens when acidified  $KMnO_4$  solution reacts with aqueous KI solution? Give the chemical



equation for the reaction.



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**32.** The most stable oxidation state of lanthanoid is +3. But Yb shows an oxidation state of +2 in its compounds. Justify on the basis of electronic configuration.



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**33.** Some d-block elements are given below. Cr, Mn, Fe, Co, Ni:- Identify the element which shows maximum paramagnetic behaviour.



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**34.** Some d- block elements are given below. Cr, Mn, Fe, Co, Ni:- Give reason for the highest paramagnetic property of that element.



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**35.** Explain why  $CuSO_4$  is blue while  $ZnSO_4$  is colourless.



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**36.** Basicity of hydroxides of lanthanoids decreases along the period from left to right. Explain the reason.



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**37.** "There are two beakers containing aqueous KI solution.' A student adds little  $KMnO_4$  alone the first beaker and  $KMnO_4$  and sulphuric acid to the second beaker:- Identify the change that happened to KI.



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**38.** "There are two beakers containing aqueous KI solution.' A student adds little  $KMnO_4$  alone the first beaker and  $KMnO_4$  and sul-phuric acid to the second beaker:- Give the balanced chemical equation for the reaction in each beaker.



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**39.** The observed magnetic of  $Sc^{3+}$  was found to be zero. Calculate the magnetic moment of  $Sc^{3+}$  using the 'spin only' formula and compare the result of observed and calculated magnetic moment.



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40.  $Cu^{2+}$  is paramagnetic while  $Cu^{+}$  is diamagnetic.

Give reason.



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41. Write the formula of the compound in which the metal is in +7 oxidation state.



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42. Compare the electronic configurations and oxidation states of actinoids and lanthanoids.



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**43.** Explain a. The lowest oxide of a transition metal( $\text{Cr}, Z=24$ ) is basic whereas the highest oxide is usually acidic



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**44.** Suggest reason, for the following:- A transition metal exhibits highest oxidation state in oxides and fluorides.



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**45.** Which among the following exhibit the property Indicated? Give reason for your answer:-  $Ti^{4+}$  or  $Co^{2+}$  (Paramagnetism).



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**46.** Which among the following exhibit the property Indicated? Give reason for your answer:-  $Zn^{2+}$  or  $Cu^{2+}$  (Colour).



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**47.** Which among the following exhibit the property Indicated? Give reason for your answer:-  $Fe^{2+}$  or  $Fe^{3+}$  (More unpaired electrons).



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**48.** During the estimation of Mohr's salt by using  $KMnO_4$  on adding acid  $KMnO_4$  to acidified Mohr's salt- solution, pink colour of  $KMnO_4$  vanished:- Give the chemistry of the reaction.



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49. During the estimation of Mohr's salt by using  $KMnO_4$  on adding acid  $KMnO_4$  to acidified Mohr's salt- solution, pink colour of  $KMnO_4$  vanished:- Illustrate the oxidising property of  $KMnO_4$  in basic medium.



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50. What happens when the following process take place? Give chemical equation for the process:- When  $H_2S$  is passed through acidified potassium dichromate solution.



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51. What happens when the following process take place? Give chemical equation for the process:- When acidified  $KMnO_4$  added to  $FeSO_4$  solution.



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52. When two electrons are lost from following atom, is there any change in magnetic properties of each? Explain which has maximum magnetic property. Mn, Cr, Fe.



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53. Give the chemical equation which represent the oxidising action of  $Cr_2O_7^{2-}$  – In acidic medium.



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54. Sketch the structure of  $Cr_2O_7^{2-}$  – In and  $CrO_4^{2-}$  – ion.



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55. Account for the following:-  $La(OH)_3$  is more basic than  $Lu(OH)_3$ .



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**56.** Account for the following:-Cd and Hg are normally not considered as transition metals.



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**57.** A list of transition metal ions are given.  $\text{Ti}^{(2+)}$ ,  $\text{Sc}^{(3+)}$ ,  $\text{Cr}^{(2+)}$ ,  $\text{V}^{(2+)}$ ,  $\text{Mn}^{(2+)}$ ,  $\text{Fe}^{(2+)}$ ,  $\text{Zn}^{(2+)}$ :-  
Give the number of unpaired electrons.



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**58.** A list of transition metal ions are given.  $\text{Ti}^{(2+)}$ ,  $\text{Sc}^{(3+)}$ ,  $\text{Cr}^{(2+)}$ ,  $\text{V}^{(2+)}$ ,  $\text{Mn}^{(2+)}$ ,  $\text{Fe}^{(2+)}$ ,  $\text{Zn}^{(2+)}$ :-

Arrange the ions in the increasing order of their magnetic moment.



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59. A list of transition metal ions are given.  $\text{Ti}^{(2+)}$ ,  $\text{Sc}^{(3+)}$ ,  $\text{Cr}^{(2+)}$ ,  $\text{V}^{(2+)}$ ,  $\text{Mn}^{(2+)}$ ,  $\text{Fe}^{(2+)}$ ,  $\text{Zn}^{(2+)}$ :- Identify the ions which are colourless. Give reason.



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60. What is lanthanoid contraction?



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**61.** What are the consequences of lanthanoid contraction?



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**62.** Transition metals show variable oxidation states due to tendency of 'd' as well as 's' electrons to take part in bond formation:- Which element in the first series of transition elements does not exhibit variable oxidation states and why?



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**63.** Transition metals show variable oxidation states due to tendency of 'd' as well as 's' electrons to take part in bond formation:- Why do actinoids, in general, exhibit a greater range of oxidation states than the lanthanoids?

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**64.** Write the electronic configuration of  $Ce^{3+}$  ion, and calculate the magnetic moment on the basis of spin only formula. (Atomic No. of Ce = 58)

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**65.** The lowest oxide of transition metal is basic the highest is amphoteric or acidic. Why?



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



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**67.** Compare the chemistry of actinoids with that of the lanthanoids with special reference to :- electronic configuration.





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**68.** Compare the chemistry of actinoids with that of the lanthanoids with special reference to :- Oxidation state.



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**69.** Compare the chemistry of actinoids with that of the lanthanoids with special reference to :- Atomic and ionic sizes.



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



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71. To what extent do the electronic configuration decide the stability of oxidation states first series of the transition elements? justify your answer with examples."



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



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**73.** In what way is the electronic configuration of the transition elements different from that of the non-transition elements?



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74. What are the different oxidation states shown by the actinides?



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75. Explain giving reason:- Transition metals and many of their compounds show paramagnetic behaviour.



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76. Explain giving reason:- the enthalpies of atomisation of the transition metals are high.



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**77.** Explain giving reason:-The transition metals generally form coloured compounds.



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**78.** Explain giving reason:- Transition metals and their many compounds act as good catalyst.



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**79.** What are interstitial compounds? Why are such compounds well known for transition metals?



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**80.** Suggest reason, for the following:- A transition metal exhibits highest oxidation state In oxides and fluorides.



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**81.** Give examples and suggest reasons for the following features of the transition metal chemistry:-  
The highest oxidation state is exhibited in oxoanions of a metal.



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**82.** In d-block elements the radii of elements of third transition series are similar to those of the elements of second transition series. Give reason.



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**83.** Outer electronic configuration of  $Cu^{2+}$  ion is  $3d^9$ . Calculate its spin only magnetic moment.



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84. Describe the method of preparation of potassium dichromate from chromite ore.

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85.  $MnO_4^-$  and ..... are formed by the disproportionation of  $MnO_4^{2-}$  In acidic medium.

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

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**87.** What is the structure of chromate ion  $\left((CrO_4)^{2-}\right)$ ?



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**88.** Give reasons for the following:- Transition metals and many of their compounds act as catalyst.



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**89.** Give reasons for the following:- Scandium ( $Z=21$ ) does not exhibit variable oxidation state and yet it is

regarded as a transition element.



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**90.** Give reasons for the following:- Write the step involved in preparation of  $Na_2 CrO_4$  from chromite ore.



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**91.** Transition elements are d- block elements Write any four characteristic properties of transition elements.



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**92.** transition elements are 'd' block elements.  $Cr^{2+}$  and  $Mn^{3+}$  have  $d^4$  configuration. But  $Cr^{2+}$  is reducing and  $Mn^{3+}$  is oxidizing. Why?



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**93.** Transition elements are 'd' block elements:- Which of the following is not a Lanthanoid element?

A. Cerium

B. Europium

C. Lutetium

D. Thorium

**Answer:**



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**94.** Which of the following oxidation state is not shown by Manganese?

A. +1

B. +2

C. +4

D. +7

**Answer:**



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**95.** Represent the structure of dichromate ion.



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**96.** Potassium permanganate ( $KMnO_4$ ) is a strong oxidizing agent. Write any two oxidizing reactions of  $KMnO_4$ .



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**97.** Fourteen elements following Lanthanum are called Lanthanoids. What is Lanthanoid contraction? Give reason for it.



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**98.** Fourteen elements following Lanthanum are called Lanthanoids.  $KMnO_2$  is a purple coloured crystal and it acts as an oxidant. How will you prepare from  $MnO_2$  ?



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**99.** Potassium dichromate is an orange coloured crystal and is an important compound used as an oxidant in many reactions How do you prepare  $K_2Cr_2O_7$  from chromite ore?



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**100.** Potassium dichromate is an orange colour crystal and is an important compound used as an oxidant in many reactions How will you account for the colour of potassium dichromate crystals?



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**101.**  $KMnO_4$  Is a strong oxidizing agent In acidic, alkaline and neutral medium:- How  $KMnO_4$  Is prepared from pyrolusite ore?

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**102.**  $KMnO_4$  Is a strong oxidizing agent In acidic, alkaline and neutral medium:- Glve the general electronic configuration of transition elements.

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**103.** Account for the following trends in atomic and ionic radii of transition metals:- Ions of the same charge in a given series (3d, 4d or 5d) show progressive decrease in radii with increasing atomic number.



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**104.** Account for the following trends in atomic and ionic radii of transition metals. The atomic radii of elements in 4d series are more than that of corresponding elements in 3d series.



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**105.** Account for the following trends in atomic and ionic radii of transition metals. The atomic radii of the corresponding elements in '4d' series and 5d series are virtually the same.



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**106.** Transition elements are d- block elements Write any four characteristic properties of transition elements.



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**107.** Describe the method of preparation of potassium dichromate from chromite ore.



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**108.** Write any one consequence of lanthanoid contraction.



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**109.** Transition elements are d-block elements, with some exceptions. Usually they are paramagnetic. They show variable oxidation states. They and their compounds show catalytic property Zn (atomic

number 30) is not a transition element, though it is a d-block element. Why?



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**110.** Transition elements are d-block elements, with some exceptions. Usually they are paramagnetic. They show variable oxidation states. They and their compounds show catalytic property. Which is more paramagnetic:  $Fe^{2+}$  or  $Fe^{3+}$ . Why?



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**111.** Two compounds of iron are given below.  $FeSO_4$   
 $Fe_2(SO_4)_3$  (The oxidation state of sulphate radical is -2): Why do transition elements show variable oxidation states?



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**112.** Transition elements are d-block elements, with some exceptions. Usually they are paramagnetic. They show variable oxidation states. They and their compounds show catalytic property. What is the reason for their catalytic property?



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**113.** Atomic sizes generally increase as we come down a group of the periodic table. But in the 4th group of the periodic table, Zr and Hf have almost the same atomic sizes. Why?



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**114.**  $E^\circ$  (standard electrode potential) values generally become less negative as we move across a transition series. But  $E^\circ$  values of  $Ni^{2+}/Ni$  and  $Zn^{2+}/Zn$  are exceptions. Justify.



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**115.** Transition metals are widely used as catalysts in industrial processes. Name any two industrial processes in which transition elements are used as catalysts.



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**116.** Transition metals are widely used as catalysts in industrial processes. Transition metals exhibit catalytic properties. Why?



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**117.** Transition metals are widely used as catalysts in industrial processes. Why do the transition elements exhibit greater similarity in properties compared to main group elements along the period as well as down the group?



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**118.** Transition elements are d- block elements Write any four characteristic properties of transition elements.



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**119.** Lanthanides and actinoids are f-block elements

What is the common oxidation state of lanthanoids?



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**120.** Lanthanoids and actinoids are f-block elements

Name the lanthanoid having oxidation state of +4



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**121.** Lanthanoids and actinoids are f-block elements It is difficult to separate lanthanoids in the pure state. Explain.



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**122.** Here certain pairs of element are given. Which of the two have almost similar size?

A. Ti and Zr

B. Nb and Ta

C. Ca and Ir

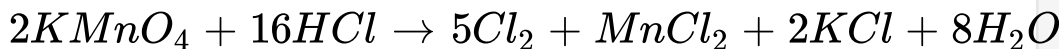
D. Hf and Zr

**Answer:**



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**123.** In the reaction



the reduction product is \_\_\_\_



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**124.** Anhydrous copper sulphate is used for detecting

the presence of water vapour:-  $CuSO_4 \cdot 5H_2O$  is known

as \_\_\_\_\_.



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**125.** Anhydrous copper sulphate is used for detecting

the presence of water vapour:- How is it useful in

detecting the presence of water vapour?



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**126.** Lanthanides and actinoids are f-block elements

What is the common oxidation state of lanthanoids?



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**127.** Lanthanoids and actinoids are f-block elements

Name the lanthanoid having oxidation state of +4



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**128.** Lanthanoids and actinoids are f-block elements. It is difficult to separate lanthanoids in the pure state. Explain.



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**129.** Potassium permanganate is a powerful oxidising agent in neutral, acidic and alkaline medium. In the lab, students were asked to convert an iodate. One of the students obtained  $I_2$  instead of iodate:- What is the reaction carried out by the students who got iodate? Write the chemical equation.



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**130.** Pottassium permangante is a powerful oxdising agent in neutral, acidic and alkaline medium. In the lab, students were asked to convert an iodate. One of the students obtained  $I_2$  instead of iodate:- What may be the reaction carried out by the student who obtained  $I_2$  as one of the products?



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**131.** Transition elements are d- block elements Write any four characteristic properties of transition elements.



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