



# CHEMISTRY

## BOOKS - OMEGA PUBLICATION

### THE D- AND F-BLOCK ELEMENTS

#### Questions

1. What are transition elements ? Which of the d block elements are not regarded as transition elements and why ?



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2. Give the electronic configurations of copper and chromium.



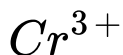
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3. Write the electronic configuration of  $Cr^{2+}$  and find the number of unpaired electrons in it.



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4. Write down the electronic configuration of:



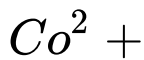
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5. Write down the electronic configuration of



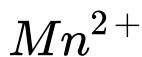
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6. Write down the electronic configuration of:



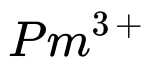
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7. Write down the electronic configuration of:



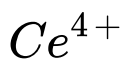
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8. Write down the electronic configuration of



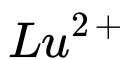
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9. Write down the electronic configuration of:



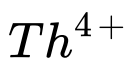
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**10.** Write down the electronic configuration of:



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**11.** Write down the electronic configuration of:



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**12.** Silver atom has completely filled d-orbitals ( $4d^{10}$ ) in its ground state. How can you say that it is a transition element ?



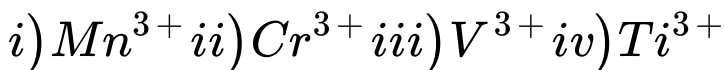
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**13.** In what way is the electronic configuration of transition elements different from that of the non-transition elements ?



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**14.** Calculate the number of unpaired electrons in the following gaseous ions



Which one of these is the most stable in aqueous solution ?



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**15.** What are d-Block elements ? Write their general electronic configuration.



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**16.** Copper atom has completely filled d-orbitals ( $3d^{10}$ ) in its ground state. How can you say that it is transition element ?



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**17.** Why Zn, Cd and Hg are not transition elements ?



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**18.** Scandium ( $z = 21$ ) is a transition element but zinc ( $z = 30$ ) is not. Explain.



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**19.** Why Zn, Cd, Hg are soft and have low m.pt.



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**20.** In 3d series name the element with highest m.p. ?



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21. How does atomic size of elements vary on moving from left to right in a period



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22. In the transition series starting from Lanthanum (atom no =57), the next element hafmniium (atom no =72) why so observe this jump in atomic number ?





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**23.** Explain why transition elements have high melting and boiling points ?



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**24.** The transition elements have high melting points.



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**25.** Why are I.E. of 5d - elements greater than 3d- elements ?



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**26.** Why enthalpy of atomisation of the transition elements are quite high ?



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**27.** Write the name of metal which shows only +3 oxidation state.



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**28.** Write the name and atomic number of fourth element of the 3d-series.



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**29.** Write the formula of ferrocyanide ion.



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**30.** Write the name and atomic number of the last element of 3d-series.



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**31.** Write the formula of dichromate ion.



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**32.** Write the name and atomic number of ninth element of the 3d-series.



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**33.** Why is the third ionization enthalpy of manganese (At. no.=25) unexpectedly high ?



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**34.** In 3d series name the element which can so an oxidation state of +1.



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**35.** Write the formula of a compound where the transition metal is in +7 oxidation state.



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**36.** Explain :Transition elements exhibit variable oxidation states.



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**37.** Which of the 3d-series of transition elements exhibits the largest number of oxidation states and why ?



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



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



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**40.** Explain why  $\text{Cu(I)}$  is diamagnetic while  $\text{Cu(II)}$  is paramagnetic in nature?



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41. Co(II) is stable in aqueous solution, but in presence of complexing reagent it is easily oxidised. Explain.



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



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**43.** Why does Mn(II) shows maximum paramagnetic

character among the divalent ions of first transition series ?



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**44.** Why does Mn(II) shows maximum paramagnetic

character among the divalent ions of first transition series ?



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



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



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**47.** Explain, why transition metal ions usually show paramagnetic behaviour ?



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**48.** Which of the two is paramagnetic V(IV) or V(V) and why ?



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49. Which one is more paramagnetic  $Fe^{2+}$  or  $Fe^{3+}$  ( $Z = 26$ ) ?



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50. How many unpaired electrons are in Cr(III) ?



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51. Why do the transition metals compounds are coloured ?





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52. Out of ions  $Co^{2+}$ ,  $Cr^{(3+)}$ ,  $(Sc^{3+}$  which will give coloured aqueous solution and what will be the magnetic behaviour of each ion ? (Atomic number of Co = 27, Sc = 21 and Cr = 24).



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53. Predict which of the following will be coloured in aqueous solution?  $Ti^{3+}$ ,  $V^{3+}$ ,  $Cu^{+}$ ,

$\text{Sc}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Fe}^{3+}$  and  $\text{Co}^{2+}$ . Give reasons for each.



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54. Out of the ions  $\text{Ag}^+$ ,  $\text{Co}^{2+}$  and  $\text{Ti}^{4+}$  which will give coloured aqueous solution and what will be the magnetic behaviour of each ion ? (Atomic number of Ag = 47, Co = 27 and Ti = 22).



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55. Why  $Cd^{2+}$  salts are white ? Cd=48



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56.  $Zn^{2+}$  salts are white while  $Cu^{2+}$  salts are blue, explain why ?



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57. Why Cu(I) is colourless and Cu(II) is blue in colour ?





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58. Which out of the following ions would form coloured complexes :  $Ni^{2+}$ ,  $Cu^{+}$  ?



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59. Why do transition metals form complexes ?



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60. Transition elements and their compounds are found to be good catalysts. Give examples.



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61. Why are  $Ni^{2+}$  compounds thermodynamically more stable than  $Pt^{2+}$  compounds whereas  $Pt^{4+}$  compounds are relatively more stable than  $Ni^{4+}$  compounds ?



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62. Why does  $V_2O_5$  act as catalyst ?



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63. Transition metals form number of interstitial compounds. Explain.



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64. What is Misch metal ?





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**65.** Why transition elements form a large number of alloys ?



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**66.** Write the composition and one use of bell metal.



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**67.** What are coinage metals ?



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**68.** How do alloys differ from amalgams ?



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**69.** Define tempering of steel.



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



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71. What is the action of heat on  $K_2Cr_2O_7$  and  $KMnO_4$ ?



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72. What is action of heat on  $KMnO_4$  ?



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73. Explain the structure of  $Cr_2O_7^{2-}$



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74. What happens when  $H_2O_2$  reacts with acidified  $FeSO_4$



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75. How acidified  $K_2Cr_2O_7$  reacts with the following :



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76. Describe the reaction of acidified  $K_2Cr_2O_7$  with  $Na_2SO_3$  solution.



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77. Describe the reaction of acidified  $K_2Cr_2O_7$  with  $Na_2SO_3$  solution.



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78. Write chemical reaction for preparation of  $K_2Cr_2O_7$  from chromite ore.



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79. Explain chromyl chloride test for chlorides.



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**80.** In Alkaline solution we have chromates and in acidic solution, dichromates ? Explain.



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**81.** How will you convert pyrolusite ore into potassium permanganate ? Give the chemical reactions only.



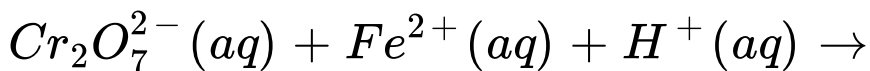
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**82.** Write the formula of manganate ion and draw the structure of permanganate ion.



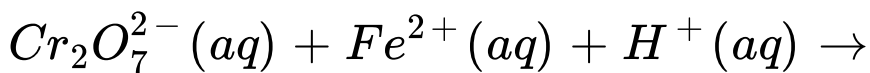
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**83.** Complete the following chemical reaction equations .



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**84.** Complete the following chemical reaction equations .



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**85.** Write the chemical equation for the oxidation of  $S_2O_3^{2-}$  by  $MnO_4^-$  in neutral medium.



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**86.** Write the chemical equation for the oxidation of  $\text{Sn}^{+2}$  by  $\text{Cr}_2\text{O}_7^{2-}$  in acidic medium.



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**87.** Why is silver bromide ( $\text{AgBr}$ ) used in photography?



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**88.** What is the basic difference between the electronic configurations of transition and inner transition elements ?



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**89.** What are f-block elements ? Write their general electronic configuration.



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**90.** What are inner transition elements ? How do they differ from transition elements ?



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**91.** Write the general electronic configuration of lanthanoids.



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**92.** Briefly explain, why are electronic configuration of lanthanides not known with certainty ?



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**93.** Chemistry of all lanthanoids is so identical. Explain.



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**94.** Why separation of lanthanoid elements is difficult ?



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**95.** Define Lanthanide Contraction.



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**96.** Give the cause of Lanthanide Contraction.



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**97.** Which ion has maximum size in Lanthanoid series ?



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**98.** Write consequences of Lanthanoid contraction. Why Zr and Hf exhibit similar properties ?



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**99.** What are different oxidation states exhibited by lanthanoids ?



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**100.** The +3 oxidation state of Lanthanum (Z=57). Gadolinium (Z=64) and Lutetium (Z=71) are especially stable, Why ?



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**101.** All the members of actinoid series have +3 O.S. Assign reason for this.



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**102.** How does lanthanoid contraction affect the physical and chemical properties of the elements of lanthanoid series ?



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**103.** Why the properties of the third transition series are very similar to the second transition series?



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**104.** Why is  $La(OH)_3$  more basic than  $Lu(OH)_3$ ?



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



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**106.** What is the most common oxidation state in the Lanthanoids ?



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**107.** Name members of lanthanoid series which exhibit +4 O.S. Assign reason for this.



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**108.** Name the members of lanthanoid series which exhibit +2 O.S. Assign reason for this.



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**109.** One among the lanthanoids, Ce(III) ( $Z=58$ ) can easily be oxidised to Ce (IV). Explain why?



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**110.** What is the general electronic configuration of actinoids?



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**111.** How would you account for the following:

There is a greater range of oxidation states among the actinoids than among the lanthanoids.



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**112.** All the ..... are radioactive.



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**113.** What is Actinoid contraction ? Explain it.



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**114.** Give three differences between lanthanides and actinides.



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**115.** Give one use of lanthanoids and actinoids.



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**116.** Why is europium (II) more stable than cerium (II) (Eu = 63, Ce =58) give one reason.



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**117.** Why Zr and Hf exhibit similar properties ?



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**118.** The chemistry of the actinoid elements is not so smooth as that of the lanthanoids. Justify this statement by giving some examples from the oxidation state of these elements.



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## Multiple Choice Questions

1. Which element belongs to d-block elements ?

A. Na

B. Ca

C. Cu

D. Ar

**Answer: C**



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2. The transition elements have a general electronic configuration of



A.  $ns^2 np^6 nd^{1-10}$

B.  $(n - 1)d^{1-10} ns^{0-2} np^{0-6}$

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

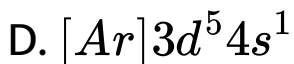
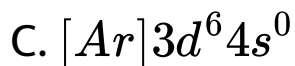
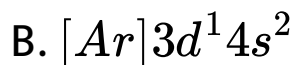
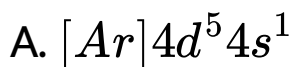
D.  $nd^{1-10} ns^{1-2}$

**Answer: C**



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**3.** The correct ground state electronic configuration of chromium atom ( $Z=24$ ) is



**Answer: D**



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4. Which of the following electronic configuration is that of a transition element ?

A.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$

B.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^1$

C.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^2$

D.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

**Answer: C**



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5. Which of the following elements is alloyed with copper to form brass?

A. Lead

B. Bismuth

C. Zinc

D. Antimony

**Answer: C**



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**6. Copper can be extracted from**

A. kupfernickel

B. dolomite

C. malachite

D. galena

**Answer: C**



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7. Argentite is an ore of

A. Cu

B. Pt

C. Au

D. Ag

**Answer: D**



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**8.** The process used for the extraction of gold is

A. Mac Arthur Forest Cyanide process

B. Parke's process

C. Baeyer's process

D. Liquation process

**Answer: A**



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**9. Important ore of zinc is**

A. calamine

B. cryolite

C. gibbsite

D. malachite

**Answer: A**



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**10.** The inner transition elements are the elements in which the added electrons goes to

A.  $(n-1)$  d-orbitals

B.  $(n-2)$  f-orbitals

C.  $(n-1)$  d-orbitals and  $(n-1)$  f-orbitals



D.  $(n-1)$  d-orbitals and ns orbitals

**Answer: B**



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**11. Transition elements**

- A. exhibit inert pair effect
- B. exhibit variable oxidation states
- C. have low melting points
- D. do not show catalytic activity.

**Answer: B**



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**12.** The tendency of the transition elements to form coloured compounds is attributed to

A. transition of electrons from one atom to the other

B. transition of electrons from s-orbitals of the outer shells to p-orbitals

C. d-d transition in last but one shell

D. none of the reason is correct.

**Answer: C**



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**13. Which of the following is diamagnetic ?**



D.  $Cu^{2+}$

**Answer: C**



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**14.** The common oxidation state of the elements of lanthanide series is

A. +2

B. +3

C. +4

D. + 1

**Answer: B**



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**15. Which of the following is a lanthanide ?**

A. Ta

B. Rh

C. Th

D. Lu

**Answer: D**



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**16.** For the process  $Cu(g) \rightarrow Cu^+(g) + e^-$ ,  
the electron is to be removed from

- A. 3d subshell
- B. 4s subshell
- C. 3p subshell
- D. any of the above

**Answer: B**



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**17. Paramagnetism is a property of**

A. completely filled electronic subshells

B. unpaired electrons

C. non transition elements

D. melting and boiling points of the elements.

**Answer: B**



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**18.** The first ionisation energy of silicon is lower than that of

A. increase as the atomic number increases

B. decrease as the atomic number increases



- C. do not show any change as the addition of electron takes place in the inner (n-1)d-orbitals
- D. None of the above.

**Answer: A**



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**19.** Which of the following electronic configurations will have the lowest magnetic moment?

A.  $d^2$

B.  $d^5$

C.  $d^8$

D.  $d^7$

**Answer: A**



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**20.** In general, the melting and boiling point of transition metals

A. increases gradually across the period

from left to right

B. decreases gradually across the period

from left to right

C. first increases till the middle of the

period configuration of and then

decreases towards the end

D. first decreases regularly till the middle of

the period and then increases towards

the end.

**Answer: A**



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**21. Which of the following transition element exhibit the oxidation state of +8?**

A. Cd

B. Ru

C. Au

D. Te

**Answer: B**



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**22.** Within each transition series, the oxidation states

A. decreases regularly in moving from left to right

B. first increases till the middle of period and then decreases

C. first decreases till the middle of period  
and then increases

D. None of the trend is correct.

**Answer: B**



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**23. Which forms interstitial compounds ?**

A. Fe

B. Co

C. Ni

D. All

**Answer: D**

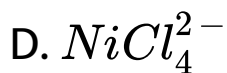


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**24.** Which of the following compounds is not coloured?

A.  $ZnCl_2$

B.  $CrCl_2$



**Answer: A**



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**25.** A transition element X-has a configuration  $[Ar]3d^4$  in its +3 oxidation state. Its atomic number is

A. 25



B. 26

C. 22

D. 19

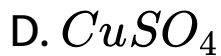
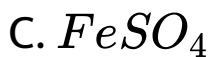
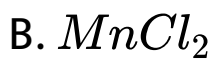
**Answer: A**



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**26.** Which of the following contains the maximum number of unpaired electrons ?

A.  $TiCl_3$

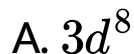


**Answer: B**



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27. The maximum magnetic moment is shown by the ion with electronic configuration of



B.  $3d^5$

C.  $3d^7$

D.  $3d^9$

**Answer: B**



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**28.** which metal is present in vitamin  $B_{12}$  or cyanocobalamin?

A. Fe

B. Co

C. Ni

D. Na

**Answer: B**



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**29. Which of the two have almost similar size ?**

A.  ${}_{22}\text{Ti}$  and  ${}_{40}\text{Zr}$

B.  ${}_{41}\text{Nb}$  and  ${}_{73}\text{Ta}$

C.  ${}_{39}Y$  and  ${}_{57}La$

D.  ${}_{20}Ca$  and  ${}_{31}Ir$

**Answer: B**



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**30.** Which of the following shows ferromagnetism?

A.  $TiO_2$

B.  $CrO_2$

C.  $MnO$

D.  $Fe_3O_4$

**Answer: B**



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**31.** Which of the following is not a d-block element?

A. Hg

B. Po

C. Ni

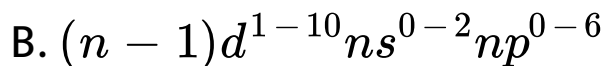
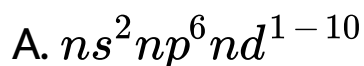
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**Answer: B**



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**32.** The transition elements have a general electronic configuration of



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

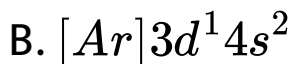
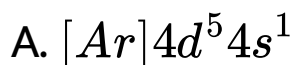
D.  $nd^{1-10}ns^{1-2}$

**Answer: C**

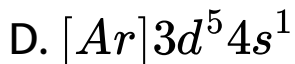
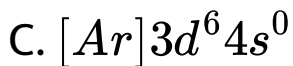


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**33.** The correct ground state electronic configuration of chromium atom ( $Z=24$ ) is







**Answer: D**



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**34.** Which of the following elements is alloyed with copper to form brass?

A. Lead

B. Bismuth

C. Zinc

D. Antimony

**Answer: C**



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**35. Argentite is an ore of**

A. Cu

B. Pt

C. Au

D. Ag.

**Answer: D**



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**36.** The inner transition elements are the elements in which the added electrons goes to

A.  $(n-1)$  d-orbitals

B.  $(n-2)$  f-orbitals

C.  $(n-1)$  d-orbitals and  $(n-1)$  f-orbitals

D.  $(n-1)$  d-orbitals and ns orbitals.

**Answer: B**



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**37. Transition elements**

- A. exhibit inert pair effect
- B. exhibit variable oxidation states
- C. have low melting points
- D. do not show any catalytic activity.

**Answer: B**



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**38.** Paramagnetism is a property of

A. completely filled electronic subshells

B. unpaired electrons

C. non-transition elements

D. melting and boiling points of the elements.

**Answer: B**



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**39.** Which of the following transition element exhibit the oxidation state of +8?

A. Cd

B. Ru

C. Au

D. Te

**Answer: B**



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**40. Which forms interstitial compounds ?**

A. Fe

B. Co

C. Ni

D. all the above

**Answer: D**



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41. which metal is present in vitamin  $B_{12}$  or cyanocobalamin?

A. Fe

B. Co

C. Ni

D. Na.

**Answer: B**





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