

Sample Question Paper – C

1. $\lambda = \frac{h}{mv} = \frac{h}{p}$ 1



3. $R = 8.314 \text{ KPa} \cdot \text{dm}^3 \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$. 1

4. Reduction reaction. 1

5. LiAlH_4 and NaBH_4 . $\frac{1}{2} + \frac{1}{2}$

6. The S.I. unit of mass is kilogram (kg), 1

Mass of a substance is the amount of matter present in it. 1

7.

Element	Percentage	Atomic mass	Relative number of atoms	Simple ratio of atoms
K	31.84	39.00	$\frac{31.84}{39.00} = 0.816$	$\frac{0.816}{0.814} = 1$
Cl	28.98	35.5	$\frac{28.98}{35.50} = 0.814$	$\frac{0.814}{0.814} = 1$
O	39.18	16.00	$\frac{39.18}{16} = 2.449$	$\frac{2.449}{0.814} = 3$

1

Empirical formula = KClO_3 1

8. Applying Le Chatelier's principle, on decreasing the pressure, equilibrium shifts to the direction in which pressure increases, i.e., number of moles of gaseous substances is more. Thus, moles of reaction products will (a) increase (b) decrease. 1 + 1

9. Herbicides are used to kill weeds or undesirable vegetations in crop. For example, sodium chlorate (NaClO_3) and 2, 4 dichlorophenoxy acid. 1 + 1

10. (a) 2-methylbut-2-ene (b) pent-1-en-3-yne 1 + 1

OR

(i) . Due to the presence of a sp^3 hybridized carbon, the system is not planar. It does contain six π -electrons cloud which surrounds all the atoms of the ring. Therefore, it is not an aromatic compound. 1

(ii)  Due to the presence of a sp^3 -carbon, the system is not planar. Further, it contains only four π -electrons, therefore, the system is not aromatic because it does not contain planar cyclic cloud having $(4n + 2)$ π -electrons. This system, however, behaves as a diene. 1

11. (a) $\text{P}_{15} = 1s^2, 2s^2 2p^6, 3s^2 3p^3$ 1

(b) $\text{Cr}_{24} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^5, 4s^1$ 1

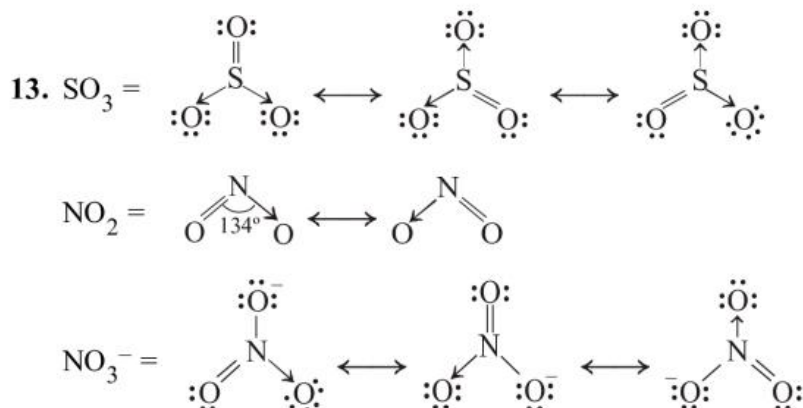
(c) $\text{Cu}_{29} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^1$ 1

12.
$$\text{Number of electrons} = \frac{\text{Total charge in oil drop}}{\text{Charge on 1 electron}}$$

$$= \frac{1.282 \times 10^{-18} \text{ C}}{-1.6022 \times 10^{-19} \text{ C}} = 0.800 \times 10$$

$$= 8.0 \text{ electrons}$$

3



2

14. The average O.N. of S in $\text{S}_2\text{O}_3^{2-}$ is +2 while in $\text{S}_4\text{O}_6^{2-}$ it is +2.5. The O.N. of S in SO_4^{2-} is +6. Since Br_2 is a stronger oxidizing agent than I_2 , it oxidizes S of $\text{S}_2\text{O}_3^{2-}$ to a higher oxidation state of +6 and hence forms SO_4^{2-} ion. I_2 , however, being a weaker oxidizing agent oxidizes S of $\text{S}_2\text{O}_3^{2-}$ ion to a lower oxidation of +2.5 in $\text{S}_4\text{O}_6^{2-}$ ion. It is because of this reason that thiosulphate reacts differently with Br_2 and I_2 . 3

15. (a) Pure hydrogen peroxide is an unstable liquid and decomposes into water and oxygen either upon standing or upon heating.



(b) Anhydrous barium peroxide is not used because barium sulphate forms a protective layer around unreacted barium peroxide which prevents its further participation in the chemical reaction.



(c) The reaction $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ is extremely exothermic in nature. 1

16. NH_3 has the strongest intermolecular hydrogen bonding and therefore, is expected to have the highest boiling point. 3

17. $[\text{Ba}^{2+}]$ before mixing = 0.05 m

$$[\text{Ba}^{2+}] \text{ after mixing} = \frac{0.05}{2} = 0.025 \text{ m} \quad \frac{1}{2}$$

Similarly, $[\text{F}^-]$ before mixing = 0.02 m

$$\therefore [\text{F}^-] \text{ after mixing} = \frac{0.02}{2} = 0.01 \text{ m} \quad \frac{1}{2}$$

Thus, ionic product = $[\text{Ba}^{2+}][\text{F}^-]^2 = (0.025)(0.01)^2 = 2.5 \times 10^{-6}$ 1

$$K_{\text{sp}} \text{ for } \text{BaF}_2 = 1.7 \times 10^{-6} \text{ (given)}$$

Since the ionic product is more than solubility product, thus BaF_2 will get precipitation. 1

18. (a) Ion dipole interaction. 1

(b) Calculation of partial pressure of H_2 in 1 L vessel

$$P_1 = 0.8 \text{ bar}, \quad V_1 = 0.5 \text{ L}$$

$$P_2 = ?, \quad V_2 = 1.0 \text{ L}$$

As temperature remains constant, $P_1 V_1 = P_2 V_2$

$$(0.8 \text{ bar})(0.5 \text{ L}) = P_2(1.0 \text{ L}) \text{ or } P_2 = 0.40 \text{ bar, i.e., } p_{\text{H}_2} = 0.40 \text{ bar} \quad 1$$

$$P_1'V_1' = P_2'V_2'$$

$$(0.7 \text{ bar})(2.0 \text{ L}) = P_2' (1 \text{ L}) \text{ or } P_2' = 1.4 \text{ bar, i.e., } p_{O_2} = 1.4 \text{ bar}$$

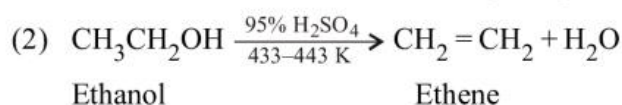
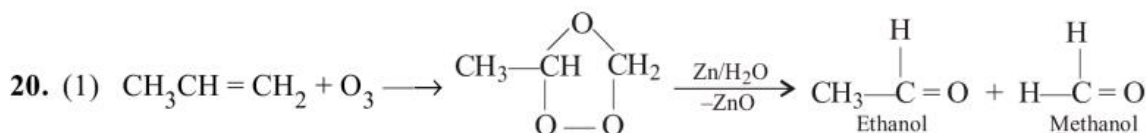
$$\therefore \text{Total pressure} = P_{H_2} + P_{O_2} = 0.4 \text{ bar} + 1.4 \text{ bar} = 1.8 \text{ bar}$$

1

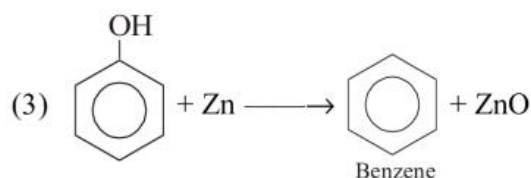
19. Excessive phytoplankton (organic pollutants like grass, roots, leaves, submerged plants etc.) present in water is usually biodegradable. This organic matter is biologically decomposed by large population of micro-organisms.

During the process of biodegradation micro-organisms consume excess of dissolved oxygen from the lake. As a consequence, the vital level of dissolve oxygen in lake (10 ppm) reduced considerably which is fatal for aquatic life. When this level falls below 6 ppm, the fish cannot survive. Hence, they die and float dead on the lake.

3

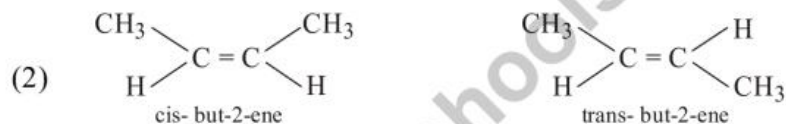


1



1

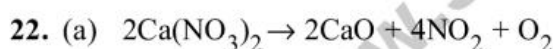
21. (1) 2-phenyl ethanol and
2-amino 2-methyl propane

 $\frac{1}{2} + \frac{1}{2}$ 

1

- (3) Resonance energy is defined as the difference in internal energy of the resonance hybrid and the most stable canonical structure.

1



1

- (b) Due to small size, the ionization enthalpies of Be and Mg are much higher than those of other alkaline earth metals. Therefore, they need large amount of energy for excitation of their valence electrons to higher energy levels. Since such a larger amount of energy is not available in Bunsen flame, therefore, these metals do not impart any colour to the flame.

2

OR

- (i) **Limestone**—Specially precipitated $CaCO_3$ is extensively used in the manufacture of high quality paper. It is also used as an antacid, mild abrasive in toothpaste, a constituent of chewing gum and as a filler in cosmetics.

1

- (ii) **Cement**—It is an important building material. It is used in concrete and reinforced concrete, in plastering and in the construction of bridges, dams and buildings.

1

- (iii) **Plaster of Paris**—It is extensively used in the building industry as well as plaster. It is used in dentistry, in ornamental work and for making casts of statue and busts. It is also used for immobilising the affected part of organ where there is bone fracture or sprain.

1

23. (i) (a) Cl is expected to have lower first ionisation enthalpy.

 $\frac{1}{2}$

- (b) S is expected to have lower first ionisation enthalpy.

 $\frac{1}{2}$

- (c) K is expected to have lower first ionisation enthalpy.

 $\frac{1}{2}$

- (d) Xe is expected to have lower first ionisation enthalpy.

 $\frac{1}{2}$

- (ii) As we move down the group Atomic size increases.

We know $I.E. \propto \frac{1}{\text{Atomic size}}$, hence it is expected that on moving down the group I.E. should decrease. 1

The deviation is due to weak screening or shielding effect of d -orbital due to which atomic size decreases and Ionisation energy increases. 1

24. (i) The free energy change of a reaction is given by $\Delta G = \Delta H - T\Delta S$

For a reaction to be spontaneous, ΔG should be $-ve$. 1

Dominate over enthalpy factor. Such reaction are therefore, called entropy driven. This can happen in either of the following two ways :

(a) ΔS should be so large that even if T is low, $T\Delta S$ should be greater than ΔH . 1

(b) If ΔS is small. T should be so large that $T\Delta S > \Delta H$. 1

- (ii) In an ideal gas, there are no intermolecular forces of attraction. Hence, no energy is required to overcome these forces. Moreover, when a gas expands against vacuum, work done is zero (because $P_{\text{ext}} = 0$). Hence, internal energy of the system does not change, *i.e.*, there is no absorption or evolution of heat. 2

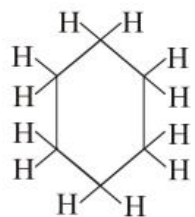
OR

- (i) (a) Exothermic reactions are generally thermodynamically spontaneous because even if it is accompanied by decrease of randomness (*e.g.*, in the condensation of a gas or solidification of a liquid), the heat released is absorbed by the surroundings so that the entropy of the surroundings increases to such an extent that ΔS_{total} is positive. 1

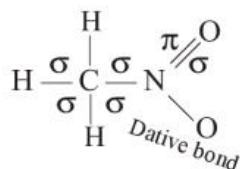
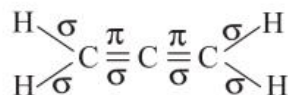
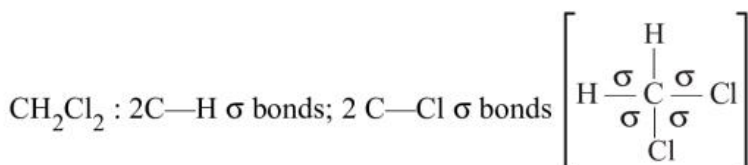
(b) The molecules in the vapour state have greater freedom of movement and hence greater randomness than those in the liquid state. Hence, entropy increases in going from liquid to vapour state 2

- (ii) A substance has a perfectly ordered arrangement of its constituent particles only at absolute zero. Hence, entropy is zero only at absolute zero. Enthalpy of formation is the heat change involved in the formation of one mole of the substance from its elements. An element formed from itself means no heat change, *i.e.*, $\Delta H^\circ = 0$. 2

25. C_6H_6 :  : 6 C—C σ bonds, 6 C—H σ bonds, 3 C—C π bonds. 1

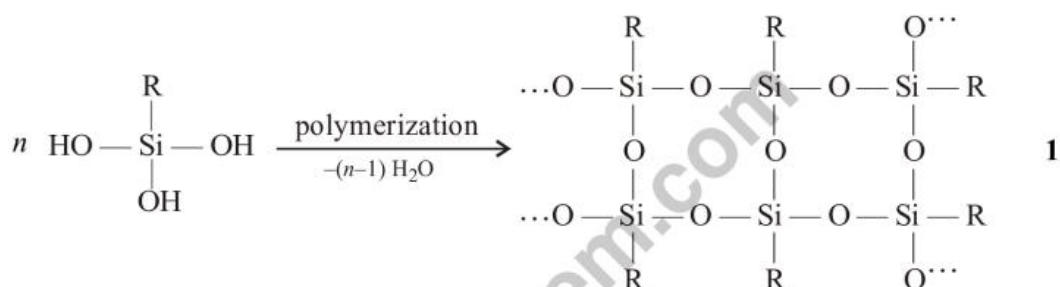
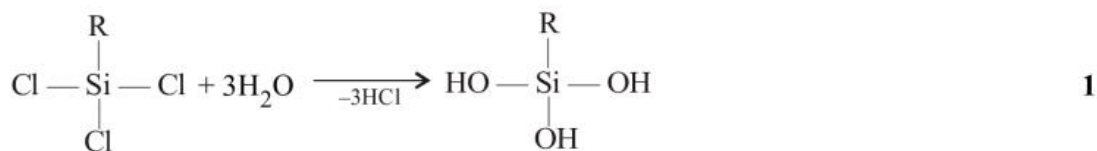


: C_6H_{12} : σ C—C σ bond, 12 C—H σ bonds. 1



- | | |
|------------------------------|---|
| (a) Propyl benzene | 1 |
| (b) 3-methylpentanenitrile | 1 |
| (c) 2, 5- dimethylheptane | 1 |
| (d) 3- bromo-3-chloroheptane | 1 |
| (e) 3-chloropropanol | 1 |

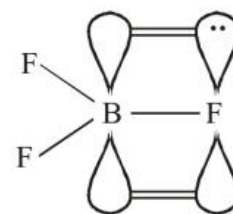
26. (a) Hydrolysis of alkyltrichlorosilanes gives cross-linked silicones.



- (b) CO_2 is produced during combustion reactions. It is released into the atmosphere. However, if the concentration of CO_2 in the atmosphere increases beyond a certain limit due to excessive combustion, some CO_2 will always remain unutilized. The excess CO_2 absorbs heat radiated by the earth. Some of it is dissipated into the atmosphere while the remaining part is redirected back towards earth's surface which heat up the atmosphere. As a result, temperature of the earth and other bodies on the earth increases. This is called green house effect. As a result of green house effect, global warming occurs which has serious consequences. 3

OR

- (a) BF_3 is a planar molecule in which B is sp^2 -hybridized. It has an empty $2p$ -orbital. F-atom has three lone pairs of electrons in the $2p$ -orbitals. Because of similar sizes, $p\pi$ - $p\pi$ back bonding occurs in which a lone pair of electrons is transferred from F to B. As a result of this back bonding, B—F bond acquires some double bond character. In contrast, in $[\text{BF}_4]^-$ ion, B is sp^3 -hybridized and hence does not have an empty p -orbital available to accept the electrons donated by the F atom. Consequently, in $[\text{BF}_4]^-$, B—F is a purely single bond. Since double bonds are shorter than single bonds, therefore, the B—F bond length in BF_3 is shorter (130 pm) than B—F bond length [143 pm] in $[\text{BF}_4]^-$. 2



- (b) **Structure of diborane**—In diborane, the four terminal hydrogen atoms and the two boron atoms lie in one plane. Above and below this plane, there are two bridging hydrogen atoms. The four terminal B—H bonds are regular bonds while the two bridge (B—H—B) bonds are different and known as banana bonds (3-centre-2-electron bridge bonds). 1½

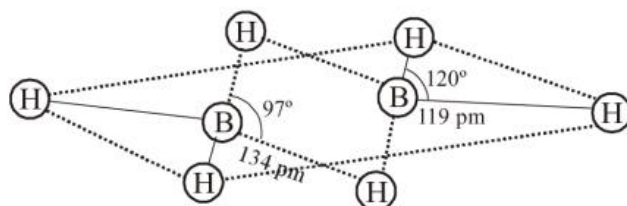
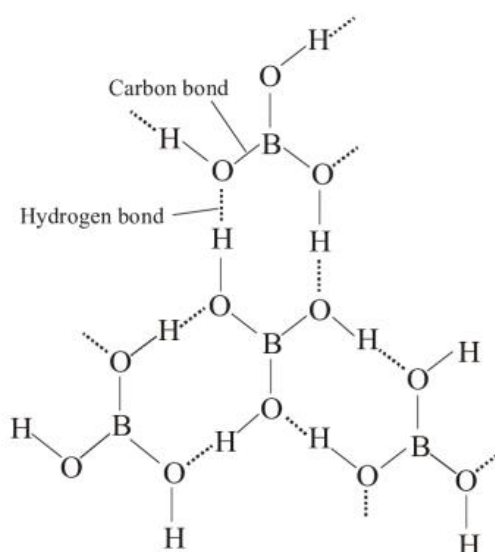


Fig. : The structure of diborane, B_2H_6

Structure of boric acid—Boric acid has a layer structure in which H_3BO_3 units are joined by hydrogen bonds.



1½

Fig. : Structure of boric acid; the dotted lines represent hydrogen bonds,

• •

