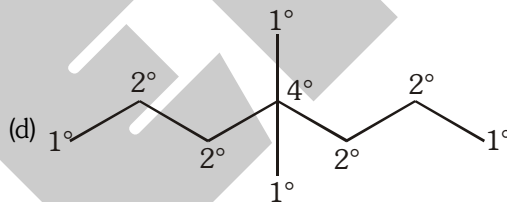
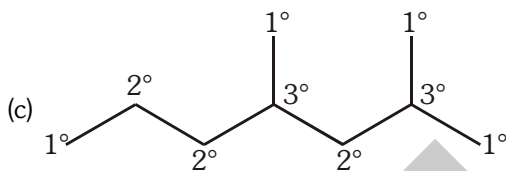
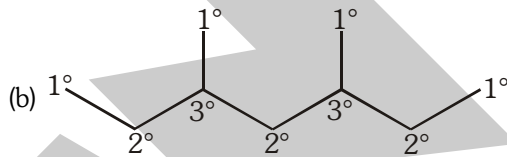
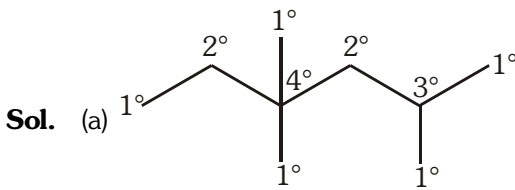


## SOLUTIONS

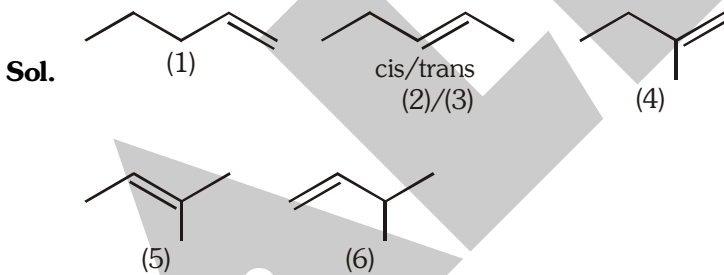
1. An alkane [X] contains five 1°, two 2°, one 3° and one 4° carbon atoms. The IUPAC name of [X] is :  
(a) 2,4,4-trimethylhexane (b) 3,5-dimethylheptane  
(c) 2,4-dimethylheptane (d) 4,4-dimethylheptane

Ans. (a)



2. The number of isomeric alkenes with molecular formula  $C_5H_{10}$  is (taking stereoisomers into account):  
(a) 4 (b) 5 (c) 6 (d) 7

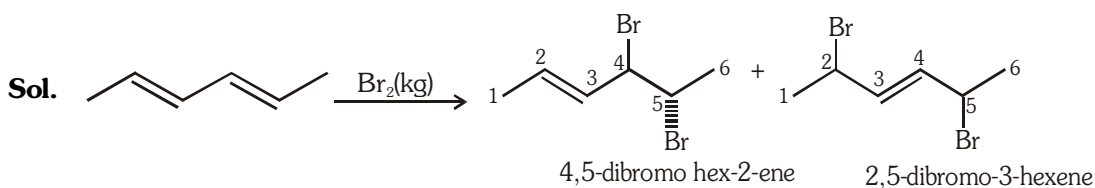
Ans. (c)



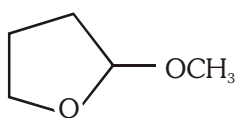
3. At 0° C, 1 equivalent bromine is added to 2,4-hexadiene to produce 4,5-dibromo-2-hexene and its isomer 'X'.  
X is :

- (a) 5,5-dibromo-2-hexene (b) 2,5-dibromo-3-hexene  
(c) 2,2-dibromo-3-hexene (d) 2,3-dibromo-4-hexene

Ans. (b)

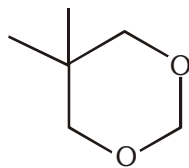


4. Which of the following is/are example/s of an acetal?



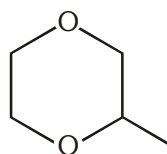
I

(a) I and II



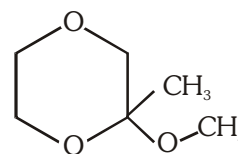
II

(b) III and IV



III

(c) Only IV



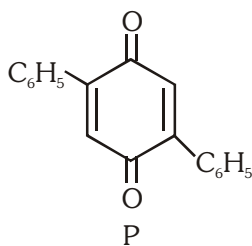
IV

(d) I, II and III

Ans. (a)

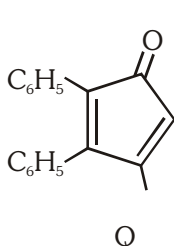
Sol. I, II are acetals

5. The compound which can be produced by double aldol condensation of 1-phenyl-1,2-propanedione:



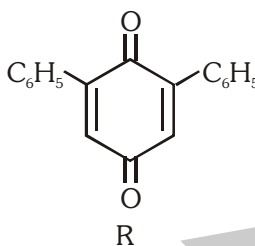
P

(a) P



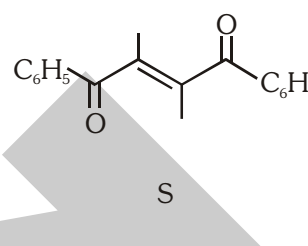
Q

(b) Q



R

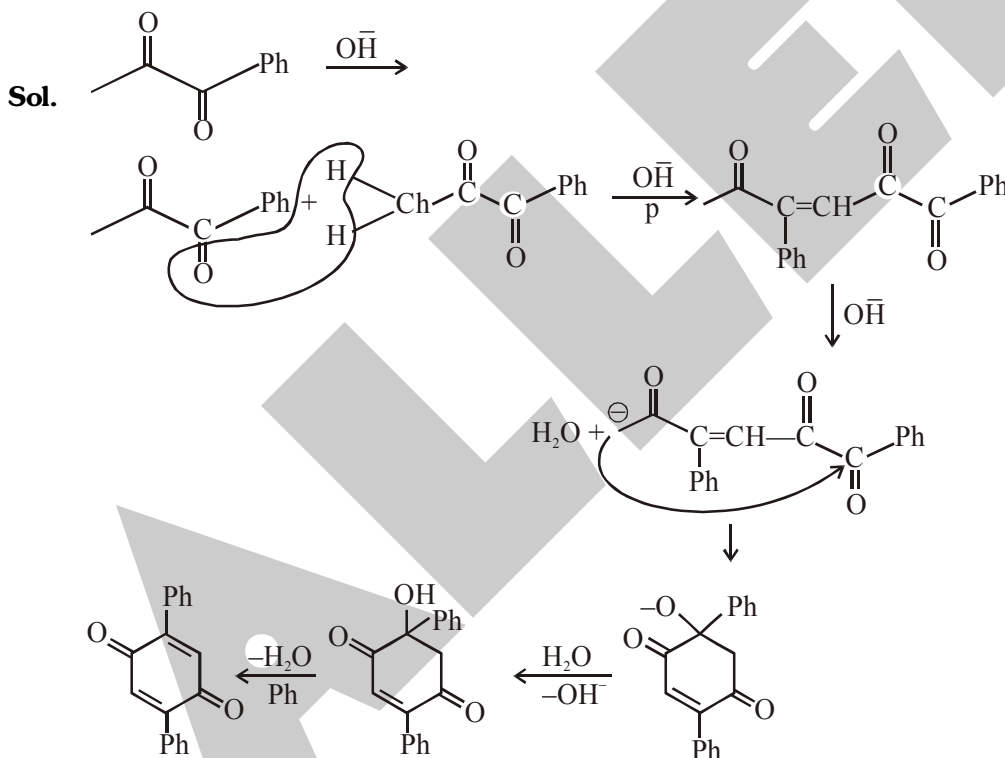
(c) R



S

(d) S

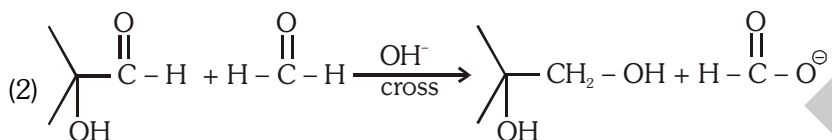
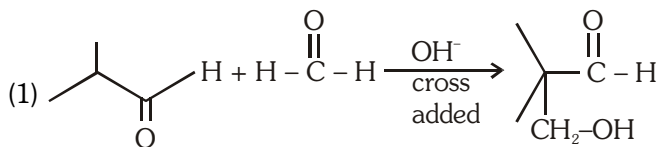
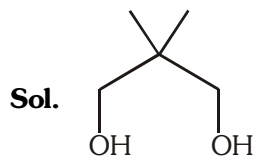
Ans. (a)



6. 2,2-Dimethyl-1,3-propanediol is formed by heating 2-methylpropanal with an excess of formaldehyde and  $\text{Ca}(\text{OH})_2$ . The sequence of reactions taking place in this synthesis is:

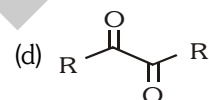
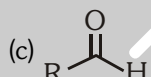
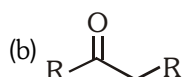
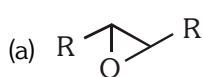
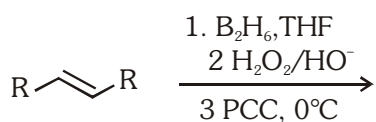
- dehydrogenation to 2-methyl-2-propenal followed by addition of formaldehyde.
- dehydrogenation to penta-2,3-diene followed by addition of formaldehyde.
- a crossed aldol reaction followed by a crossed Cannizzaro reaction.
- a crossed Cannizzaro reaction followed by a crossed aldol reaction.

Ans. (c)

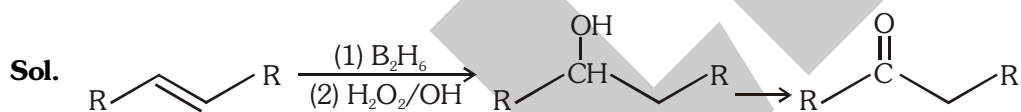


7. Predict the major product in the following reaction.

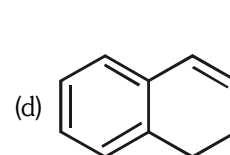
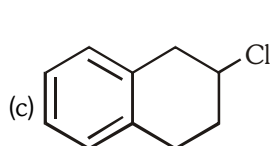
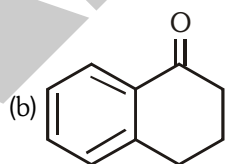
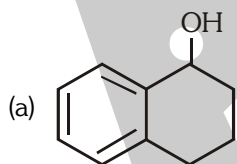
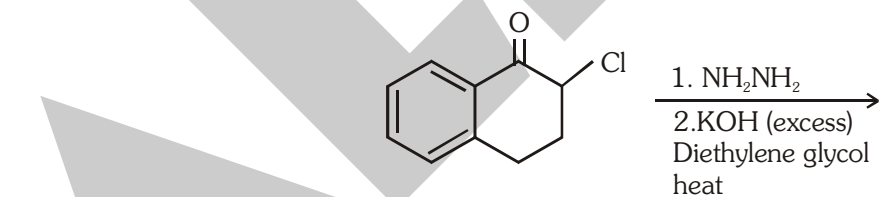
PCC is pyridinium chlorochromate



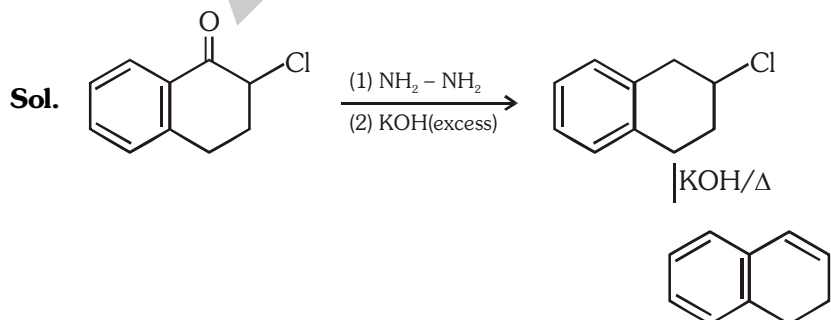
Ans. (b)



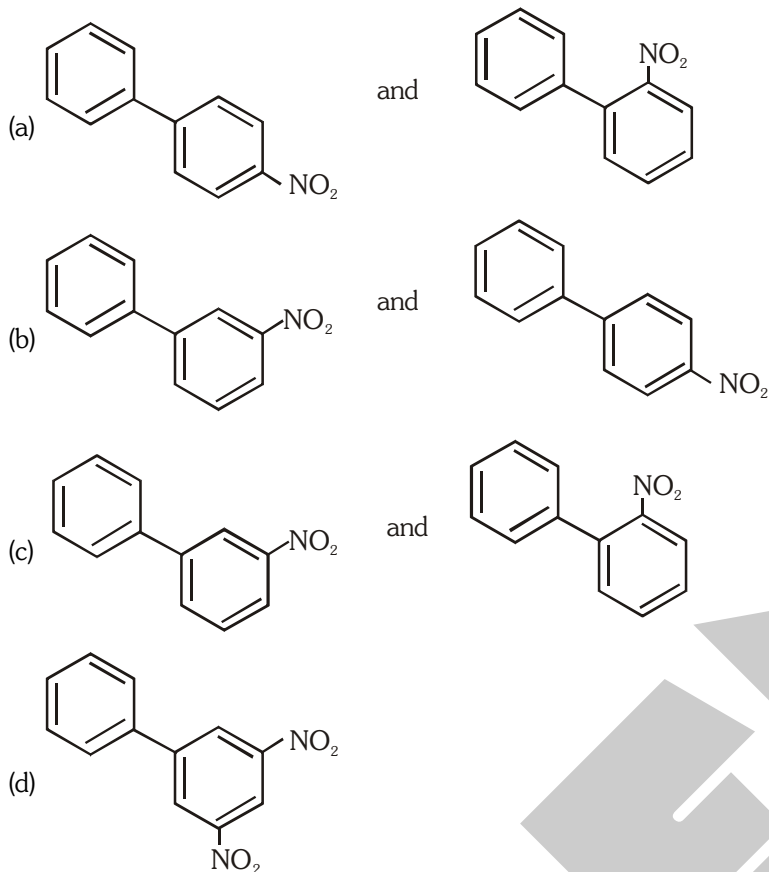
8. Find out the product in the following reaction.



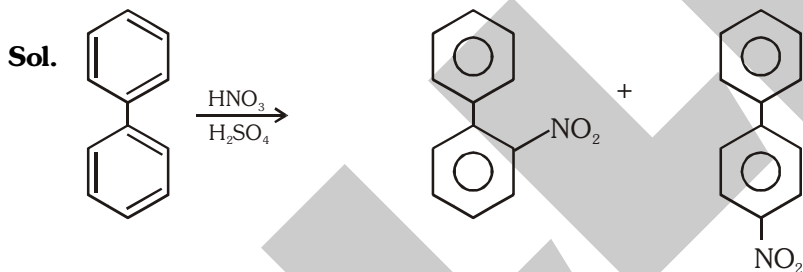
Ans. (d)



9. The product/s obtained on reaction of biphenyl (Ph-Ph) with nitrating mixture ( $\text{HNO}_3 + \text{H}_2\text{SO}_4$ ) is/are:



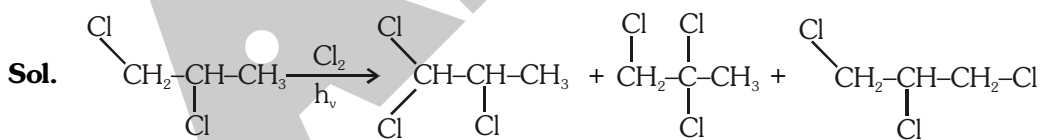
Ans. (a)



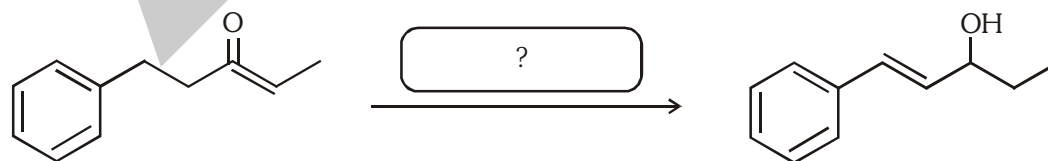
10. Chlorination of propane gives four dichloro products. One of them is optically active. The number of trichloro products possible from the optically active dichloro product is (excluding stereoisomers):

- (a) 1 (b) 2 (c) 3 (d) 4

Ans. (c)



11. The suitable reagent for the following transformation is:



- (a) Na / liq.  $\text{NH}_3$  (b)  $\text{H}_2$ , Pd/C (c)  $\text{LiAlH}_4$  (d) Zn-Hg, HCl, heat

Ans. (c)

Sol. Theory based question.

12. Column A represents a set of functional groups and Column B their respective electronic effects. The correct match is:

Column A

- (a)  $-\text{NH}_2$ ,  $-\text{COCl}$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{COOH}$  ;  
 (b)  $-\text{X}$ ,  $-\text{NHCOCH}_3$ ,  $-\text{CHO}$ ,  $-\text{CH}_3$  ;  
 (c)  $-\text{COCl}$ ,  $-\text{COCH}_3$ ,  $-\text{NH}_2$ ,  $-\text{CN}$  ;  
 (d)  $-\text{SO}_3\text{H}$ ,  $-\text{NH}_2$ ,  $-\text{OCH}_3$ ,  $-\text{CONH}_2$  ;

Column B

- m-directing, EWG, activating, o/p-directing  
 o/p directing, EDG, m-directing, activating  
 EDG, EWG, deactivating, /m-directing  
 activating, deactivating, EWG, EWG

[EDG: Electron donating group and EWG: Electron withdrawing group]

Ans. (b)

Sol. Theory based question.

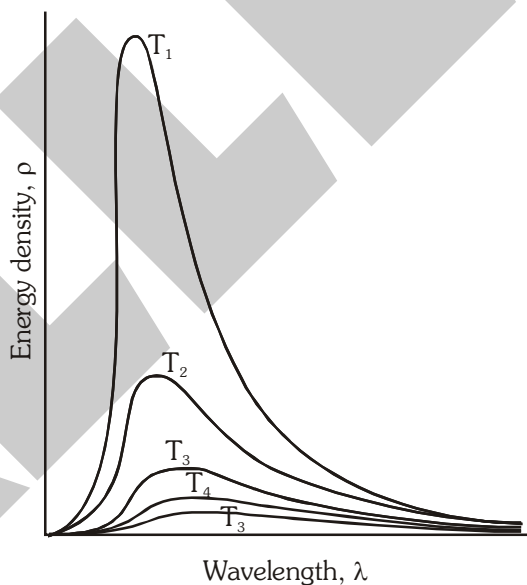
13. The correct order of reactivity of  $-\text{CHO}$ ,  $-\text{COR}$ ,  $-\text{COOR}$ ,  $-\text{CONR}_2$  groups toward  $\text{MeMgI}$  in ether

- (a)  $-\text{CONR}_2 > -\text{COOR} > -\text{COR} > -\text{CHO}$       (b)  $-\text{CHO} > -\text{COR} > -\text{COOR} > -\text{CONR}_2$   
 (c)  $-\text{CONR}_2 > -\text{CHO} > -\text{COR} > -\text{COOR}$       (d)  $-\text{CHO} > -\text{CONR}_2 > -\text{COOR} > -\text{COR}$

Ans. (b)

Sol. Theory based question.

14. The plots of energy density (energy per unit area) vs wavelength for blackbody radiation at various temperatures are given below. The correct option among the following is:



- (i)  $T_1 > T_2 > T_3 > T_4 > T_5$   
 (ii) As temperature increases, the wavelength at which the intensity is maximum shifts towards the higher energy regions of the electromagnetic spectrum.  
 (iii) Radiations of all wave lengths are emitted, absorbed, reflected, and refracted by the black body.  
 (iv) The total energy density increases as the temperature is decreased.  
 (a) (i) and (ii)      (b) (ii) and (iii)      (c) (i), (iii) and (iv)      (d) (ii), (iii) and (iv)

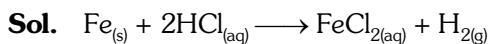
Ans. (a)

Sol. Spectral intensity of black body radiation peaks at a frequency that increases with the temperature of the emitting body.

15. A student adds 'x' g of iron (Fe) powder to dil. HCl and measures the work done by the reaction between HCl and the added Fe to be 1000 J. If the experiment was conducted at a constant pressure of 1 atm at 27°C, mass of Fe powder added is:

- (a) 22.4 g                      (b) 2.24 g                      (c) 11.2 g                      (d) 1.12 g

Ans. (a)



$$W = -\Delta n_g RT = -1000$$

$$-\Delta n_g \times 8.314 \times 300 = -1000$$

$$\Delta n_g = 0.4 = \text{mole of Fe}$$

$$\therefore \text{mass of Fe} = 0.4 \times 56 \\ = 22.4 \text{ gm.}$$

16. Antacids are medicines that temporarily neutralize the acid in the stomach and prevent heartburns. The volume of an antacid syrup containing 2.9 g of  $\text{Mg}(\text{OH})_2$  per 100 mL to be given to a patient whose stomach contains 2 L of gastric juice with HCl concentration of  $6.0 \times 10^{-3} \text{ M}$  is :

(Molar mass of  $\text{Mg}(\text{OH})_2 = 58.0 \text{ g mol}^{-1}$ )

- (a) 4.0 mL                      (b) 7.8 mL                      (c) 12.0 mL                      (d) 120 mL

Ans. (c)



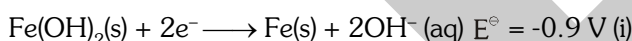
moles of  $\text{Mg}(\text{OH})_2 = 2x$  moles of HCl

$$\frac{29}{58} \times 1000 \times V = 2 \times 6 \times 10^{-3} \times 2 \\ \frac{58}{100}$$

$$V = 0.012 \text{ lt}$$

$$V = 12 \text{ ml}$$

17. A half-cell reaction represented by (i) as given below



takes place in two different electrochemical cells, I and II, in which the other half cell reactions are (ii) and (iii) respectively:



The correct option that represents the redox reactions in cells I and II is:

- (a) Fe is oxidised in cell I; Fe is oxidised in cell II  
 (b) Fe is oxidised in cell I; Fe is reduced in cell II  
 (c) Fe is reduced in cell I; Fe is reduced in cell II  
 (d) Fe is reduced in cell I; Fe is oxidised in cell II

Ans. (d)

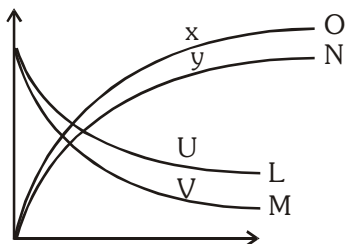
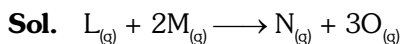
Sol. Electrode having higher reduction potential act as cathode & electrode having lower reduction potential act as anode is electrochemical cell.

18. The following are the concentration vs time plots of the reactants and products represented by the reaction  $\text{L}(g) + 2 \text{M}(g) \longrightarrow \text{N}(g) + 3\text{O}(g)$

The curves that represent  $\text{M}(g)$  and  $\text{N}(g)$  qualitatively are respectively

- (a) X, Y                      (b) Y, U                      (c) V, Y                      (d) U, X

Ans. (c)



- 19.** The current produced due to photoelectric effect
- increases with the increase of frequency of the incident radiation,
  - increases with the increase in intensity of the incident radiation.
  - decreases with time of irradiation.
  - is independent of the intensity of incident radiation.

**Ans. (b)**

**Sol.** With increase in intensity of radiation number of photo electrons increases so photo current increases.

- 20.** The property of radiation that is not different at various regions of the electromagnetic spectrum is:
- energy
  - frequency
  - velocity
  - wavelength

**Ans. (c)**

**Sol.** Velocity of electromagnetic radiation does not depend upon energy, frequency or wavelength of radiation.

- 21.** The ligand with which the homoleptic octahedral complex of  $Co^{3+}$  will be most stable is:
- Ethylenediamine tetra acetate ion
  - Dien (N-(2-aminoethyl)-1,2-ethanediamine) .
  - Ethane-1,2-diamine
  - Ammonia

**Ans. (a)**

- 22.** Which of the following properties may have positive values of  $\Delta H$ ?
- Lattice enthalpy
  - Hydration enthalpy
  - Electron gain enthalpy for noble gases
  - Ionisation enthalpy
- (i) and (ii)
  - (iii) and (iv)
  - Only (iv)
  - (ii), (iii) and (iv)

**Ans. (b)**

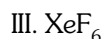
- 23.** The correct IUPAC name of potassium permanganate is:
- potassium tetraoxomanganate (VI)
  - potassium tetraoxidopermanganate (VII)
  - potassium tetraoxidomanganese (VII)
  - potassium tetraoxidomanganate (VII)

**Ans. (d)**

- 24.** Which of the following statements is true with respect to sodium salts of oxoanions of phosphorus  $NaH_2PO_2$  and  $Na_2HPO_3$
- $NaH_2PO_2$  is reducing and  $Na_2HPO_3$  is oxidizing
  - $NaH_2PO_2$  is more reducing than  $Na_2HPO_3$
  - $NaH_2PO_2$  is more oxidizing than  $Na_2HPO_3$
  - $NaH_2PO_2$  is oxidizing and  $Na_2HPO_3$  is reducing

**Ans. (b)**

25. The fluoride/s of xenon,  $\text{XeF}_n$  ( $n = 2$  or  $4$  or  $6$ ), which on complete hydrolysis gives back xenon as one of the products, is/are\_\_\_\_\_.



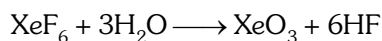
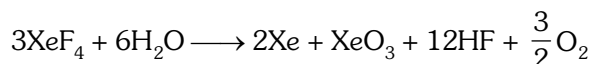
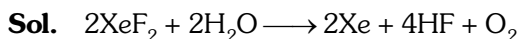
(a) II only

(b) I and II

(c) III only

(d) I, II and III

Ans. (b)



26. If an element after oganesson (Og, atomic number 118 and electronic configuration  $[\text{Rn}] 5f^{14} 6d^{10} 7s^2 7p^6$ ) was discovered, in which of the following orbital, will the 119<sup>th</sup> electron be accommodated?

(a) 7d

(b) 6f

(c) 8s

(d) 5g

Ans. (c)

27. The number of 'two-center-two electron' and 'three-center-two electron' bonds in  $[\text{Al}(\text{BH}_4)_3]$  are respectively

(a) twelve and zero

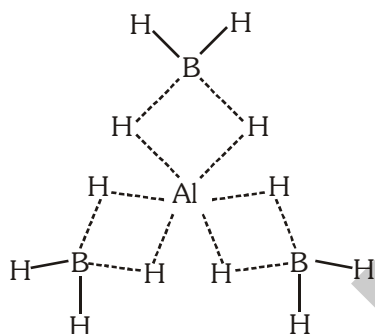
(b) twelve and three

(c) six and six

(d) nine and three

Ans. (c)

Sol.



28. Identify the correct matching of the following oxides in column M with their property in column N:

M	N
(i) Aluminium trioxide	(p) Acidic oxide
(ii) Calcium oxide	(q) Basic oxide
(iii) Arsenic pentoxide	(r) Amphoteric oxide

(a) (i)-(p), (ii)-(q), (iii)-(r)

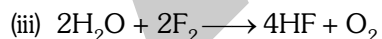
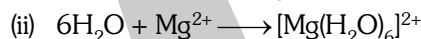
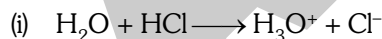
(c) (i)-(r), (ii)-(q), (iii)-(p)

(b) (i)-(q), (ii)-(r), (iii)-(p)

(d) (i)-(r), (ii)-(p), (iii)-(q)

Ans. (c)

29. In each of the following reactions, role of water is:



(a) (i) oxidant; (ii) reductant; (iii) base

(b) (i) reductant; (ii) oxidant; (iii) base

(c) (i) base; (ii) base; (iii) reductant

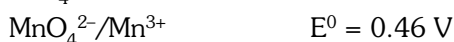
(d) (i) acid; (ii) base; (iii) reductant

Ans. (c)

Sol.  $\text{H}_2\text{O}$  acts as base in reaction (i) because it accepts  $\text{H}^+$  and in reaction (ii) because it donates lone pair of  $e^-$ .  $\text{H}_2\text{O}$  acts as reductant because it reduces  $\text{F}_2$ .



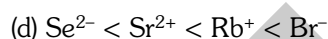
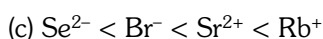
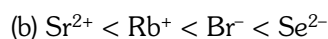
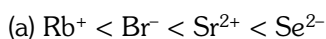
30. The correct order of the following oxidizing agents in basic aqueous medium is:



Ans. (b)

Sol. Electrode having higher reduction potential are better oxidising agent.

31. The correct order of ionic radii of  $\text{Rb}^+$ ,  $\text{Br}^-$ ,  $\text{Sr}^{2+}$  and  $\text{Se}^{2-}$  is



Ans. (b)

Sol.  $\text{Sr}^{2+} < \text{Rb}^+ < \text{Br}^- < \text{Se}^{2-}$

32. Consider the following statements:

(i) Calcination is carried out in absence of air below the melting point of the ore

(ii) Roasting and calcination are carried out in presence of flux

(iii) Calcination is carried out in limited supply of air above the melting point of the ore

(iv) Roasting is carried out in air below the melting point of ore

The correct set of statements is

(a) (i) and (iv)

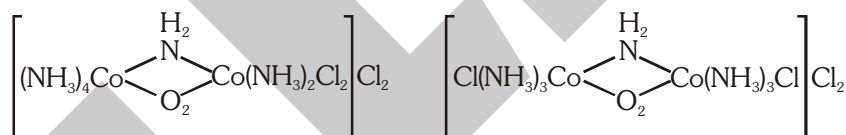
(b) (ii) and (iii)

(c) (i), (iii) and (iv)

(d) (iii) and (iv)

Ans. (a)

33. The cobalt complexes (I) and (II) given below are examples of



(a) linkage isomers

(b) coordination isomers

(c) ligand isomers

(d) coordination position isomers

Ans. (d)

34. The magnetic moment (in units of BM) of copper in  $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$  and  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  respectively is

(a) 1.73 and 0

(b) 1.73 and 1.73

(c) 2.83 and 2.83

(d) 0 and 2.83

Ans. (b)

Sol.  $dsp^2$  hybridization

35. In qualitative inorganic analysis of a water-soluble salt mixture (salt AB + salt XY) both the cations were identified as sulphides. In the tests for anions sodium carbonate extract when treated with  $\text{AgNO}_3$  gave yellowish precipitate soluble with difficulty in  $\text{NH}_4\text{OH}$  while the other anion can be confirmed with brown ring test.

(Given  $K_{sp}$  for AS =  $1 \times 10^{-44}$  and XS =  $1.4 \times 10^{-24}$ ).

Identify the INCORRECT statement about the analysis. .

(a)  $\text{H}_2\text{S}$  can be used under appropriate conditions of pH to separate and identify the cations.

(b) Cation A will be precipitated under acidic condition as the concentration of sulphides ions required is low.

(c) The anions are  $\text{NO}_3^-$  and  $\text{Cl}^-$ .

(d) Cation X will be precipitated as sulphides under alkaline condition, as the concentration of sulphides ions required is very high.

Ans. (c)

- 36.** The correct statement about the solubilities of Group 2 hydroxides is:
- The solubilities increase because lattice energy increases as we go down Group 2
  - The solubilities increase because lattice energy decreases as we go down Group 2
  - The solubilities decrease because atomic size increases as we go down Group 2
  - The solubilities decrease because lattice energy decreases as we go down Group 2

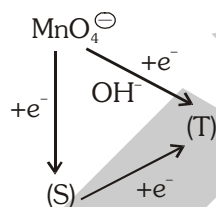
**Ans. (b)**

- 37.** A solution of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  in methanol has  $[\text{Cu}^{2+}] = 1.00 \text{ mg per } 1000 \text{ g of methanol}$ . The molarity of  $\text{Cu}^{2+}$  in this solution is  $Y \times 10^{-5} \text{ mol L}^{-1}$ . Y is (Given; density of methanol =  $0.792 \text{ g mL}^{-1}$ )
- 1.57
  - 5.04
  - 1.25
  - 3.99

**Ans. (c)**

**Sol.** Molarity of  $\text{Cu}^{2+} = \frac{1 \times 10^{-3}}{\frac{63.5}{1000/0.792}} \times 1000 = 1.25 \times 10^{-5}$

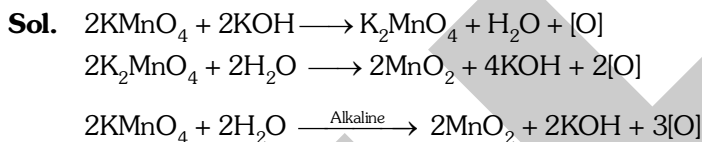
- 38.** Following is the reaction flow chart for manganese oxidocomplexes under different alkaline pH conditions. Compounds (S) and (T) respectively are:



- $\text{S} = \text{MnO}(\text{OH})_2$ ;  $\text{T} = \text{Mn}(\text{OH})_2$
- $\text{S} = \text{MnO}_4^{2-}$ ;  $\text{T} = \text{MnO}(\text{OH})$

- $\text{S} = \text{MnO}_2$ ;  $\text{T} = \text{MnO}(\text{OH})$
- $\text{S} = \text{MnO}_4^{2-}$ ;  $\text{T} = \text{MnO}_2$

**Ans. (d)**

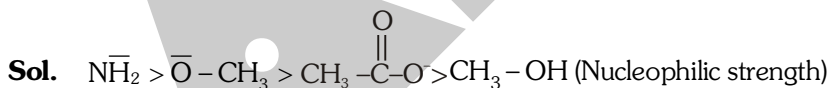


- 39.** The Correct order of relative strength for the following nucleophilic species is



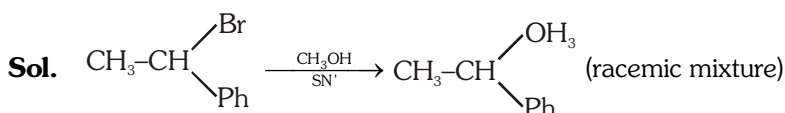
- $\text{IV} > \text{III} > \text{II} > \text{I}$
- $\text{II} > \text{III} > \text{IV} > \text{I}$
- $\text{I} > \text{II} > \text{IV} > \text{III}$
- $\text{I} > \text{II} > \text{III} > \text{IV}$

**Ans. (d)**



- 40.** The product obtained on reaction of optically pure l-bromo-l-phenyl ethane with  $\text{CH}_3\text{OH}$ , is:
- phenyl ethene.
  - l-methoxy-l-phenyl ethane with inverted configuration only..
  - l-methoxy-l-phenyl ethane with retention of configuration.
  - a racemic mixture of l-methoxy-l-phenyl ethane.

**Ans. (d)**



41. Among the following, the correct statements about the compressibility factor (Z) of real gases are:

- (i) If  $Z < 1$ , intermolecular repulsive forces are more dominant.
- (ii) If  $Z < 1$ , intermolecular attractive forces are more dominant.
- (iii) If  $Z > 1$ , intermolecular repulsive forces are more dominant.
- (iv) If  $Z > 1$  intermolecular attractive forces are more dominant.

- (a) (i) and (iv)                      (b) (i) and (iii)                      (c) (ii) and (iv)                      (d) (ii) and (iii)

Ans. (c)

Sol. If  $Z < 1$  : due to dominance of intermolecular attractive forces.

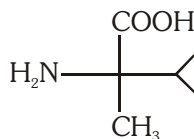
If  $Z > 1$  : due to dominance of intermolecular repulsive forces.

42. Number of different types of dipeptides produced using a mixture of glycine and L-valine, and number of optically active dipeptides formed in this mixture will be:

- (a) Four dipeptides, all optically active
- (b) Two dipeptides, all optically active
- (c) Four dipeptides, three optically active
- (d) Two dipeptides, none optically active

Ans. (c)

Sol.  $\text{NH}_2 - \text{CH}_2 - \text{COOH}$



(Inactive)  
gly- gly

(active)  
gly - val

val-val  
(active)

val-gly  
(active)

43. The figure represents the processes AB, BC and CA undertaken by a certain mass of an ideal gas. Along the path AB, the gas is isothermally compressed with release of 800 J heat to the surroundings. It is then compressed adiabatically along the path BC and the work done is 500 J. The gas then returns to the state A along path CA and absorbs 100 J heat from the surroundings. The work done by the gas along the path CA is

- (a) -300 J                      (b) -900 J                      (c) -600 J                      (d) -400 J

Ans. (c)

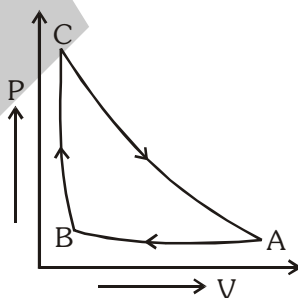
Sol. For overall cycle :  $\Delta U = 0$

$$\therefore q = -W$$

$$q_{AB} + q_{BC} + q_{CA} = -[W_{AB} + W_{BC} + W_{CA}]$$

$$-800 + 0 + 100 = -[800 + 500 + W_{CA}]$$

$$W_{CA} = -600 \text{ J}$$



**44.** Two flasks I and II of equal volume are evacuated and connected by a tube of negligible volume fitted with a stopcock. They are then placed in two different constant temperature baths of 250 K and 750 K respectively. 20 moles of an ideal gas are introduced into the system of these flasks through the stopcock. When the system reaches equilibrium, the ratio of the moles of the gas in flasks I and II is:

- (a) 1 : 1                      (b) 2 : 1                      (c) 3 : 1                      (d) 4 : 1

**Ans. (c)**

**Sol.** Finally, pressure in both flask will be same.

$$\therefore n_1 T_1 = n_2 T_2$$

**45.** When a certain amount of a univalent salt AB (molar mass = 54 g mol<sup>-1</sup>) was dissolved in 0.1 dm<sup>3</sup> of water, the relative lowering of the vapour pressure was found to be 3.55%. The molality of the resulting solution is:

(Assume complete dissociation of the salt under given condition. Density of water = 1 g cm<sup>-3</sup>)

- (a) 0.5 m                      (b) 1.0 m                      (c) 2.0 m                      (d) 4.0 m

**Ans. (b)**

**Sol.** 
$$\chi_{AB} = \frac{2 \times n_{AB}}{2 \times n_{AB} + n_{H_2O}} = \frac{3.55}{100}$$

$$\frac{2 \times \text{wt}_{AB} / 54}{2 \times \left( \frac{\text{wt}_{AB}}{54} \right) + \frac{100}{18}} = \frac{3.55}{100}$$

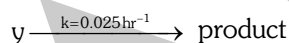
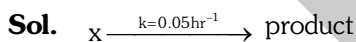
$$\therefore \text{wt}_{AB} = 5.5 \text{ gm}$$

$$\text{molality of AB} = \frac{5.5 / 54}{100} \times 1000 = 1$$

**46.** The rate constant values for the decay of radioisotopes X and Y, used in radio-medicine are 0.05 h<sup>-1</sup> and 0.025 h<sup>-1</sup> respectively. In a hospital, at a time 't<sub>0</sub>' the activity of a sample of X was found to be twice that of Y. The activities of the two radioisotopes will be approximately equal when the time elapsed is:

- (a) twice the half-life of Y                      (b) twice the half-life of X  
(c) equal to the half-life of X                      (d) equal to 1/2 the half-life of Y

**Ans. (b)**



Initially, Let activity of y = a<sub>0</sub>

activity of x = 2a<sub>0</sub>

and

after time t:

activity of x = activity of y

$$2a_0 [e^{-0.05t}] = a_0 [e^{-0.025 \times t}]$$

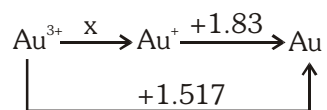
$$\therefore 2 \times e^{-0.05t} = e^{-0.025 \times t}$$

$$2 = e^{+0.025 t}$$

$$\therefore \ln 2 = + 0.025 t$$

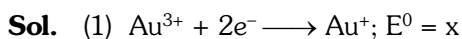
$$\therefore t = \frac{\ln 2}{0.025} = \text{half life of y} = 2 \times \text{half life of x.}$$

47. Latimer diagrams are the compact representations of electrochemical equilibria in substances of multiple oxidation states. The value of the potential,  $x$ , in the Latimer diagram of gold (at  $\text{pH} = 1.0$ ) is:

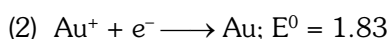


- (a) 2.72 V                      (b) 3.18 V                      (c) -3.18 V                      (d) 1.36 V

**Ans. (d)**

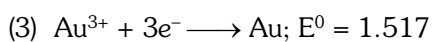


$$\therefore \Delta G_1^0 = -2Fx$$



$$\therefore \Delta G_2^0 = 1 \times F \times 1.83$$

Equation (1) + (2)



$$\therefore \Delta G_3^0 = \Delta G_1^0 + \Delta G_2^0$$

$$\therefore -3 \times F \times 1.517 = -2Fx - 1 \times F \times 1.83$$

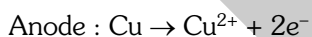
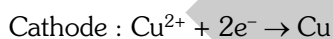
$$\therefore x = 1.36 \text{ V}$$

48. Electrolysis of aqueous  $\text{CuSO}_4$  (0.1 M) was carried out in two cells I and II. In I, the electrodes are of Cu and in II they were of Pt. As the electrolysis proceeds pH of the electrolyte solution will:

- (a) decrease in II and remain the same in I                      (b) remain the same in both I and II  
 (c) increase in both I and II                      (d) increase in I and decrease in II

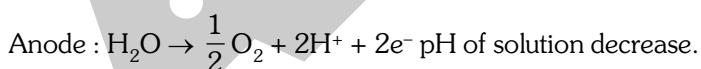
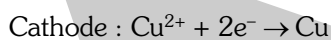
**Ans. (a)**

**Sol.** If Cu is used as electrode then reaction at



pH of the solution remains unchanged.

If Pt is used as electrode then reaction at



49. 2,4,6-trinitrophenol is more acidic than phenol. Identify the correct statement(s)

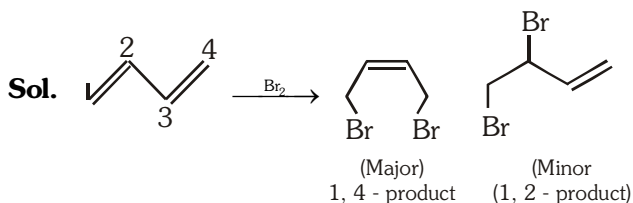
- (a)  $\text{pK}_a$  for 2,4,6-trinitrophenol is less than that of phenol.  
 (b) phenol is stabilized by intramolecular  $\pi$  hydrogen bonding.  
 (c) The conjugate base of 2,4,6-trinitrophenol delocalizes the negative charge on the oxygen atom to a very large extent.  
 (d) The conjugate base of phenol delocalizes the negative charge to a greater extent than the conjugate base of 2,4,6-trinitrophenol.

**Ans. (a, c)**

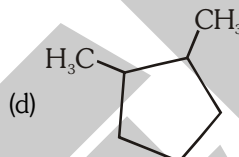
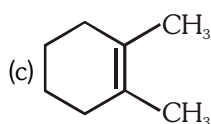
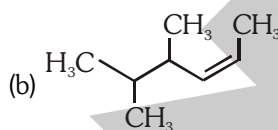
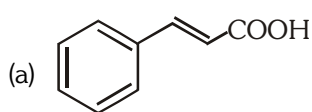
50. The correct statements for 1,3-butadiene from following are:

- (a) Molar addition of  $\text{Br}_2$  yields only 1,4-dibromo-2-butene as the major product when the reaction is performed for longer time period
- (b) Molar addition of  $\text{Br}_2$  yields only 1,2-dibromo-2-butene for longer time period
- (c)  $\text{C}_1 - \text{C}_2$  and  $\text{C}_3 - \text{C}_4$  bonds are slightly longer than a  $\text{C}=\text{C}$  bond
- (d)  $\text{C}_2 - \text{C}_3$  single bond is slightly shorter than a  $\text{C} - \text{C}$  bond

Ans. (a, d)



51. Which of the following representations will exhibit cis-trans isomerism?



Ans. (a, b, d)

Sol.

52. For an elementary dimerization reaction of the type  $2\text{R} \rightarrow \text{R}_2$ , the value of the steric factor was found to be 2.5. This indicates that

- (a) the experimentally obtained rate is 2.5 times faster than the theoretical rate.
- (b) ratio of the number of collisions calculated from collision theory and that actually take place is 1:2.5.
- (c) the activation energy of the reaction is the same for both the experimental and calculated values.
- (d) the molecules of reactant R may be of some complex structure

Ans. (a, c, d)

Sol.

53. The correct statements among the following is/are:

- (a) The charge on the diffused layer of AgI colloidal solution by the addition of few drops of dilute aqueous solution of KI to an aqueous solution of  $\text{AgNO}_3$  is negative.
- (b) The charge on the diffused layer of AgI colloidal solution by the addition of few drops of dilute aqueous solution of  $\text{AgNO}_3$  to an aqueous solution of KI is positive.
- (c) When the ionic strength of a colloidal solution is increased, thickness of the double layer is increased, and the colloid gets precipitated.
- (d) When the ionic strength of a colloidal solution is increased, thickness of the double layer is decreased, and the colloid gets precipitated.

Ans. (a, b, c)

Sol. If drops of KI solution is added in  $\text{AgNO}_3$  solution then positive solution of AgI will form and diffused layer acquire negative charge.

If drops of  $\text{AgNO}_3$  solution is added in KI solution then negative solution of AgI will form and diffused layer acquire positive charge.

54. In reverse osmosis the flow of solvent across semi permeable membrane occurs

- (a) when hydrostatic pressure is greater than osmotic pressure
- (b) when hydrostatic pressure is lower than osmotic pressure
- (c) from higher concentrated solution to lower concentrated solution
- (d) from lower concentrated solution to higher concentrated solution

Ans. (a, c)

Sol. In reverse osmosis, solvent molecules flow from higher concentration to lower concentration.

55. Choose the correct statement(s) regarding zeolites:

- (a) Silicon atoms are replaced by aluminium atoms in the zeolites.
- (b) The pores and cavities of the zeolites as well as size and shape of reactant decides the reactions taking place in the zeolites.
- (c) The cracking of hydrocarbons and isomerisation reactions are catalyzed by zeolites in the petrochemical industries.
- (d) Zeolites act as molecular sieves and can separate the molecules of different sizes.

Ans. (a, b, c, d)

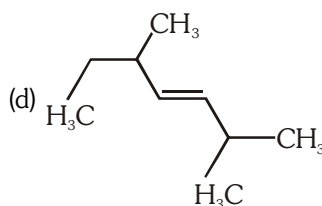
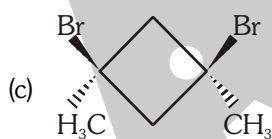
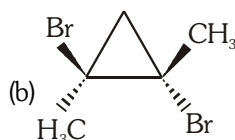
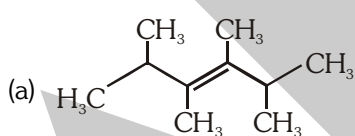
56. Crystalline iron(III) nitrate nonahydrate,  $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ , has a very pale violet colour. When added to water, the crystals dissolve to form a brown solution. Treatment of this brown solution with concentrated nitric acid yields a very pale violet solution while treatment with HCl yields a yellow solution.

Identify the correct statements regarding the above observations.

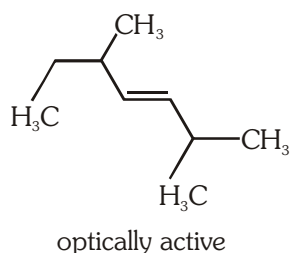
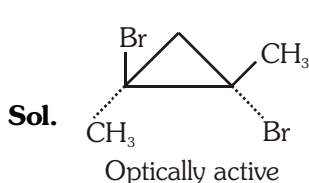
- (a) The brown colour is due to  $[\text{Fe}(\text{OH})(\text{H}_2\text{O})_5]^{2+}$ ,  $[\text{Fe}(\text{OH})_2(\text{H}_2\text{O})_4]^+$
- (b) Violet colour is due to  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  and yellow colour due to  $[\text{FeCl}_4]^-$
- (c) Addition of  $\text{HNO}_3$  shifts the equilibrium  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+} + \text{H}_2\text{O} \rightleftharpoons [\text{Fe}(\text{OH})(\text{H}_2\text{O})_5]^{2+} + \text{H}_3\text{O}^+$  to left giving pale violet colour
- (d) Addition of  $\text{HNO}_3$  shifts the equilibrium  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+} + \text{H}_2\text{O} \rightleftharpoons [\text{Fe}(\text{OH})(\text{H}_2\text{O})_5]^{2+} + \text{H}_3\text{O}^+$  to right giving violet colour

Ans. (a, b, c)

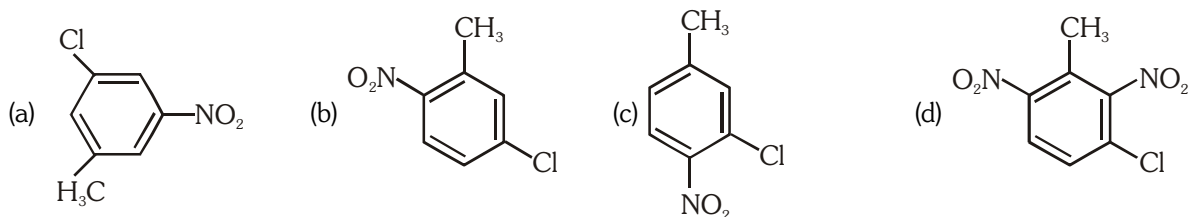
57. The optically active compound from the following are:



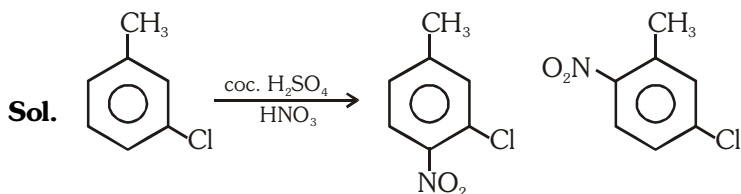
Ans. (b,d)



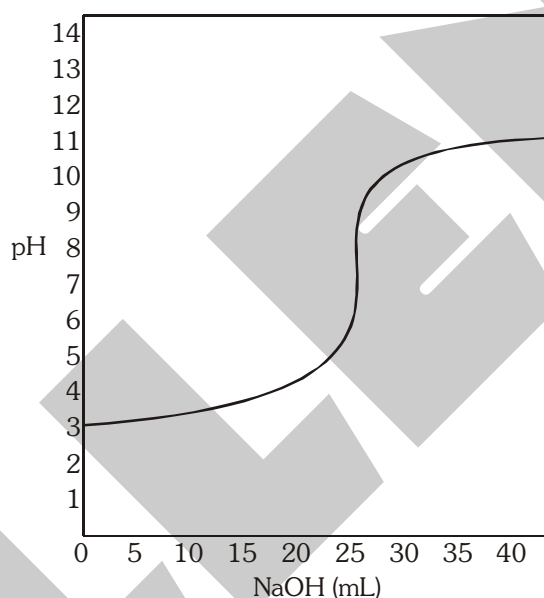
58. 3-chlorotoluene is reacted with a mixture of cone.  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$ . The product/s formed is/are:



Ans. (b,c)



59. Given below is the plot of pH vs volume of NaOH added in an acid-base titration. The correct statements among the following is/are:



- (a) Before the equivalence point, a series of buffer solutions determine the pH.  
 (b) The graph represents the titration of a strong acid with NaOH.  
 (c) At the equivalence point, hydrolysis of the anion of the acid determines the pH.  
 (d) After the equivalence point acid/salt buffer solution determines the pH.

Ans. (a, c)

Sol. From the graph it can be concluded that it is titration of weak acid with strong base (NaOH).

60. The correct statements among the following is/are:

- (a) The probability density ( $\Psi^2$ ) for a hydrogen atom is zero at  $r = 0$ .  
 (b) In an atom, orbitals with the same quantum number have different energies.  
 (c) The energy of a given orbital with same principal quantum number decreases as the atomic number 'Z', increases.  
 (d) For a given atomic number, the configuration having the maximum number of parallel spins is of the lowest energy than any other arrangement arising from the same configuration.

Ans. (a, c, d)

Sol. In an atom, orbitals with same quantum number have same energies.