



# CFE-KOTA

IIT-JEE | NEET | CA | CS | Foundation

A Unit of PP SAVANI

Beginning For Successful Career

## STD: 12th JEE/NEET SUBJECT: CHEMISTRY

### CH-8 The d- and f-block Elements

#### 8.2 Electronic Configurations of the d-Block Elements

- Sc ( $Z = 21$ ) is a transition element but Zn ( $Z = 30$ ) is not because
  - both  $\text{Sc}^{3+}$  and  $\text{Zn}^{2+}$  ions are colourless and form white compounds
  - in case of Sc,  $3d$  orbitals are partially filled but in Zn these are filled
  - last electron is assumed to be added to  $4s$  level in case of Zn
  - both Sc and Zn do not exhibit variable oxidation states
- Which of the following ions has electronic configuration  $[\text{Ar}]3d^6$ ?
  - $\text{Ni}^{3+}$
  - $\text{Mn}^{3+}$
  - $\text{Fe}^{3+}$
  - $\text{Co}^{3+}$(At. nos. Mn = 25, Fe = 26, Co = 27, Ni = 28)
- Among the following series of transition metal ions, the one where all metal ions have  $3d^2$  electronic configuration is  
[At. nos. Ti = 22, V = 23, Cr = 24, Mn = 25]
  - $\text{Ti}^{3+}, \text{V}^{2+}, \text{Cr}^{3+}, \text{Mn}^{4+}$
  - $\text{Ti}^+, \text{V}^{4+}, \text{Cr}^{6+}, \text{Mn}^{7+}$
  - $\text{Ti}^{4+}, \text{V}^{3+}, \text{Cr}^{2+}, \text{Mn}^{3+}$
  - $\text{Ti}^{2+}, \text{V}^{3+}, \text{Cr}^{4+}, \text{Mn}^{5+}$
- Which of the following configuration is correct for iron?
  - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
- Which of the following has more unpaired  $d$ -electrons?
  - $\text{N}^{3+}$
  - $\text{Fe}^{2+}$
  - $\text{Zn}^+$
  - $\text{Cu}^+$
- The electronic configuration of transition elements is exhibited by
  - $ns^1$
  - $ns^2 np^5$
  - $ns^2 (n-1)d^{1-10}$
  - $ns^2 (n-1)d^{10}$

- The electronic configurations of four elements are given below. Which element does not belong to the same family as others?

- $[\text{Xe}]4f^{14}5d^{10}6s^2$
- $[\text{Kr}]4d^{10}5s$
- $[\text{Ne}]3s^2 3p^5$
- $[\text{Ar}]3d^{10}4s^2$

#### 8.3 General Properties of the Transition Elements (d-Block)

- Identify the incorrect statement.
  - $\text{Cr}^{2+}$  ( $d^4$ ) is a stronger reducing agent than  $\text{Fe}^{2+}$  ( $d^6$ ) in water.
  - The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.
  - Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.
  - The oxidation states of chromium in  $\text{CrO}_4^{2-}$  and  $\text{Cr}_2\text{O}_7^{2-}$  are not the same.
- The calculated spin only magnetic moment of  $\text{Cr}^{2+}$  ion is
  - 3.87 BM
  - 4.90 BM
  - 5.92 BM
  - 2.84 BM
- Match the metal ions given in Column-I with the spin magnetic moments of the ions given in Column-II and assign the correct code :

| Column-I            | Column-II             |
|---------------------|-----------------------|
| A. $\text{Co}^{3+}$ | (i) $\sqrt{8}$ B.M.   |
| B. $\text{Cr}^{3+}$ | (ii) $\sqrt{35}$ B.M. |
| C. $\text{Fe}^{3+}$ | (iii) $\sqrt{3}$ B.M. |
| D. $\text{Ni}^{2+}$ | (iv) $\sqrt{24}$ B.M. |
|                     | (v) $\sqrt{15}$ B.M.  |

The d - and f - Block Elements

- |  | A         | B    | C     | D     |
|--|-----------|------|-------|-------|
|  | (a) (iv)  | (v)  | (ii)  | (i)   |
|  | (b) (i)   | (ii) | (iii) | (iv)  |
|  | (c) (iv)  | (i)  | (ii)  | (iii) |
|  | (d) (iii) | (v)  | (i)   | (ii)  |
11. Magnetic moment 2.84 B.M. is given by (At. nos. Ni = 28, Ti = 22, Cr = 24, Co = 27)
    - (a)  $\text{Cr}^{2+}$
    - (b)  $\text{Co}^{2+}$
    - (c)  $\text{Ni}^{2+}$
    - (d)  $\text{Ti}^{3+}$
  12. Which of the following processes does not involve oxidation of iron?
    - (a) Formation of  $\text{Fe}(\text{CO})_5$  from Fe.
    - (b) Liberation of  $\text{H}_2$  from steam by iron at high temperature.
    - (c) Rusting of iron sheets.
    - (d) Decolourisation of blue  $\text{CuSO}_4$  solution by iron.
  13. Which of the following statements about the interstitial compounds is incorrect?
    - (a) They are much harder than the pure metal.
    - (b) They have higher melting points than the pure metal.
    - (c) They retain metallic conductivity.
    - (d) They are chemically reactive.
  14. Identify the alloy containing a non-metal as a constituent in it.
    - (a) Invar
    - (b) Steel
    - (c) Bell metal
    - (d) Bronze
  15. The catalytic activity of transition metals and their compounds is ascribed mainly to
    - (a) their magnetic behaviour
    - (b) their unfilled d-orbitals
    - (c) their ability to adopt variable oxidation states
    - (d) their chemical reactivity.
  16. Which one of the following does not correctly represent the correct order of the property indicated against it?
    - (a)  $\text{Ti} < \text{V} < \text{Cr} < \text{Mn}$ ; increasing number of oxidation states
    - (b)  $\text{Ti}^{3+} < \text{V}^{3+} < \text{Cr}^{3+} < \text{Mn}^{3+}$ ; increasing magnetic moment
    - (c)  $\text{Ti} < \text{V} < \text{Cr} < \text{Mn}$ ; increasing melting points
    - (d)  $\text{Ti} < \text{V} < \text{Mn} < \text{Cr}$ ; increasing 2<sup>nd</sup> ionization enthalpy
  17. Four successive members of the first series of the transition metals are listed below. For which one of them the standard potential ( $E^\circ_{\text{M}^{2+}/\text{M}}$ ) value has a positive sign?
    - (a) Co (Z = 27)
    - (b) Ni (Z = 28)
    - (c) Cu (Z = 29)
    - (d) Fe (Z = 26)
  18. For the four successive transition elements (Cr, Mn, Fe and Co), the stability of +2 oxidation state will be there in which of the following order?
    - (a)  $\text{Mn} > \text{Fe} > \text{Cr} > \text{Co}$
    - (b)  $\text{Fe} > \text{Mn} > \text{Co} > \text{Cr}$
    - (c)  $\text{Co} > \text{Mn} > \text{Fe} > \text{Cr}$
    - (d)  $\text{Cr} > \text{Mn} > \text{Co} > \text{Fe}$  (At. nos. Cr = 24, Mn = 25, Fe = 26, Co = 27)
  19. Which of the following ions will exhibit colour in aqueous solutions?
    - (a)  $\text{La}^{3+}$  (Z = 57)
    - (b)  $\text{Ti}^{3+}$  (Z = 22)
    - (c)  $\text{Lu}^{3+}$  (Z = 71)
    - (d)  $\text{Sc}^{3+}$  (Z = 21)
  20. Which of the following pairs has the same size?
    - (a)  $\text{Fe}^{2+}$ ,  $\text{Ni}^{2+}$
    - (b)  $\text{Zr}^{4+}$ ,  $\text{Ti}^{4+}$
    - (c)  $\text{Zr}^{4+}$ ,  $\text{Hf}^{4+}$
    - (d)  $\text{Zn}^{2+}$ ,  $\text{Hg}^{2+}$
  21. Which one of the elements with the following outer orbital configurations may exhibit the largest number of oxidation states?
    - (a)  $3d^5 4s^1$
    - (b)  $3d^5 4s^2$
    - (c)  $3d^2 4s^2$
    - (d)  $3d^3 4s^2$
  22. The correct order of decreasing second ionisation enthalpy of Ti(22), V(23), Cr(24) and Mn(25) is
    - (a)  $\text{Mn} > \text{Cr} > \text{Ti} > \text{V}$
    - (b)  $\text{Ti} > \text{V} > \text{Cr} > \text{Mn}$
    - (c)  $\text{Cr} > \text{Mn} > \text{V} > \text{Ti}$
    - (d)  $\text{V} > \text{Mn} > \text{Cr} > \text{Ti}$
  23. In which of the following pairs are both the ions coloured in aqueous solution? (At. no. : Sc = 21, Ti = 22, Ni = 28, Cu = 29, Co = 27)
    - (a)  $\text{Ni}^{2+}$ ,  $\text{Cu}^+$
    - (b)  $\text{Ni}^{2+}$ ,  $\text{Ti}^{3+}$
    - (c)  $\text{Sc}^{3+}$ ,  $\text{Ti}^{3+}$
    - (d)  $\text{Sc}^{3+}$ ,  $\text{Co}^{2+}$
  24. Four successive members of the first row transition elements are listed below with their atomic numbers. 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)
  25. The aqueous solution containing which one of the following ions will be colourless? (Atomic number : Sc = 21, Fe = 26, Ti = 22, Mn = 25)
    - (a)  $\text{Sc}^{3+}$
    - (b)  $\text{Fe}^{2+}$
    - (c)  $\text{Ti}^{3+}$
    - (d)  $\text{Mn}^{2+}$
  26. Which one of the following characteristics of the transition metals is associated with their catalytic activity?
    - (a) High enthalpy of atomization
    - (b) Paramagnetic behaviour
    - (c) Colour of hydrated ions
    - (d) Variable oxidation states

27. The basic character of the transition metal monoxides follows the order  
(Atomic no's. Ti = 22, V = 23, Cr = 24, Fe = 26)  
(a)  $\text{VO} > \text{CrO} > \text{TiO} > \text{FeO}$   
(b)  $\text{CrO} > \text{VO} > \text{FeO} > \text{TiO}$   
(c)  $\text{TiO} > \text{FeO} > \text{VO} > \text{CrO}$   
(d)  $\text{TiO} > \text{VO} > \text{CrO} > \text{FeO}$
28. Which of the following shows maximum number of oxidation states?  
(a) Cr (b) Fe  
(c) Mn (d) V
29. Which ion is colourless?  
(a)  $\text{Cr}^{4+}$  (b)  $\text{Sc}^{3+}$   
(c)  $\text{Ti}^{3+}$  (d)  $\text{V}^{3+}$
30. Bell metal is an alloy of  
(a) Cu + Zn (b) Cu + Sn  
(c) Cu + Pb (d) Cu + Ni
31. In which of the following compounds transition metal has zero oxidation state?  
(a)  $\text{NOClO}_4$  (b)  $\text{NH}_2\text{NH}_2$   
(c)  $\text{CrO}_5$  (d)  $[\text{Fe}(\text{CO})_5]$
32. Which one of the following ionic species will impart colour to an aqueous solution?  
(a)  $\text{Zn}^{2+}$  (b)  $\text{Cu}^+$   
(c)  $\text{Ti}^{4+}$  (d)  $\text{Cr}^{3+}$
33. A transition element X has a configuration  $[\text{Ar}]3d^4$  in its +3 oxidation state. Its atomic number is  
(a) 22 (b) 19  
(c) 25 (d) 26
34. Amongst  $\text{TiF}_6^{2-}$ ,  $\text{CoF}_6^{3-}$ ,  $\text{Cu}_2\text{Cl}_2$  and  $\text{NiCl}_2^{2-}$ , which are the colourless species? (Atomic number of Ti = 22, Co = 27, Cu = 29, Ni = 28)  
(a)  $\text{CoF}_6^{3-}$  and  $\text{NiCl}_2^{2-}$  (b)  $\text{TiF}_6^{2-}$  and  $\text{Cu}_2\text{Cl}_2$   
(c)  $\text{Cu}_2\text{Cl}_2$  and  $\text{NiCl}_4^{2-}$  (d)  $\text{TiF}_6^{2-}$  and  $\text{CoF}_6^{3-}$
35. The mercury is the only metal which is liquid at  $0^\circ\text{C}$ . This is due to its  
(a) high vapour pressure  
(b) weak metallic bond  
(c) high ionization energy  
(d) both (b) and (c).
- (c) there is no  $\pi$ -bonding  
(d) the  $\pi$ -bonding involves overlap of  $p$ -orbitals of oxygen with  $p$ -orbitals of manganese.
37. When neutral or faintly alkaline  $\text{KMnO}_4$  is treated with potassium iodide, iodide ion is converted into ' $X$ ', ' $X$ ' is  
(a)  $\text{I}_2$  (b)  $\text{IO}_4^-$  (c)  $\text{IO}_3^-$  (d)  $\text{IO}^-$
38. Which one of the following ions exhibits  $d-d$  transition and paramagnetism as well?  
(a)  $\text{CrO}_4^{2-}$  (b)  $\text{Cr}_2\text{O}_7^{2-}$   
(c)  $\text{MnO}_4^-$  (d)  $\text{MnO}_4^{2-}$
39. Name the gas that can readily decolourise acidified  $\text{KMnO}_4$  solution.  
(a)  $\text{SO}_2$  (b)  $\text{NO}_2$   
(c)  $\text{P}_2\text{O}_5$  (d)  $\text{CO}_2$
40. Which one of the following statements is correct when  $\text{SO}_2$  is passed through acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution?  
(a)  $\text{SO}_2$  is reduced.  
(b) Green  $\text{Cr}_2(\text{SO}_4)_3$  is formed.  
(c) The solution turns blue.  
(d) The solution is decolourised.
41. Assuming complete ionisation, same moles of which of the following compounds will require the least amount of acidified  $\text{KMnO}_4$  for complete oxidation?  
(a)  $\text{FeSO}_3$  (b)  $\text{FeC}_2\text{O}_4$   
(c)  $\text{Fe}(\text{NO}_2)_2$  (d)  $\text{FeSO}_4$
42. The reaction of aqueous  $\text{KMnO}_4$  with  $\text{H}_2\text{O}_2$  in acidic conditions gives  
(a)  $\text{Mn}^{4+}$  and O (b)  $\text{Mn}^{2+}$  and O  
(c)  $\text{Mn}^{2+}$  and  $\text{O}_3^2$  (d)  $\text{Mn}^{4+}$  and  $\text{MnO}_2$ .
43. Which of the statements is not true?  
(a) On passing  $\text{H}_2\text{S}$  through acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution, a milky colour is observed.  
(b)  $\text{Na}_2\text{Cr}_2\text{O}_7$  is preferred over  $\text{K}_2\text{Cr}_2\text{O}_7$  in volumetric analysis.  
(c)  $\text{K}_2\text{Cr}_2\text{O}_7$  solution in acidic medium is orange.  
(d)  $\text{K}_2\text{Cr}_2\text{O}_7$  solution becomes yellow on increasing the pH beyond 7.

## 8.4 Some Important Compounds of Transition Elements

36. The manganate and permanganate ions are tetrahedral, due to  
(a) the  $\pi$ -bonding involves overlap of  $d$ -orbitals of oxygen with  $d$ -orbitals of manganese  
(b) the  $\pi$ -bonding involves overlap of  $p$ -orbitals of oxygen with  $d$ -orbitals of manganese
44. Acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution turns green when  $\text{Na}_2\text{SO}_3$  is added to it. This is due to the formation of  
(a)  $\text{Cr}_2(\text{SO}_4)_3$  (b)  $\text{CrO}_4^{2-}$   
(c)  $\text{Cr}_2(\text{SO}_3)_3$  (d)  $\text{CrSO}_4$
45. The number of moles of  $\text{KMnO}_4$  reduced by one mole of KI in alkaline medium is  
(a) one (b) two  
(c) five (d) one fifth.

46.  $K_2Cr_2O_7$  on heating with aqueous NaOH gives  
 (a)  $CrO_4^{2-}$  (b)  $Cr(OH)_3$   
 (c)  $CrO_4^{2-}$  (d)  $Cr(OH)_3$

47.  $KMnO_4$  reacts with oxalic acid according to the equation  
 $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

Here 20 mL of 0.1 M  $KMnO_4$  is equivalent to

- (a) 50 mL of 0.5 M  $C_2H_2O_4$   
 (b) 20 mL of 0.1 M  $C_2H_2O_4$   
 (c) 20 mL of 0.5 M  $C_2H_2O_4$   
 (d) 50 mL of 0.1 M  $C_2H_2O_4$
48. The oxidation state of Cr in  $K_2Cr_2O_7$  is  
 (a) +5 (b) +3  
 (c) +6 (d) +7

## 8.5 The Lanthanoids

49. Which one of the following statements related to lanthanons is incorrect?  
 (a) Europium shows +2 oxidation state.  
 (b) The basicity decreases as the ionic radius decreases from Pr to Lu.  
 (c) All the lanthanons are much more reactive than aluminium.  
 (d)  $Ce(+4)$  solutions are widely used as oxidizing agent in volumetric analysis.
50. The electronic configurations of Eu (Atomic No. 63), Gd (Atomic No. 64) and Tb (Atomic No. 65) are  
 (a)  $[Xe]4f^6 5d^1 6s^2$ ,  $[Xe]4f^7 5d^1 6s^2$  and  $[Xe]4f^8 5d^1 6s^2$   
 (b)  $[Xe]4f^7 6s^2$ ,  $[Xe]4f^7 5d^1 6s^2$  and  $[Xe]4f^9 6s^2$   
 (c)  $[Xe]4f^7 6s^2$ ,  $[Xe]4f^8 6s^2$  and  $[Xe]4f^8 5d^1 6s^2$   
 (d)  $[Xe]4f^6 5d^1 6s^2$ ,  $[Xe]4f^7 5d^1 6s^2$  and  $[Xe]4f^9 6s^2$
51. Gadolinium belongs to 4f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium?  
 (a)  $[Xe] 4f^9 5s^1$  (b)  $[Xe] 4f^7 5d^1 6s^2$   
 (c)  $[Xe] 4f^6 5d^2 6s^2$  (d)  $[Xe] 4f^8 6d^2$
52. Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii? (Numbers in the parenthesis are atomic numbers)  
 (a) Zr(40) and Hf(72) (b) Zr(40) and Ta(73)  
 (c) Ti(22) and Zr(40) (d) Zr(40) and Nb(41)
53. Reason of lanthanoid contraction is  
 (a) negligible screening effect of 'f'-orbitals  
 (b) increasing nuclear charge  
 (c) decreasing nuclear charge  
 (d) decreasing screening effect.
54. Which of the following lanthanoid ions is diamagnetic?  
 (At. nos. Ce = 58, Sm = 62, Eu = 63, Yb = 70)  
 (a)  $Eu^{2+}$  (b)  $Yb^{2+}$  (c)  $Ce^{2+}$  (d)  $Sm^{2+}$
55. Which of the following oxidation states is the most common among the lanthanoids?  
 (a) 4 (b) 2 (c) 5 (d) 3
56. Identify the incorrect statement among the following :  
 (a) Lanthanoid contraction is the accumulation of successive shrinkages.  
 (b) As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements.  
 (c) Shielding power of 4f electrons is quite weak.  
 (d) There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu.
57. Lanthanoids are  
 (a) 14 elements in the sixth period (atomic no. 90 to 103) that are filling 4f sublevel  
 (b) 14 elements in the seventh period (atomic number = 90 to 103) that are filling 5f sublevel  
 (c) 14 elements in the sixth period (atomic number = 58 to 71) that are filling the 4f sublevel  
 (d) 14 elements in the seventh period (atomic number = 58 to 71) that are filling 4f sublevel.
58. The correct order of ionic radii of  $Y^{3+}$ ,  $La^{3+}$ ,  $Eu^{3+}$  and  $Lu^{3+}$  is (At. nos. Y = 39, La = 57, Eu = 63, Lu = 71)  
 (a)  $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$   
 (b)  $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$   
 (c)  $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$   
 (d)  $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$
59. General electronic configuration of lanthanides is  
 (a)  $(n-2)f^{1-14}(n-1)s^2p^6d^{0-1}ns^2$   
 (b)  $(n-2)f^{0-14}(n-1)d^{0-1}ns^2$   
 (c)  $(n-2)f^{0-14}(n-1)d^{10}ns^2$   
 (d)  $(n-2)d^{0-1}(n-1)f^{1-14}ns^2$
60. Which of the following statement is not correct?  
 (a)  $La(OH)_3$  is less basic than  $Lu(OH)_3$ .  
 (b) In lanthanide series ionic radius of  $Ln^{+3}$  ion decreases.  
 (c) La is actually an element of transition series rather lanthanides.  
 (d) Atomic radius of Zn and Hf are same because of lanthanide contraction.

61. The lanthanide contraction is responsible for the fact that
- Zr and Hf have about the same radius
  - Zr and Zn have the same oxidation state
  - Zr and Y have about the same radius
  - Zr and Nb have similar oxidation state.

62. Which of the following statements concerning lanthanide elements is false?
- All lanthanides are highly dense metals.
  - More characteristic oxidation state of lanthanide elements is +3.
  - Lanthanides are separated from one another by ion exchange method.
  - Ionic radii of trivalent lanthanides steadily increases with increase in the atomic number.

### 8.6 The Actinoids

63. The reason for greater range of oxidation states in actinoids is attributed to
- actinoid contraction
  - 5*f*, 6*d* and 7*s* levels having comparable energies
  - 4*f* and 5*d* levels being close in energies
  - the radioactive nature of actinoids.
64. Which of the following exhibits only +3 oxidation state?
- U
  - Th
  - Ac
  - Pa
65. More number of oxidation states are exhibited by the actinoids than by the lanthanoids. The main reason for this is
- more active nature of the actinoids
  - more energy difference between 5*f* and 6*d* orbitals than that between 4*f* and 5*d* orbitals
  - lesser energy difference between 5*f* and 6*d* orbitals than that between 4*f* and 5*d* orbitals
  - greater metallic character of the lanthanoids than that of the corresponding actinoids.

66. Which one of the following elements shows maximum number of different oxidation states in its compounds?
- Gd
  - La
  - Eu
  - Am

### 8.7 Some Applications of *d*- and *f*-Block Elements

67. Match the catalyst with the process :
- | Catalyst   | Process   |
|--|---|
| (i) V <sub>2</sub> O <sub>5</sub>                          | (p) The oxidation of ethyne to ethanal  |
| (ii) TiCl <sub>4</sub> + Al(CH <sub>3</sub> ) <sub>3</sub> | (q) Polymerisation of alkynes   |
| (iii) PdCl <sub>2</sub>                                    | (r) Oxidation of SO <sub>2</sub> in the manufacture of H <sub>2</sub> SO <sub>4</sub> |
| (iv) Nickel complexes                                      | (s) Polymerisation of ethylene  |
- Which of the following is the correct option?
- (i)-(r), (ii)-(s), (iii)-(p), (iv)-(q)
  - (i)-(p), (ii)-(q), (iii)-(r), (iv)-(s)
  - (i)-(p), (ii)-(r), (iii)-(q), (iv)-(s)
  - (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q)

68. HgCl<sub>2</sub> and I<sub>2</sub> both when dissolved in water containing I<sup>-</sup> ions, the pair of species formed is
- HgI<sub>2</sub>, I<sup>-</sup>
  - HgI<sub>4</sub><sup>2-</sup>, I<sub>3</sub><sup>-</sup>
  - Hg<sub>2</sub>I<sub>2</sub>, I<sup>-</sup>
  - HgI<sub>3</sub><sup>-</sup>, I<sub>2</sub>
69. Which of the following elements is responsible for oxidation of water to O<sub>2</sub> in biological processes?
- Cu
  - Mo
  - Fe
  - Mn
70. When calomel reacts with NH<sub>4</sub>OH, we get
- Hg<sub>2</sub>O
  - HgO
  - HgNH<sub>2</sub>Cl
  - NH<sub>2</sub>-Hg-Hg-Cl
71. Photographic films and plates have an essential ingredient of
- silver nitrate
  - silver bromide
  - sodium chloride
  - oleic acid.

### ANSWER KEY

1. (b) 2. (d) 3. (d) 4. (d) 5. (b) 6. (c) 7. (c) 8. (d) 9. (b) 10. (a)  
 11. (c) 12. (a) 13. (d) 14. (b) 15. (c) 16. (c) 17. (c) 18. (a) 19. (b) 20. (c)  
 21. (b) 22. (c) 23. (b) 24. (c) 25. (a) 26. (d) 27. (d) 28. (c) 29. (b) 30. (b)  
 31. (d) 32. (d) 33. (c) 34. (b) 35. (d) 36. (b) 37. (c) 38. (d) 39. (a) 40. (b)  
 41. (d) 42. (b) 43. (b) 44. (a) 45. (b) 46. (c) 47. (d) 48. (c) 49. (c) 50. (b)  
 51. (b) 52. (a) 53. (a) 54. (b) 55. (d) 56. (b) 57. (c) 58. (b) 59. (a) 60. (a)  
 61. (a) 62. (d) 63. (b) 64. (c) 65. (c) 66. (d) 67. (a) 68. (b) 69. (c) 70. (c)  
 71. (b)