

AIEEE 2008 Chemistry Solutions

36. At 80°C , the vapour pressure of pure liquid 'A' is 520 mm. Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at 80°C and 1 atm pressure, the amount of 'A' in the mixture is (1 atm = 760 mm Hg)

- (1) 50 mol percent
- (2) 52 mol percent
- (3) 34 mol percent
- (4) 48 mol percent

Ans

$$\left. \begin{array}{l} P_A^0 = 520\text{mmHg} \\ P_B^0 = 1000\text{mmHg} \end{array} \right\} \Rightarrow P_A^0 X_A + P_B^0 X_B = 760\text{mmHg}$$

(solution boils when its pressure becomes 1 atm \equiv 760 mm Hg)

$$X_B = 1 - X_A$$

$$\Rightarrow X_A = 1/2 \Rightarrow 50 \text{ mol percent}$$

37 For a reaction $\frac{1}{2}A \rightarrow 2B$, rate of disappearance of 'A' is related to the rate appearance of 'B' by the expression

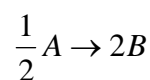
$$(1) -\frac{d[A]}{dt} = 4 \frac{d[B]}{dt}$$

$$(2) -\frac{d[A]}{dt} = \frac{1}{2} \frac{d[B]}{dt}$$

$$(3) -\frac{d[A]}{dt} = \frac{1}{4} \frac{d[B]}{dt}$$

$$(4) -\frac{d[A]}{dt} = \frac{d[B]}{dt}$$

Ans

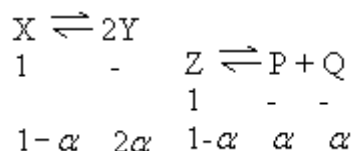


$$-\frac{1}{1/2} \frac{d[A]}{dt} = \frac{1}{2} \frac{d[B]}{dt} \Rightarrow -\frac{d[A]}{dt} = \frac{1}{4} \frac{d[B]}{dt}$$

38 The equilibrium constants K_{P_1} and K_{P_2} for the reactions $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$, respectively are in the ratio of 1: 9. If the degree of dissociation of X and Z be equal then the ratio of total pressures at these equilibria is

- (1) 1 : 9
- (2) 1 : 36
- (3) 1 : 1
- (4) 1 : 3

Ans



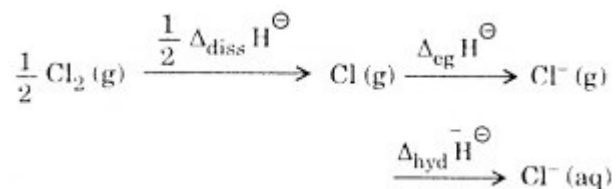
$$K_{P_1} = \frac{P_y^2}{P_x} = \frac{\left(\frac{2\alpha}{1+\alpha} \cdot P_1\right)^2}{\left(\frac{1-\alpha}{1+\alpha} \cdot P_1\right)} = \frac{4\alpha^2 P_1}{1-\alpha^2}$$

$$K_{P_2} = \frac{P_P \cdot P_Q}{P_Z} = \frac{\left(\frac{\alpha}{1+\alpha} \cdot P_2\right) \left(\frac{\alpha}{1+\alpha} \cdot P_2\right)}{\left(\frac{1-\alpha}{1+\alpha} \cdot P_2\right)}$$

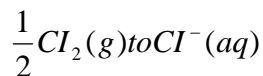
$$= \frac{\alpha^2 P_2}{1-\alpha^2}$$

$$\Rightarrow \frac{K_{P_1}}{K_{P_2}} = \frac{1}{9} = \frac{4P_1}{P_2} \Rightarrow \frac{P_1}{P_2} = \frac{1}{36}$$

39 Oxidising power of chlorine in aqueous solution can be determined by the parameters indicated below:



The energy involved in the conversion of



(using the data,

$$\Delta_{\text{diss}} H_{\text{Cl}_2}^\ominus = 240 \text{ kJ mol}^{-1},$$

$$\Delta_{\text{eg}} H_{\text{Cl}}^\ominus = -349 \text{ kJ mol}^{-1},$$

$$\Delta_{\text{hyd}} H_{\text{Cl}^-}^\ominus = 381 \text{ kJ mol}^{-1}), \text{ will be}$$

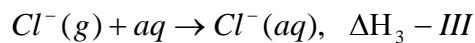
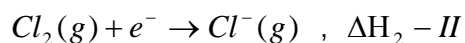
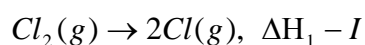
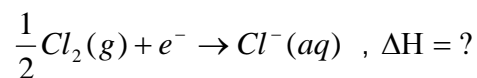
(1) $+120 \text{ kJ mol}^{-1}$

(2) $+152 \text{ kJ mol}^{-1}$

(3) -610 kJ mol^{-1}

(4) -850 kJ mol^{-1}

Ans



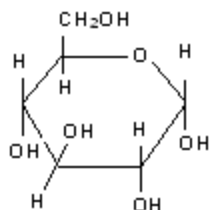
$$\Delta H = \frac{\Delta H_1}{2} + \Delta H_2 + \Delta H_3 = \frac{240}{2} + (-349) + (-381)$$

$$\Rightarrow \Delta H = -610 \text{ kJ mol}^{-1}$$

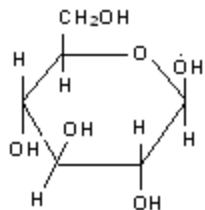
40 α -D-(+) glucose and β -D-(+)-glucose are

- (1) Enantiomers
- (2) Conformers
- (3) Epimers
- (4) Anomers

Ans



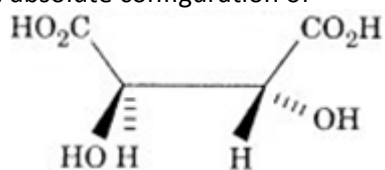
α - D - (+) - Glucopyranose



β - D - (+) - Glucopyranose

α - form & β - form are known as anomers

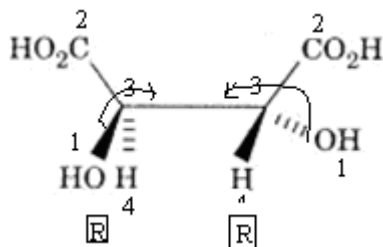
41. The absolute configuration of



is

- (1) S, R
- (2) S, S
- (3) R, R
- (4) R, S

Ans

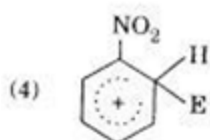
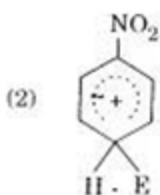
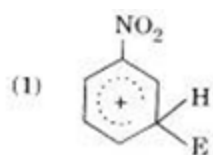


Note: we should view from the opposite side of priority (4) group => R, R

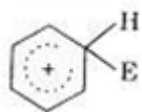
42 Which of the following factors is of no significance for roasting sulphide ores to the oxides and not subjecting the sulphide ores to carbon reduction directly?

- (1) CO_2 is more volatile than CS_2
- (2) Metal sulphides are thermodynamically more stable than CS_2
- (3) CO_2 is thermodynamically more stable than CS_2
- (4) Metal sulphides are less stable than the corresponding oxides

43 The electrophile, E^\oplus attacks the benzene ring to generate the intermediate σ -complex, Of the following, which σ -complex is of lowest energy?

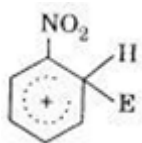


Ans



[Due to resonance stabilization of +ve charge]

hence, this structure is of least energy



[This structure is of height energy since NO_2 being $-\text{EWG}$ destabilizes +ve charge directly]

Note: other 2 structures are also of higher energy due to the some reason above.

44 Bakelite is obtained from phenol by reacting with

- (1) HCHO
- (2) $(\text{CH}_2\text{OH})_2$
- (3) CH_3CHO
- (4) CH_3COCH_3

Ans

Phenol + HCHO \rightarrow Bakelite

45 The organic chloro compound, which shows complete stereochemical inversion during a $\text{S}_{\text{N}}2$ reaction, is

- (1) CH_3Cl
- (2) $(\text{C}_2\text{H}_5)_2\text{CHCl}$
- (3) $(\text{CH}_3)_3\text{CCl}$
- (4) $(\text{CH}_3)_2\text{CHCl}$

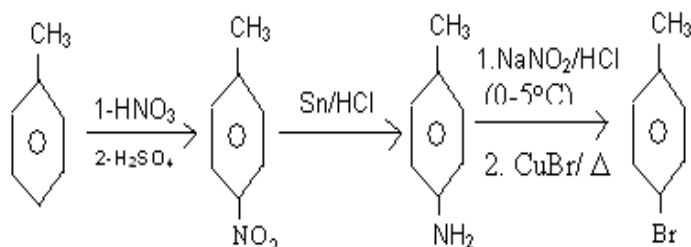
Ans

$\text{S}_{\text{N}}2$ reaction occur with primary alkyl halides with complete stereochemical (walder) inversion.

46 Toluene is nitrated and the resulting product is reduced with tin and hydrochloric acid. The product so obtained is diazotised and then heated with cuprous bromide. The reaction mixture so formed contains

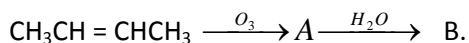
- (1) Mixture of o- and m-bromotoluenes
- (2) Mixture of o- and p-bromotoluenes
- (3) Mixture of o- and p-dibromobenzenes
- (4) Mixture of o- and p-bromoanilines

Ans



Note: O-product will also be formed

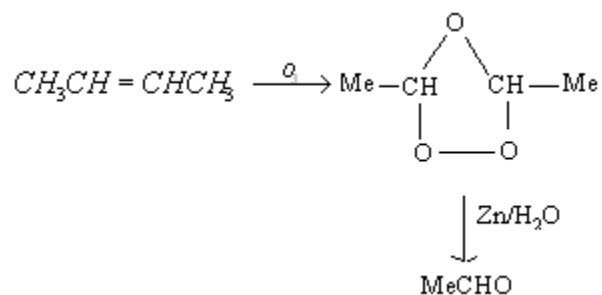
47 In the following sequence of reactions, the alkene affords the compound 'B'



The compound B is

- (1) CH_3CHO
- (2) $\text{CH}_3\text{CH}_2\text{CHO}$
- (3) CH_3COCH_3
- (4) $\text{CH}_3\text{CH}_2\text{COCH}_3$

Ans



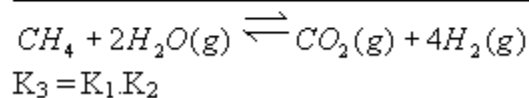
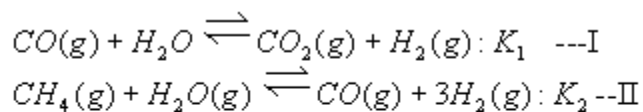
48 For the following three reactions a, b and c, equilibrium constants are given:

- a) $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g}); K_1$
- b) $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g}); K_2$
- c) $\text{CH}_4(\text{g}) + 2\text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + 4\text{H}_2(\text{g}); K_3$

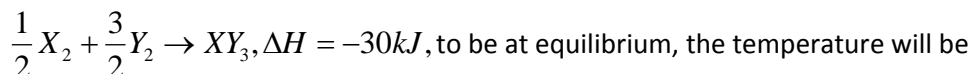
Which of the following relations is correct?

1. $K_3 \cdot K_2^3 = K_1^2$
2. $K_1 \sqrt{K_2} = K_3$
3. $K_2 K_3 = K_1$
4. $K_3 = K_1 K_2$

Ans

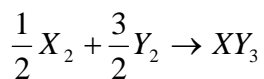


49 Standard entropy of X_2 , Y_2 and XY_3 are 60, 40 and $50 \text{ J K}^{-1} \text{ mol}^{-1}$, respectively. For the reaction,



- (1) 1000 K
- (2) 1250 K
- (3) 500 K
- (4) 750 K

Ans



$$\Delta S_s^- = \Delta S_{XY_3}^- - \frac{1}{2} \Delta S_{X_2}^- - \frac{3}{2} \Delta S_{Y_2}^-$$

$$= 50 - \frac{1}{2} \times 60 - \frac{3}{2} \times 40 = -40 \text{ JK}^{-1}$$

$$\text{use: } \Delta G = \Delta H^- - T\Delta S^- \Rightarrow T = \frac{\Delta H^-}{\Delta S^-} \quad [\Delta G = 0 \text{ at eq.}]$$

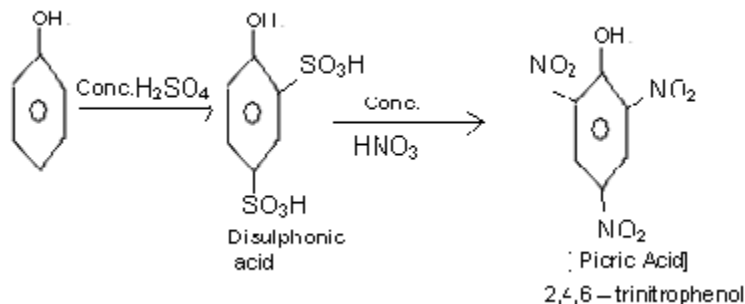
$$\Rightarrow T = \frac{-30 \times 1000}{-40} = 750 \text{ K}$$

50 Phenol, when it first reacts with concentrated sulphuric acid and then with concentrated nitric acid, gives

1. nitrobenzene
2. 2, 4, 6-trinitrobenzene
3. o-nitrophenol

4. p-nitrophenol

Ans



None of the choice is correct

51 The hydrocarbon which can react with sodium in liquid ammonia is

1. $\text{CH}_3\text{CH}_2\text{C} = \text{CCH}_2\text{CH}_3$
2. $\text{CH}_3\text{CH}_2\text{CH}_2\text{C} = \text{CCH}_2\text{CH}_3$
3. $\text{CH}_3\text{CH}_2\text{C} = \text{CH}$
4. $\text{CH}_3\text{CH} = \text{CHCH}_3$

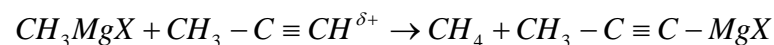
Ans

Only terminal alkynes react with Na in liq. NH_3 to give sodium acetylides

52 The treatment of CH_3MgX with $\text{CH}_3\text{C} \equiv \text{C-H}$ produces

1. CH_4
2. $\text{CH}_3 - \text{CH} = \text{CH}_2$
3. $\text{CH}_3\text{C} = \text{C} - \text{CH}_3$
4. $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$

Ans



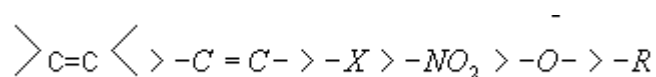
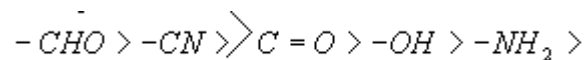
53 The correct decreasing order of priority for the functional groups of organic compounds in the IUPAC system of nomenclature is

1. $\text{—CONH}_2, \text{—CHO}, \text{—SO}_3\text{H}, \text{—COOH}$
2. $\text{—COOH}, \text{—SO}_3\text{H}, \text{—CONH}_2, \text{—CHO}$

3. $\text{—SO}_3\text{H}, \text{—COOH}, \text{—CONH}_2, \text{—CHO}$
4. $\text{—CHO}, \text{—COOH}, \text{—SO}_3\text{H}, \text{—CONH}_2$

Ans

Order of preference is



54 The pK_a of a weak acid, HA is 4.80. The pK_b of a weak base, BOH, is 4.78. The pH of an aqueous solution of the corresponding salt, BA, will be

1. 9.22
2. 9.58
3. 4.79
4. 7.01

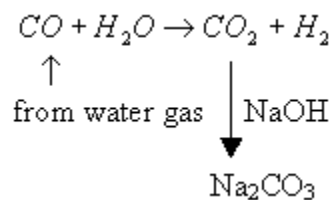
Ans

$$\text{pH} = 7 + \frac{1}{2}(\text{pK}_a - \text{pK}_b) = 7 + \frac{1}{2}(4.8 - 4.78) = 7.01$$

55 In context with the industrial preparation of hydrogen from water gas ($\text{CO} + \text{H}_2$), which of the following is the correct statement?

1. CO is oxidised to CO_2 with steam in the presence of a catalyst followed by absorption of CO_2 in alkali
2. CO and H_2 are fractionally separated using differences in their densities
3. CO is removed by absorption in aqueous Cu_2Cl_2 solution
4. H_2 is removed through occlusion with Pd

Ans



56 In a compound, atoms of element Y form ccp lattice and those of element X occupy $\frac{2}{3}$ rd of tetrahedral voids. The formula of the compound will be

1. X_3Y_4
2. X_4Y_3
3. X_2Y_3
4. X_2Y

Ans

No. of Y atom = 4 (due to CCP)

No. of tetrahedral voids in FCC = 8

No. of tetrahedral voids occupied by X = $\frac{2}{3} \times 8 = \frac{16}{3}$

$$\Rightarrow X_{\frac{16}{3}}Y_4 \equiv X_4Y_3$$

57 Which one of the following pairs of species has the same bond order?

1. NO^+ and CN^+
2. CN^- and NO^+
3. CN^- and CN^+
4. O_2^- and CN^-

Ans

Look for total number of electrons:

NO^+ : 14

CN^- : 14

CN^+ : 12

O_2^- : 17

58 The vapour pressure of water at 20°C is 17.5 mm Hg. If 18 g of glucose (C₆H₁₂O₆) is added to 178.2 g of water at 20°C, the vapour pressure of the resulting solution will be

1. 17.325 mm Hg
2. 17.675 mm Hg
3. 15.750 mm Hg
4. 16.500 mm Hg

Ans

$$P_{\text{solution}} = P_A^0 X_A, \left\{ X_A = \frac{n_A}{n_A + n_B} = \frac{178.2/18}{178.2/18 + 18/180} = 0.99 \right\}$$

$$\Rightarrow P_{\text{solution}} = 17.5 \times 0.99 = 17.325 \text{ mmHg}$$

59 Four species are listed below :

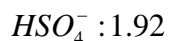
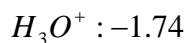
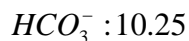
- (i) HCO_3^-
- (ii) H_3O^+
- (iii) HCO_4^-
- (iv) HSO_3F

Which one of the following is the correct sequence of their acid strength?

1. iii < i < iv < ii
2. iv < ii < iii < i
3. ii < iii < i < iv
4. i < iii < ii < iv

Ans

Look at the PK_a values:



HSO_3F : (super acid)

60 The ionization enthalpy of hydrogen atom is $1.312 \times 10^6 \text{ J mol}^{-1}$. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is

1. $9.84 \times 10^5 \text{ J mol}^{-1}$
2. $8.51 \times 10^5 \text{ J mol}^{-1}$
3. $6.56 \times 10^5 \text{ J mol}^{-1}$
4. $7.56 \times 10^5 \text{ J mol}^{-1}$

Ans

$$\Delta E = 1.312 \times 10^6 \times 1^2 \times \left(\frac{1}{1^2} - \frac{1}{2^2} \right) \text{ J mol}^{-1}$$

$$= 9.84 \times 10^5 \text{ J mol}^{-1}$$

61 Which one of the following constitutes a group of the isoelectronic species?

1. N_2, O_2^-, NO^+, CO
2. C_2^{2-}, O_2^-, CO, NO
3. $NO^+, C_2^{2-}, CN^-, N_2$
4. $CN^-, N_2, O_2^{2-}, C_2^{2-}$

Ans

Isoelectronic species same electronic configuration (same no of e^- s)

N_2 : 14

O_2^- : 17

NO^+ : 14

CO : 14

NO : 13

C_2^{2-} : 14

O_2^{2-} : 18

CN^- : 14

62 Gold numbers of protective colloids A, B, C and D are 0.50, 0.01, 0.10 and 0.005 respectively. The correct order of their protective powers is

1. $B < D < A < C$
2. $D < A < C < B$
3. $C < B < D < A$
4. $A < C < B < D$

Ans

$$\text{GoldNumber} \propto \frac{1}{\text{ProtectivePower}}$$

63 Larger number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being

1. more reactive nature of the actinoids than the lanthanoids
2. 4f orbitals more diffused than the 5f orbitals
3. lesser energy difference between 5f and 6d than between 4f and 5d orbitals
4. more energy difference between 5f and 6d than between 4f and 5d orbitals.

Ans

Due to lesser energy difference between 5f & 6d, larger oxidation station of actinoids are possible

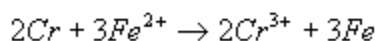
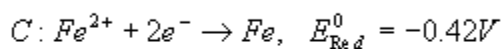
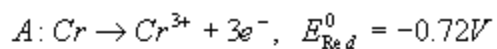
64 Given $E_{Cr^{3+}/Cr}^0 = -0.72V$, $E_{Fe^{2+}/Fe}^0 = -0.42V$

The potential for the cell

$Cr | Cr^{3+} (0.1M) || Fe^{2+} (0.01 M) | Fe$ is

1. -0.26 V
2. 0.26 V
3. 0.339 V
4. -0.339 V

Ans



use Nernst equation:
$$E_{cell} = E_{cell}^0 - \frac{0.059}{n_{cell}} \log_{10} \frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$$

$$E_{cell}^0 = (-0.42 - (-0.72)) = 0.3V$$

$$E_{cell} = 0.3 - \frac{0.059}{6} \log_{10} \frac{(0.1)^2}{(0.01)^3} = 0.26V$$

65 Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4 . The titration gives unsatisfactory results when carried out in the presence of HCl, because HCl

1. oxidises oxalic acid to carbon dioxide and water
2. gets oxidised by oxalic acid to chlorine
3. furnishes H^+ ions in addition to those from oxalic acid
4. reduces permanganate to Mn^{2+}

Ans

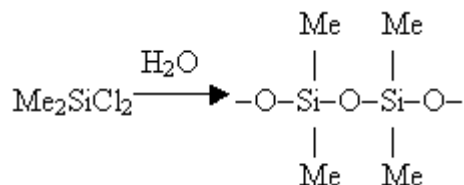
MnO_4^- oxidizes HCl to Cl_2

66 Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is

1. R_3SiCl
2. R_4Si
3. $RSiCl_3$
4. R_2SiCl_2

Ans

Commercial silicon polymers are synthesized by the hydrolysis of 1 R_2SiCl_2 [$R \equiv Me$ or Ph]



67 In which of the following octahedral complexes of Co (at no. 27), will the magnitude of Δ_0 be the highest?

1. $[Co(NH_3)_6]^{3+}$

2. $[\text{Co}(\text{CN})_6]^{3-}$
3. $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
4. $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

Ans

CN^- is the strongest ligand out of $-\text{NH}_3$, $\text{C}_2\text{O}_4^{2-}$, H_2O thus Δ_0 will be highest for $[\text{Co}(\text{CN})_6]^{3-}$

68 The coordination number and the oxidation state of the element 'E' in the complex $[\text{E}(\text{en})_2(\text{C}_2\text{O}_4)]\text{NO}_2$ (where (en) is ethylene diamine) are, respectively,

1. 6 and 3
2. 6 and 2
3. 4 and 2
4. 4 and 3

Ans

$[\text{E}(\text{en})_2\text{C}_2\text{O}_4]^+ \text{NO}_2^-$ en & $\text{C}_2\text{O}_4^{2-}$ are bidentate ligands

Coordination NO. of E = 6

O.S. of E = +3

69 Identify the wrong statement in the following:

1. Acid rain is mostly because of oxides of nitrogen and sulphur
2. Chlorofluorocarbons are responsible for ozone layer depletion
3. Greenhouse effect is responsible for global warming
4. Ozone layer does not permit infrared radiation from the sun to reach the earth

Ans

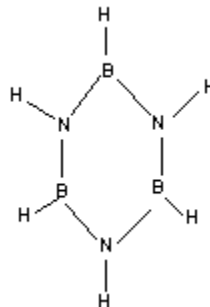
Ozone layer does not permit UV radiation from the sun to reach the earth.

70 Which one of the following is the correct statement?

1. $\text{B}_2\text{H}_6 \cdot 2\text{NH}_3$ is known as 'inorganic benzene'
2. Boric acid is a protonic acid
3. Beryllium exhibits coordination number of six

4. Chlorides of both beryllium and aluminium have bridged chloride structures in solid phase.

Ans



Inorganic Benzene – Borazine ($B_3H_6N_3$)

Choice (1) is incorrect

Boric Acid $\Rightarrow H_3BO_3$ is monobasic [gives H^+ ion in the solution Thus, protonic Acid]

Note: Be & Al Chlorides form bridge elements in gaseous station