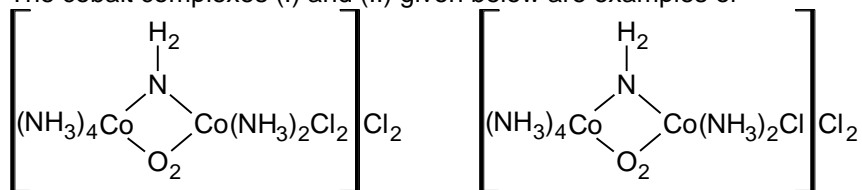


8. The ligand with which the homoleptic octahedral complex of Co^{3+} will be most stable is
 (A) Ethylenediamine tetra acetate ion (B) Dien (N-(2-aminoethyl)-1, 2-ethanediamine)
 (C) Ethane-1, 2-diamine (D) Ammonia
9. Which of the following properties may have positive values of ΔH ?
 (i) Lattice enthalpy (ii) Hydration enthalpy
 (iii) Electron gain enthalpy for noble gases (iv) Ionization enthalpy
 (A) (i) and (ii) (B) (iii) and (iv)
 (C) Only (iv) (D) (ii), (iii) and (iv)
10. The correct IUPAC name of potassium permanganate is
 (A) potassium tetraoxomanganate (VI) (B) potassium tetraoxidopermanganate (VII)
 (C) potassium tetraoxidomanganese (VII) (D) potassium tetraoxidomanganate (VII)
11. Which of the following statements is true with respect to sodium salts of oxoanions of phosphorus NaH_2PO_2 and Na_2HPO_3 ?
 (A) NaH_2PO_2 is reducing and Na_2HPO_3 is oxidizing
 (B) NaH_2PO_2 is more reducing than Na_2HPO_3
 (C) NaH_2PO_2 is more oxidizing than Na_2HPO_3
 (D) NaH_2PO_2 is oxidizing and Na_2HPO_3 is reducing
12. The fluoride/s of xenon, XeF_n ($n = 2$ or 4 or 6), which on complete hydrolysis gives back xenon as one of the products, is/are _____.
 I. XeF_2 II. XeF_4 III. XeF_6
 (A) II only (B) I and II
 (C) III only (D) I, II and III
13. 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 119th electron be accommodated?
 (A) 7d (B) 6f
 (C) 8s (D) 5g
14. 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
15. 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) (B) (i) – (q), (ii) – (r), (iii) – (p)
 (C) (i) – (r), (ii) – (q), (iii) – (p) (D) (i) – (r), (ii) – (p), (iii) – (q)
16. In each of the following reactions, role of water is:
 (i) $\text{H}_2\text{O} + \text{HCl} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
 (ii) $6\text{H}_2\text{O} + \text{Mg}^{2+} \rightarrow [\text{Mg}(\text{H}_2\text{O})_6]^{2+}$
 (iii) $2\text{H}_2\text{O} + 2\text{F}_2 \rightarrow 4\text{HF} + \text{O}_2$
 (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
17. The correct order of following oxidizing agents in basic aqueous medium is:
 $\text{CrO}_4^{2-} / \text{Cr}^{3+}$ $E^0 = -0.11 \text{ V}$
 $\text{FeO}_4^{2-} / \text{Fe}^{3+}$ $E^0 = +0.72 \text{ V}$
 $\text{MnO}_4^{2-} / \text{Mn}^{3+}$ $E^0 = +0.46 \text{ V}$
 (A) $[\text{CrO}_4]^{2-} > [\text{FeO}_4]^{2-} > [\text{MnO}_4]^{2-}$ (B) $[\text{FeO}_4]^{2-} > [\text{MnO}_4]^{2-} > [\text{CrO}_4]^{2-}$
 (C) $[\text{CrO}_4]^{2-} > [\text{MnO}_4]^{2-} > [\text{FeO}_4]^{2-}$ (D) $[\text{MnO}_4]^{2-} > [\text{FeO}_4]^{2-} > [\text{CrO}_4]^{2-}$
18. The correct order of ionic radii of Rb^+ , Br^- , Sr^{2+} and Se^{2-} is
 (A) $\text{Rb}^+ < \text{Br}^- < \text{Sr}^{2+} < \text{Se}^{2-}$ (B) $\text{Sr}^+ < \text{Rb}^+ < \text{Br}^- < \text{Se}^{2-}$
 (C) $\text{Se}^{2-} < \text{Br}^- < \text{Sr}^{2+} < \text{Rb}^{1+}$ (D) $\text{Se}^{2-} < \text{Sr}^{2+} < \text{Rb}^+ < \text{Br}^-$

19. 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 statement is
 (A) (i) and (iv) (B) (ii) and (iii)
 (C) (i), (iii) and (iv) (D) (iii) and (iv)

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



- (A) linkage isomers (B) coordination isomers
 (C) ligand isomers (D) coordination position isomers

21. 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

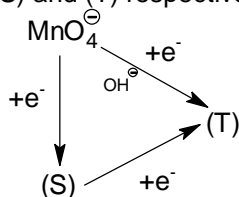
22. In qualitative inorganic analysis of a water soluble salt mixture (salt AB + salt XY) both the cations were identified as sulphides. In the tests for anions sodium carbonate extract when treated with AgNO_3 gave yellowish precipitate soluble with difficulty in NH_4OH while the other anion can be confirmed with brown ring test. (Given K_{sp} for AS = 1×10^{-44} and XS = 1.4×10^{-24}).

Identify the INCORRECT statement about the analysis:

- (A) H_2S 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 sulphide ions required is low
 (C) The anions are NO_3^- and Cl^-
 (D) Cation X will be precipitated as sulphides under alkaline conditions as the concentration of sulphides ions required to very high
23. The correct statement about the solubilities of Group-2 hydroxides is
 (A) The solubilities increase because lattice energy increases as we go down in Group 2
 (B) The solubilities increase because lattice energy decreases as we go down Group 2
 (C) The solubilities decrease because atomic size increases as we go down Group 2
 (D) The solubilities decrease because lattice energy decreases as we go down Group 2

24. 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 Cu^{2+} in this solution is $Y \times 10^{-5} \text{ mol L}^{-1}$. Y is
 (Given: density of methanol = 0.792 g mL^{-1})
 (A) 1.57 (B) 5.04
 (C) 1.25 (D) 3.99

25. Following is the reaction flow chart the manganese oxidocomplexes under different alkaline pH conditions. Compounds (S) and (T) respectively are



- (A) S = $\text{MnO}(\text{OH})_2$; T = $\text{Mn}(\text{OH})_2$ (B) S = MnO_2 ; T = $\text{MnO}(\text{OH})$
 (C) S = MnO_4^{2-} ; T = $\text{MnO}(\text{OH})$ (D) S = MnO_4^{2-} ; T = MnO_2

26. The correct order of relative strength for the following nucleophilic species is



- (A) $\text{IV} > \text{III} > \text{II} > \text{I}$ (B) $\text{II} > \text{III} > \text{IV} > \text{I}$
 (C) $\text{I} > \text{II} > \text{IV} > \text{III}$ (D) $\text{I} > \text{II} > \text{III} > \text{IV}$

27. The product obtained on reaction of optically pure 1-bromo-1-phenyl ethane with CH_3OH is

- (A) phenyl ethene
 (B) 1-methoxy-1-phenyl ethane with inverted configuration only
 (C) 1-methoxy-1-phenyl ethane with retention of configuration
 (D) a racemic mixture of 1-methoxy-1-phenyl ethane

28. An alkane [X] contains five 1° , two 2° , one 3° and 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

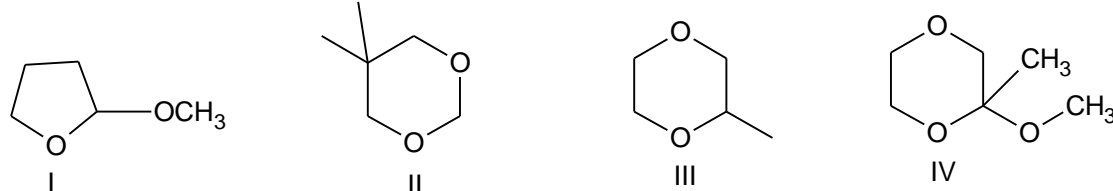
29. The number of isomeric alkenes with molecular formula C_5H_{10} is (taking stereoisomers into account)

- (A) 4 (B) 5
 (C) 6 (D) 7

30. 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

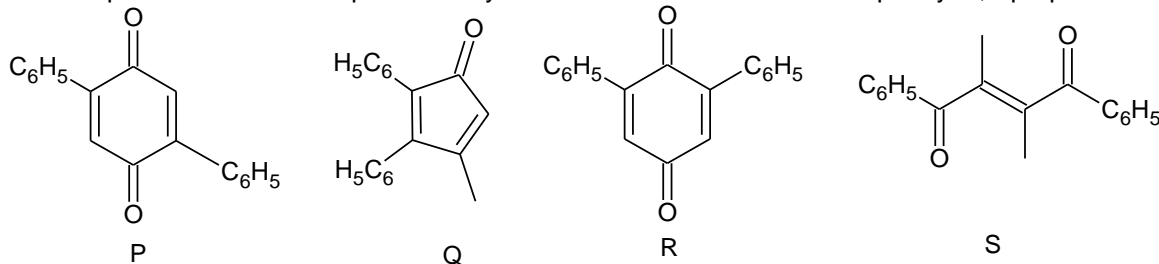
- (A) 5, 5 – dibromo-2-hexene (B) 2, 5 – dibromo-3-hexene
 (C) 2, 2 – dibromo-3-hexene (D) 2, 3 – dibromo-4-hexene

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



- (A) I and II (B) III and IV
 (C) Only IV (D) I, II and III

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



- (A) P (B) Q
 (C) R (D) S

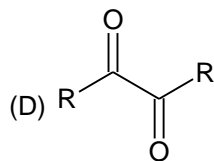
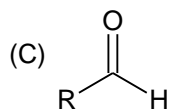
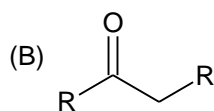
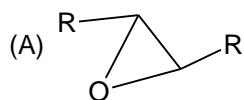
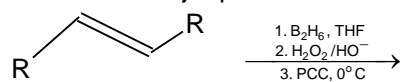
33. 2,2-Dimethyl-1,3-propanediol is formed by heating 2-methylpropanal with an excess of formaldehyde and $\text{Ca}(\text{OH})_2$. The sequence of reactions taking place in this synthesis is:

- (A) dehydrogenation to 2-methyl-2-propenal followed by addition of formaldehyde
 (B) dehydrogenation to penta-2,3-diene followed by addition of formaldehyde
 (C) a crossed aldol reaction followed by a crossed Cannizzaro reaction.
 (D) a crossed Cannizzaro reaction followed by a crossed aldol reaction.

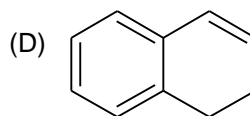
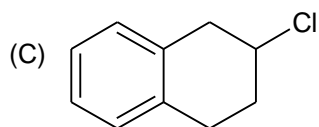
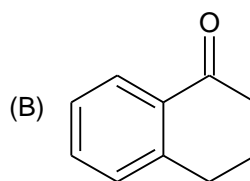
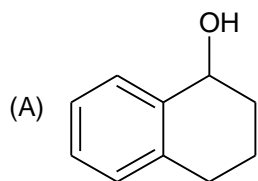
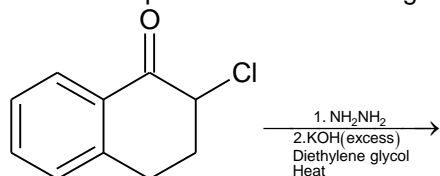
34. Number of different types of dipeptides produced using a mixture of glycine and L-valine, and number of optically active dipeptides formed in this mixture will be:

- (A) Four dipeptides, all optically active (B) Two dipeptides, all optically active
 (C) Four dipeptides, three optically active (D) Two dipeptides, none optically active

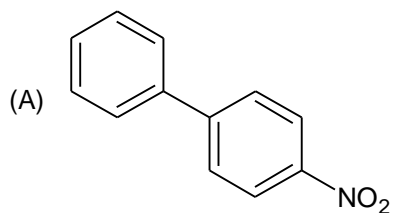
35. Predict the major product in the following reaction, PCC is pyridinium chlorochromate



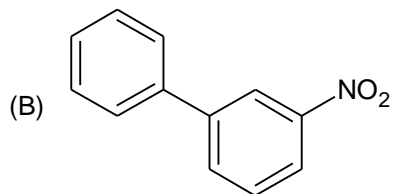
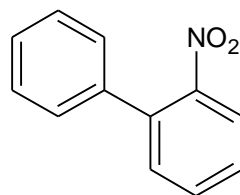
36. Find out the product in the following reaction.



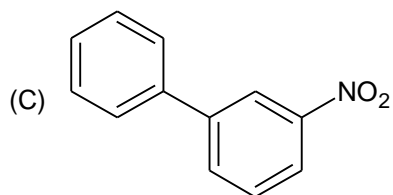
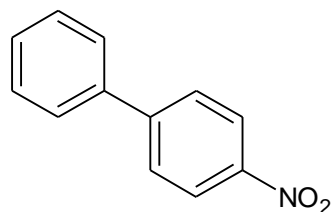
37. The product/s obtained on reaction of biphenyl (Ph – Ph) with nitrating mixture ($\text{HNO}_3 + \text{H}_2\text{SO}_4$)



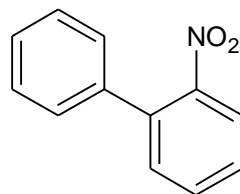
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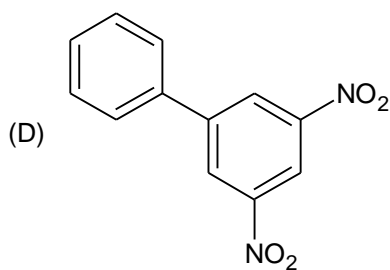


and



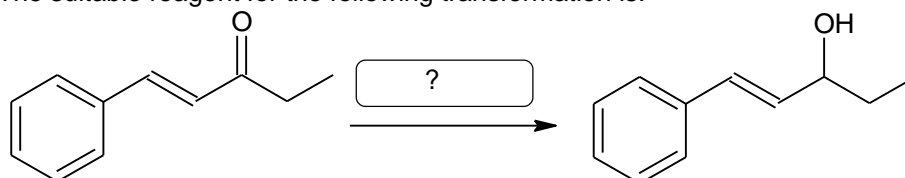
and





38. Chlorination of propane give 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

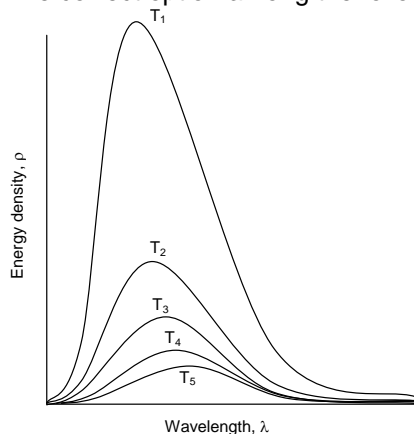
39. The suitable reagent for the following transformation is:



- (A) Na / liq. NH₃ (B) H₂, Pd / C
 (C) LiAlH₄ (D) Zn - Hg, HCl, heat
40. Column A represents a set of functional groups and Column B their respective electronic effects. The correct match is:
- | Column A | Column B |
|---|---|
| (A) -NH ₂ , -COCl, -SO ₃ H, -COOH ; | <i>m</i> -directing, EWG, activating, <i>o/p</i> -directing |
| (B) -X, -NHCOCH ₃ , -CHO, -CH ₃ ; | <i>o/p</i> directing, EDG, <i>m</i> -directing, activating |
| (C) -COCl, -COCH ₃ , -NH ₂ , -CN ; | EDG, EWG, deactivating, <i>m</i> -directing |
| (D) -SO ₃ H, -NH ₂ , -OCH ₃ , -CONH ₂ ; | activating, deactivating, EWG, EWG |
- [EDG : Electron donating group and EWG : Electron withdrawing group]

41. The correct order of reactivity of -CHO, -COR, -COOR, -CONR₂ groups towards MeMgI in ether is:
 (A) -CONR₂ > -COOR > -COR > -CHO (B) -CHO > -COR > -COOR > -CONR₂
 (C) -CONR₂ > -CHO > -COR > -COOR (D) -CHO > -CONR₂ > -COOR > -COR

42. The plots of energy density (energy per unit area) vs wavelength for blackbody radiation at various temperatures is 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.

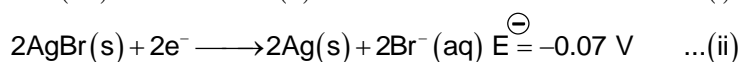
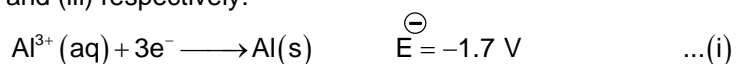
- (iii) Radiations of all wave lengths are emitted, absorbed, reflected, and refracted by the black body.
 (iv) The total energy density increases as the temperature is decreased.
 (A) (i) and (ii) (B) (ii) and (iii)
 (C) (i), (iii) and (iv) (D) (ii), (iii) and (iv)

43. 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

44. Antacid are medicines that temporarily neutralize the acid in the stomach and prevent heart burns. The volume of an antacid syrup containing 2.9 g of Mg(OH)₂ per 100 mL to be given to a patients whose stomach contains 2 L of gastric juice with HCl concentration of 6.0 × 10⁻³ M is:
 (Molar mass of Mg(OH)₂ = 58.0 g mol⁻¹)
 (A) 4.0 mL (B) 7.8 mL
 (C) 12.0 mL (D) 120 mL

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

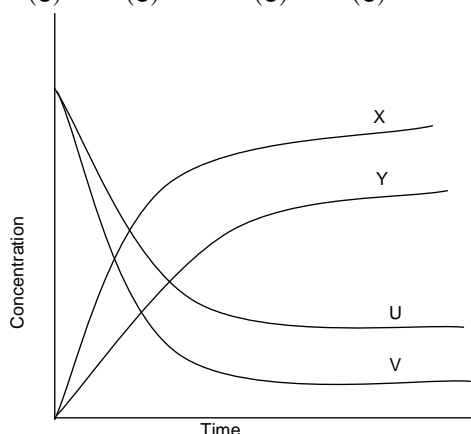
$$\text{Fe}(\text{OH})_2(\text{s}) + 2\text{e}^- \longrightarrow \text{Fe}(\text{s}) + 2\text{OH}^-(\text{aq}) \quad E^\ominus = -0.9 \text{ V} \quad \dots(\text{i})$$
 takes place in two different electrochemical cells, I and II, in which the other half cell reactions are (ii) and (iii) respectively:



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
46. The following are the concentration vs time plots of the reactants and products represented by the reaction

$$\text{L}(\text{g}) + 2\text{M}(\text{g}) \longrightarrow \text{N}(\text{g}) + 3\text{O}(\text{g})$$



- The curves that represent M(g) and N(g) qualitatively are respectively
 (A) X, Y (B) Y, U
 (C) V, Y (D) U, X

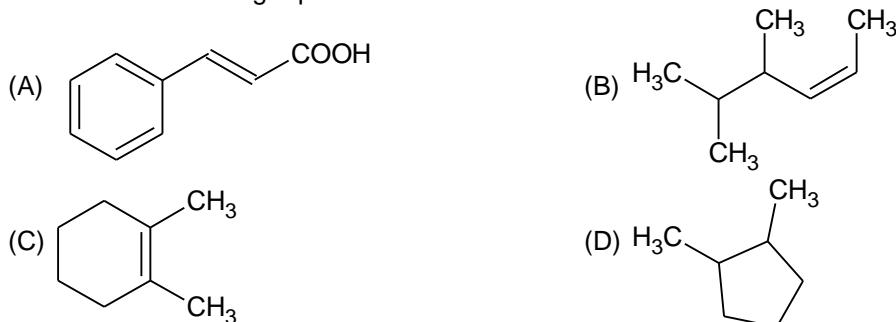
47. The current produced due to photoelectric effect
 (A) increases with the increase of frequency of the incident radiation.
 (B) increases with the increase in intensity of the incident radiation.
 (C) decreases with time of irradiation.
 (D) is independent of the intensity of incident radiation.

48. The property of radiation that is not different at various regions of the electromagnetic spectrum is:
(A) energy (B) frequency
(C) velocity (D) wavelength

ANY NUMBER OF OPTIONS 4, 3, 2 or 1 MAY BE CORRECT
MARKS WILL BE AWARDED ONLY IF ALL THE CORRECT OPTIONS ARE BUBBLED

49. 2,4,6-trinitrophenol is more acidic than phenol. Identify the correct statement(s)
(A) pK_a for 2,4,6-trinitrophenol is less than that of phenol.
(B) phenol is stabilized by intramolecular π 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.
50. The correct statements for 1,3-butadiene from following are:
(A) Molar addition of 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 Br_2 yields only 1,2-dibromo-2-butene for longer time period
(C) $C_1 - C_2$ and $C_3 - C_4$ bonds are slightly longer than a $C = C$ bond
(D) $C_2 - C_3$ single bond is slightly shorter than a $C - C$ bond

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



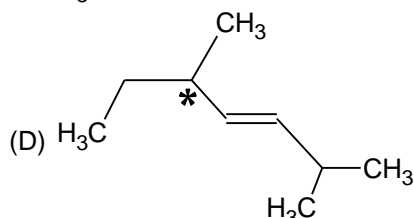
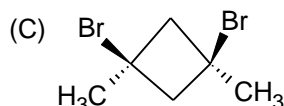
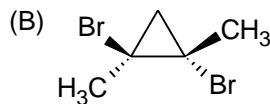
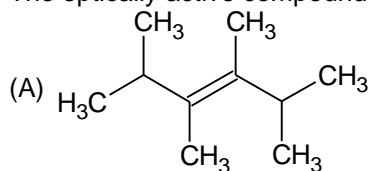
52. For an elementary dimerization reaction of the type $2R \rightarrow R_2$, the value of the steric factor was found to be 2.5. This indicates that
(A) the experimentally obtained rate is 2.5 times faster than the theoretical rate.
(B) ratio of the number of collisions calculated from collision theory 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.
53. The correct statement/s 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 $AgNO_3$ is negative.
(B) The charge on the diffused layer of AgI colloidal solution by the addition of few drops of dilute aqueous solution of $AgNO_3$ 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.
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

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.

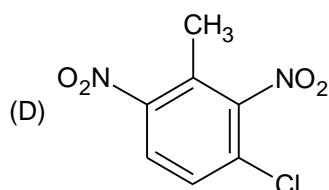
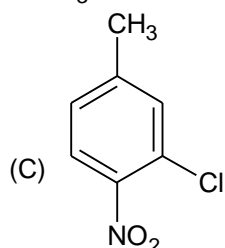
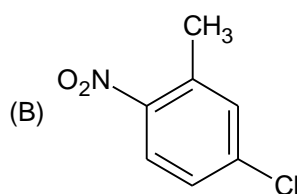
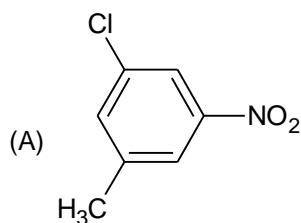
56. Crystalline iron(III) nitrate nonahydrate, $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, has a very pale violet colour. When added to water, the crystals dissolve to form a brown solution. Treatment of this brown solution with concentrated nitric acid yields a very pale violet solution while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

Identify the correct statements regarding the above observations.

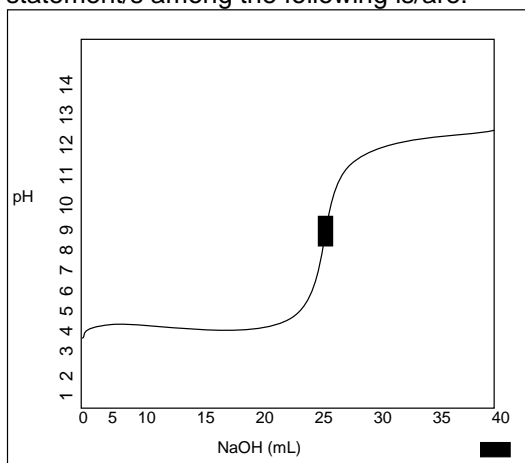
- (A) The brown colour is due to $[\text{Fe}(\text{OH})(\text{H}_2\text{O})_5]^{2+}$, $[\text{Fe}(\text{OH})_2(\text{H}_2\text{O})_4]^+$
 - (B) Violet colour is due to $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ and yellow colour due to $[\text{FeCl}_4]^-$
 - (C) Addition of HNO_3 shifts the equilibrium $[\text{Fe}(\text{H}_2\text{O})_6]^{3+} + \text{H}_2\text{O} \rightleftharpoons [\text{Fe}(\text{OH})(\text{H}_2\text{O})_5]^{2+} + \text{H}_3\text{O}^+$ to left giving pale violet colour
 - (D) Addition of 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
- 57 The optically active compounds from the following are:



58. 3-chlorotoluene is reacted with a mixture of conc. H_2SO_4 and HNO_3 . The product/s formed is/are:



59. Given below is the plot of pH vs volume of NaOH added in an acid-base titration. The correct statement/s 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.
60. The correct statement/s among the following is/are:
- (A) The probability density (ψ^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.