EXAM DATE
8th , 9th, 10th & 12th April

Chemistry Practice Problems

JEE Main

Time: 100 min. **Max. Marks:** 200

LEVEL - 1

1. The decreasing order of the boiling points of the following hydrides is
(i) NH_3 (ii) PH_3 (iii) AsH_3 (iv) SbH_3 (v) H_2O
(a) (v) > (iv) > (i) > (iii) > (ii)
(b) (v) > (i) > (ii) > (iii) > (iv)
(c) (ii) > (iv) > (iii) > (i) > (v)
(d) (iv) > (iii) > (i) > (ii) > (v)

2. The atomic numbers of vanadium (V), chromium (Cr), manganese (Mn) and iron (Fe) are respectively 23, 24, 25 and 26. Which one of these may be expected to have the highest second ionisation enthalpy?
(a) V (b) Cr (c) Mn (d) Fe

3. Which one of the following has the highest molar conductivity?
(a) Diamminedichloroplatinum(II)
(b) Tetraamminedichlorocobalt(III) chloride
(c) Potassium hexacyanoferrate(II)
(d) Hexaaquachromium(III) bromide

4. A metal *X* on heating in nitrogen gas gives *Y*. *Y* on treatment with H_2O gives a colourless gas, which when passed through $CuSO_4$ solution gives blue colour. *Y* is
(a) $Mg(NO_3)_2$ (b) Mg_3N_2
(c) NH_3 (d) MgO

5. The number of electrons in 3*d* orbitals of Fe^{2+}, Co^{2+}, Ni^{2+} and Cu^{2+} are 6, 7, 8 and 9, respectively. Which of the following ions will have the largest value of magnetic moment (μ)?
(a) Fe^{2+} (b) Co^{2+} (c) Ni^{2+} (d) Cu^{2+}

6. Among the following, the compound that is both paramagnetic and coloured is
(a) $K_2Cr_2O_7$ (b) $(NH_4)_2(TiCl_6)$
(c) $CoSO_4$ (d) $K_3[Cu(CN)_4]$

7. Which of the following compounds gives nitrogen on heating?
(a) $NaNO_2$ (b) $AgNO_2$
(c) $Ba(NO_2)_2$ (d) NH_4NO_2

8. In the aqueous solution, Cu(+1) salts are unstable because
(a) Cu(+1) has $3d^{10}$ configuration
(b) the change in free energy of the overall reaction is zero
(c) they disproportionate easily to Cu and Cu (+2) states
(d) they disproportionate easily to the Cu (+2) and Cu (+3) states.

9. The type of isomerism present in nitropentamine chromium (III) chloride is
(a) optical (b) linkage
(c) ionisation (d) polymerisation.

10. The oxidation state of sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follows the order
(a) $S_2O_6^{2-} < S_2O_4^{2-} < SO_3^{2-}$ (b) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$
(c) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$ (d) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

11. Which compound is formed when excess of KCN is added to aqueous solution of $CuSO_4$?
(a) $Cu(CN)_2$ (b) $K_2[Cu(CN)_4]$
(c) $K[Cu(CN)_2]$ (d) $K_3[Cu(CN)_4]$

12. Which one of the following complexes is an outer orbital complex? [At. No.: Mn = 25, Fe = 26, Co = 27, Ni = 28]
(a) $[Fe(CN)_6]^{4-}$ (b) $[Mn(CN)_6]^{4-}$
(c) $[Co(NH_3)_6]^{3+}$ (d) $[Ni(NH_3)_6]^{2+}$

13. One mole of fluorine is reacted with two moles of hot and concentrated KOH. The products formed are KF , H_2O and O_2. The molar ratio of KF, H_2O and O_2 respectively is
(a) 1 : 1 : 2 (b) 2 : 1 : 0.5
(c) 1 : 2 : 1 (d) 2 : 1 : 2

14. Pick out the wrong reaction.
(a) $2Na_2CrO_4 + H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$
(b) $2MnO_2 + 4KOH + O_2 \rightarrow 4KMnO_4 + 2H_2O$
(c) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$
(d) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

15. In $Fe(CO)_5$, the Fe – C bond possesses
(a) π-character only
(b) both σ and π characters
(c) ionic character
(d) σ-character only.

16. The correct order of bond angle of H_2O, H_2S, H_2Se and H_2Te is
(a) $H_2Te > H_2Se > H_2S > H_2O$
(b) $H_2O > H_2S > H_2Se > H_2Te$
(c) $H_2S > H_2O > H_2Se > H_2Te$
(d) $H_2Se > H_2S > H_2Te > H_2O$

17. Arrange Ce^{3+}, La^{3+}, Pm^{3+} and Yb^{3+} in increasing order of their ionic radii.
(a) $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$
(b) $Ce^{3+} < Yb^{3+} < Pm^{3+} < La^{3+}$
(c) $Yb^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$
(d) $Pm^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

18. In which of the following complex ion, the central metal ion is in a state of sp^3d^2 hybridisation?
(a) $[CoF_6]^{3-}$ (b) $[Co(NH_3)_6]^{3+}$
(c) $[Fe(CN)_6]^{3-}$ (d) $[Cr(NH_3)_6]^{3+}$

19. Which one of the following species is not a pseudohalide?
(a) CNO^- (b) $RCOO^-$ (c) OCN^- (d) NNN^-

20. Of the following outer electronic configurations of atoms, the highest oxidation state is achieved by which one of them?
(a) $(n-1)d^8ns^2$ (b) $(n-1)d^5ns^1$
(c) $(n-1)d^3ns^2$ (d) $(n-1)d^5ns^2$

21. The formula for iron(III) hexacyanoferrate(II), commonly known as Prussian blue, is
(a) $Fe_3[Fe(CN)_6]_2$ (b) $Fe_2[Fe(CN)_6]_3$
(c) $Fe_4[Fe(CN)_6]_3$ (d) $Fe_3[Fe(CN)_6]_4$

22. The number of S – S bonds in sulphur trioxide trimer (S_3O_9) is
(a) three (b) two (c) one (d) zero.

23. Which of the following factors may be regarded as the main cause of lanthanide contraction?
(a) Poor shielding of one of 4*f*-electrons by another in the subshell.
(b) Effective shielding of one of 4*f*-electrons by another in the subshell.
(c) Poorer shielding of 5*d*-electrons by 4*f*-electrons.
(d) Greater shielding of 5*d*-electrons by 4*f*-electrons.

24. Coordination compounds have great importance in biological systems. In this context which of the following statements is incorrect?
(a) Chlorophylls are green pigments in plants and contain calcium.
(b) Haemoglobin is the red pigment of blood and contains iron.
(c) Cyanocobalamin is B_{12} and contains cobalt.
(d) Carboxypeptidase A is an enzyme and contains zinc.

25. Which blue liquid is obtained on reacting equimolar amounts of two gases at –30°C?
(a) N_2O (b) N_2O_3 (c) N_2O_4 (d) N_2O_5

LEVEL - 2

26. The brown ring test for nitrates depends on
(a) the reduction of nitrate to nitric oxide
(b) oxidation of nitric oxide to nitrogen dioxide
(c) reduction of ferrous sulphate to iron
(d) oxidising action of sulphuric acid.

27. In acidic medium, $KMnO_4$ oxidises $FeSO_4$ solution. Which of the following statements is correct?
(a) 10 mL of 1 N $KMnO_4$ solution oxidises 10 mL of 5 N $FeSO_4$ solution.
(b) 10 mL of 1 M $KMnO_4$ solution oxidises 10 mL of 5 M $FeSO_4$ solution.
(c) 10 mL of 1M $KMnO_4$ solution oxidises 10 mL of 1 M $FeSO_4$ solution.
(d) 10 mL of 1 N $KMnO_4$ solution oxidises 10 mL of 0.1 M $FeSO_4$ solution.

28. The pair of the compounds in which both the metals are in the highest possible oxidation state is
(a) $[Fe(CN)_6]^{3-}$, $[Co(CN)_6]^{3-}$
(b) CrO_2Cl_2, MnO_4^-
(c) TiO_3, MnO_2 (d) $[Co(CN)_6]^{3-}$, MnO_4^{2-}

29. When excess of water is added to $BiCl_3$ solution
(a) ionisation of $BiCl_3$ is increased
(b) a white ppt. of $Bi(OH)_3$ is obtained
(c) $BiCl_3$ is hydrolysed to give white ppt. of BiOCl
(d) $BiCl_3$ is precipitated.

30. Which pair of compounds is expected to show similar colour in aqueous medium?
(a) $FeCl_2$ and $CuCl_2$ (b) $VOCl_2$ and $CuCl_2$
(c) $VOCl_2$ and $FeCl_2$ (d) $FeCl_2$ and $MnCl_2$

31. The metal ion in complex *A* has EAN identical to the atomic number of krypton. *A* is
(At. No. of Cr = 24, Fe = 26, Pd = 46)
(a) $[Pd(NH_3)_6]Cl_4$ (b) $[Cr(NH_3)_5Cl]SO_4$
(c) $Na_4[Fe(CN)_6]$ (d) $K_3[Fe(CN)_6]$

32. In the manufacture of sulphuric acid by Contact process, Tyndall box is used to
(a) convert SO_2 to SO_3
(b) test the presence of dust particles
(c) filter the dust particles (d) remove impurities.

33. A red solid is insoluble in water. However, it becomes soluble if some KI is added to water. Heating the red solid in a test tube results in 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 (d) Pb_3O

34. Lanthanoids are
(a) 14 elements in the sixth period (at. no. = 90 – 103) in which 4*f*-subshell is being filled
(b) 14 elements in the seventh period (at. no. = 90 – 103) in which 5*f*-subshell is filled

(c) 14 elements in the sixth period (at. no. = 58 – 71) in which 4*f*-subshell is filled
(d) 14 elements in the seventh period (at. no. = 50 – 71) in which 4*f*-subshell is filled.

35. The oxidation states of the most electronegative element in the products of the reaction of BaO_2 with dil. H_2SO_4 are
(a) 0 and –1 (b) –1 and –2
(c) –2 and 0 (d) –2 and +1

36. What would happen when a solution of potassium chromate is treated with an excess of dilute nitric acid?
(a) Cr^{3+} and $Cr_2O_7^{2-}$ are formed.
(b) $Cr_2O_7^{2-}$ and H_2O are formed.
(c) CrO_4^{2-} is reduced to +3 state of Cr.
(d) CrO_4^{2-} is oxidised to +7 state of Cr.

37. A coordination complex compound of cobalt has molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three moles of ions in an aqueous solution. On reacting this solution with excess of silver nitrate solution , two moles of AgCl get precipitated. The ionic formula of this complex would be
(a) $[Co(NH_3)_4(NO_2)Cl](NH_3)Cl$
(b) $[Co(NH_3)_5Cl]Cl(NO_2)$
(c) $[Co(NH_3)_5(NO_2)]Cl_2$
(d) $[Co(NH_3)_5](NO_2)_2Cl_2$

38. Which of the following ions does not have S—S linkage?
(a) $S_2O_8^{2-}$ (b) $S_2O_6^{2-}$ (c) $S_2O_5^{2-}$ (d) $S_2O_3^{2-}$

39. An aqueous solution of $FeSO_4$, $Al_2(SO_4)_3$ and chrome alum is heated with excess of Na_2O_2 and filtered. The materials obtained are
(a) a colourless filtrate and a green residue
(b) a yellow filtrate and a green residue
(c) a yellow filtrate and a brown residue
(d) a green filtrate and a brown residue.

40. The value of the 'spin only' magnetic moment for one of the following configurations is 2.84 B.M. The correct one is
(a) d^4 (in strong ligand field)
(b) d^4 (in weak ligand field)
(c) d^3 (in weak as well as in strong ligand fields)
(d) d^5 (in strong ligand field)

41. Which of the following statements is correct?
(a) SF_6 does not react with water.
(b) OF_6 is d^2sp^3-hybridised.
(c) $S_2O_3^{2-}$ is a linear ion.
(d) There is no π-bonding in SO_4^{2-}.

42. In which of the following compounds manganese has oxidation number equal to that of iodine in KIO_4?
(a) Potassium manganate
(b) Potassium permanganate
(c) Manganous chloride
(d) Manganese chloride

43. Ammonia forms the complex ion $[Cu(NH_3)_4]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. What is the reason for it?
(a) In acidic solutions hydration protects copper ions.
(b) In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available.
(c) In alkaline solutions insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali.
(d) Copper hydroxide is an amphoteric substance.

44. What products are expected from the disproportionation reaction of hypochlorous acid?
(a) $HClO_3$ and Cl_2O (b) $HClO_2$ and $HClO_4$
(c) HCl and Cl_2O (d) HCl and $HClO_3$

45. In the dichromate dianion,
(a) 4 Cr—O bonds are equivalent
(b) 6 Cr—O bonds are equivalent
(c) all Cr—O bonds are equivalent
(d) all Cr—O bonds are non-equivalent.

46. Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $NiCl_4^{2-}$
(a) $Ni(CO)_4$ and $NiCl_4^{2-}$ are diamagnetic; $[Ni(CN)_4]^{2-}$ is paramagnetic
(b) $NiCl_4^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic; $Ni(CO)_4$ is paramagnetic
(c) $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic; $NiCl_4^{2-}$ is paramagnetic.
(d) $Ni(CO)_4$ is diamagnetic ; $NiCl_4^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic.

47. HI cannot be prepared by the action of conc. H_2SO_4 on KI because
(a) HI is stronger acid than H_2SO_4
(b) HI is more volatile than H_2SO_4
(c) H_2SO_4 is an oxidising agent
(d) H_2SO_4 forms complex.

48. How do we differentiate between Fe^{3+} and Cr^{3+} in group III?

(a) By taking excess of NH_4OH solution

(b) By increasing NH_4^+ ion concentration

(c) By decreasing ^-OH ion concentration

(d) Both (b) and (c).

49. The geometry of $Ni(CO)_4$ and $Ni(PPh_3)_2Cl_2$ are

(a) both square planar

(b) tetrahedral and square planar respectively

(c) both tetrahedral

(d) square planar and tetrahedral respectively.

50. Which of the following is correct about the reaction?

$$3NaClO \xrightarrow{Heat} NaClO_3 + 2NaCl$$

(a) It is a disproportionation reaction.

(b) Oxidation number of Cl decreases as well as increases in this reaction.

(c) In this reaction halate is formed.

(d) All of the above.