

Nagaland Board
Class XI
Chemistry
Sample Paper 2 – Solution

1. (i) By Kolbe's electrolysis process we can prepare alkanes having even number of carbon atoms
2. (i) An organic compound will exhibit geometric isomerism only when each of its double bonded carbon is bonded to two different groups
3. (ii) Since the magnesium or its compound does not give flame test, it must be a compound of calcium. Also the gas evolved is brown coloured shows that it is the oxide of nitrogen. All these inference indicates towards the compound calcium nitrate
4. (ii) In Clark's method of water softening, hard water is treated with $\text{Ca}(\text{OH})_2$ (Slaked lime)
5. (i) Oxygen never shows +3 oxidation state, but +2 can be seen in oxygen difluoride OF_2 . So, it shows oxidation states +2, -1/2, -1.
6. A mixture of NH_4OH and NH_4Cl
7. Chloro acetic acid is a stronger because of -I effect of chloro group
8. Ionic product remains unchanged
9. Molecular mass = $28 \times 0.78 + 32 \times 0.22 = 28.88\text{g}$
10. $2\text{KClO}_3(\text{s}) \xrightarrow{\Delta} 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$
11.
 - (a) No change
 - (b) equilibrium will shift in backward direction

Or

- (a) Ionic product should be more than solubility product.
- (b) In solution with pH 3.7, solubility will be more.

12. Taj Mahal is made of marble which is CaCO_3 . Acid rain contains H_2SO_4 which reacts with marble making it pitted and mechanically weak

Or

Hybridisation of B is sp^2 and N is sp^3 .

After formation of new complex, hybridization of B changes from sp^2 to sp^3 while that of N remains same.

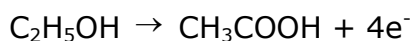
13.

- (a) 4 bond pairs and 2 lone pairs, shape: square planar
(b) 3 bond pairs and 2 lone pairs, shape: T shaped.

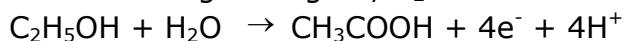
14.

- (a) Temperature at which a real gas behaves as an ideal gas over a considerable range of pressure is called Boyle's temperature.
(b) Dipole - dipole interaction

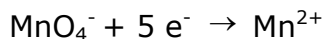
15. Oxidation half reaction:



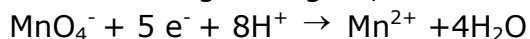
Balance charge using H^+ , H_2O



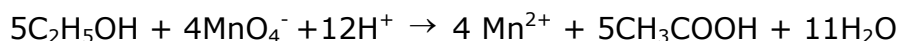
Reduction half reaction



Balance charge using H^+ , H_2O



Multiply oxidation half reaction by 5 and reduction half reaction by 4 and add



16.

- (a) 6.022×10^{23} atoms of oxygen weigh 16g
Therefore, Mass of one atom = $16 / (6.022 \times 10^{23})$
 $= 2.657 \times 10^{-23}$

- (b) 1 atom of He

Or

Molar mass of $\text{CuFeS}_2 = 63.5 + 55.8 + (2 \times 32) = 183.3 \text{ gm mole}^{-1}$

Mass percentage of Cu =

$$\frac{63.5}{183.3} \times 100 = 34.64\%$$

Mass percentage of Fe =

$$\frac{55.8}{183.3} \times 100 = 30.44\%$$

Mass percentage of S =

$$\frac{64}{183.3} \times 100 = 34.92\%$$

17.

(a) After the loss of one electron, Na attains the configuration of a noble gas which is highly stable. Mg after loss of 1 electron becomes $3s^1$ which is not so stable. Thus, the second ionization enthalpy of Na is higher than Mg.

(b) $O < N < P$

(c) $(n-1)d^{1-10} ns^{0-2}$

18. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

Let the volume of NaOH neutralized by given HCl = V_1 mL

NaOH HCl

$$M_1V_1 = M_2V_2$$

$$1.0 V_1 = 2.0 \times 200$$

$$V_1 = 400 \text{ mL}$$

$$\text{Moles of NaOH used} = 400 \times 1.0 \times 10^{-3}$$

$$M = n \times 1000 / v_1$$

$$1 = n \times 1000 / 400$$

$$n = 0.4 \text{ moles}$$

No. of moles of NaCl produced = No. of moles of NaOH

$$\text{Mass of NaCl} = 0.4 \times 58.5 = 23.4\text{g}$$

19.

(a) NaCl is more ionic. I^- being a bigger anion has high polarisability and has more covalent character.

(b) C_2 ($12 e^-$) - $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 (\pi 2p_x^2 = \pi 2p_y^2)$

Diamagnetic

(c) Water molecules are associated by intermolecular H-bonding hence is liquid at room temperature.

20. Let initial conc. of B = a mol L⁻¹



Initial conc.



At Equilibrium



$$x^2$$

$$K_c = \frac{x^2}{(2a-x)(a-x)}$$

At equilibrium,

$$[C] = 3[B]$$

$$x = 3(a-x)$$

$$x = 3a/4$$

$$(3a/4)^2$$

$$K_c = \frac{(3a/4)^2}{(2a-3a/4)(a-3a/4)}$$

$$[(2a-3a)/4] [(a-3a)/4] = 1.8$$

Or

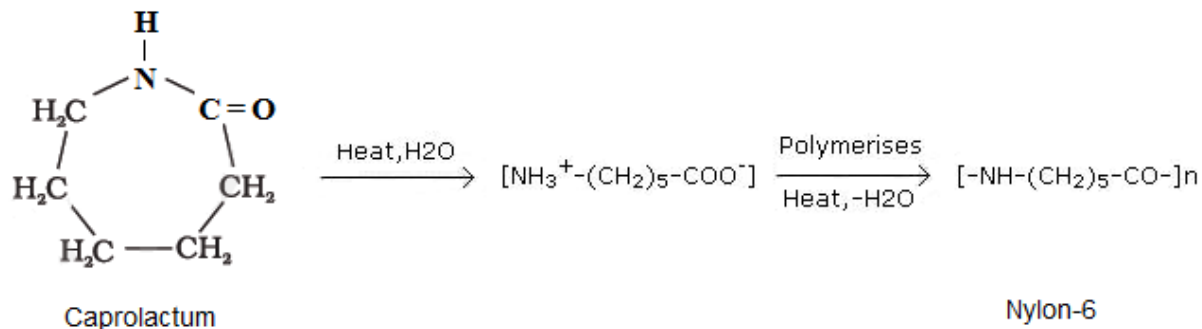
(a) $n=3, l=1, m_l=-1, m_s=-1/2$

(b) Magnetic Quantum number

(c) 12 electrons

21. Perlon is Nylon-6. It is prepared from cyclohexane. Cyclohexane on oxidation gives cyclohexanone which forms cyclohexanone-oxime on treatment with NH₂OH.

The oxime on Beckmann rearrangement forms caprolactum. This on hydrolysis with trace of water forms Nylon-6.



22.

(i) Antacids: These are substances used to counteract or neutralise gastric acids and relieve the discomfort caused by gastric acidity. For example: sodium bicarbonate, milk of magensia.

(ii) Disinfectants: These are substances that are applied to non-living objects to destroy micro-organisms that are living on the objects. For example: isopropyl alcohol.

(iii) Enzymes: These are proteins that catalyze i.e, increase the rate of chemical reactions. For example: lactase is the enzyme that cleaves lactose.

23. Analgesic medicines are those medicines which reduce or abolish pain causing impairment of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system. These are classified as follows:

(i) Non-narcotic (non-addictive) analgesics: These drugs are effective in relieving skeletal pain such as that due to arthritis and preventing platelet coagulation.

(ii) Narcotic drugs: These analgesics are chiefly used for the relief of severe pain like postoperative pain, cardiac pain and pains of terminal cancer, and in child birth.

24.

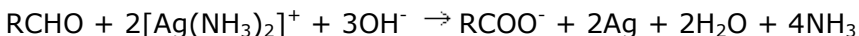
(i) Benzene ring in aromatic amines is highly activated. This is due to the displacement of lone pair of nitrogen towards the ring, which results in the increase in the electron density on the ring. This facilitates the electrophilic attack on the ring.

(ii) In CH_3CONH_2 , the lone pair of electrons on nitrogen atom is involved in resonance with the carbonyl group. So the electron pair of nitrogen is not easily available for protonation. Hence CH_3CONH_2 is a weaker base than $\text{CH}_3\text{CH}_2\text{NH}_2$.

(iii) Nitro compounds are polar compounds whereas hydrocarbons are non-polar. Due to their polarity, nitro compounds have higher boiling points than the hydrocarbons having almost same molecular mass.

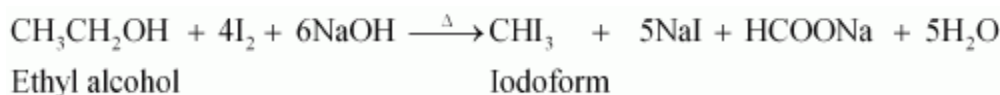
25.

(i) Propanal and propanone can be distinguished by Tollen's test. Propanal will form the silver mirror. Thus propanal gives this test but propanone (Ketones) do not respond to this test.

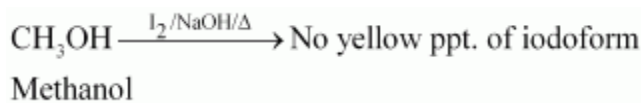


Silver mirror

(ii) Methyl acetate and ethyl acetate can be distinguished by the iodoform test. When ethyl acetate is boiled with excess of NaOH, ethyl alcohol and sodium acetate is formed. When this alkaline solution is heated with I_2 , yellow precipitate of iodoform is formed.

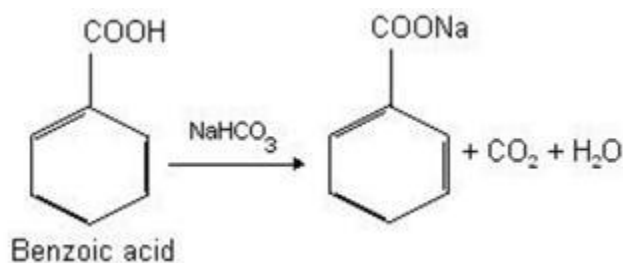


On hydrolysis, methyl acetate gives methyl alcohol that does not respond to the iodoform test.



(iii) Benzaldehyde and benzoic acid can be distinguished by the NaHCO_3 test. Being an acid, benzoic acid responds to this test, but benzaldehyde does not.

Benzoic acid reacts with sodium bicarbonate to liberate CO_2 .



26.

- (i) As an antiseptic and disinfectant in soaps and lotions.
- (ii) In the manufacture of drugs like aspirin, salol, salicylic acid, phenacetin etc.
- (iii) In the manufacture of bakelite which is used in the manufacture of electrical goods like switches, plugs etc.
- (iv) In the manufacture of picric acid used in making explosives and dyeing silk and wool.
- (v) In the manufacture of azo dyes.
- (vi) As a preservative for ink.

Or

Phenoxide is better stabilized than phenol as it carries only a negative charge and phenol has a strong tendency to form more stable phenoxide ion by the release of proton.



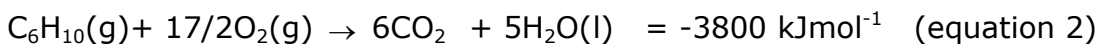
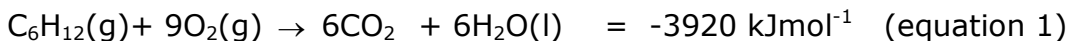
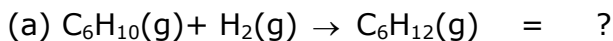
But, in case of alcohol both the alcohol molecule and the alkoxide ion are represented by one structure each and there is no resonance.

Also the alkoxide ion due to presence of a formal negative charge has greater energy and is less stable than the alcohol molecule. Thus alcohol have negligible tendency to form less stable alkoxide ion by releasing a proton.

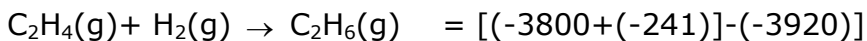
Thus Phenols are stronger acids than alcohol because in case of phenol the phenoxide ion left after the release of a proton is stabilized by resonance.

27. In haloalkane, the halogen is attached to sp^3 hybridised carbon atom while in case of haloarene it is attached to sp^2 hybridised carbon atom. The sp^2 hybridized carbon have greater s-character than sp^3 -hybridised carbon and thus more electronegative and can hold the electron pair of C—X bond more tightly than in haloalkane. The, C—Cl bond length in haloalkane is greater than in haloarene. Since it is difficult to break a shorter bond than a longer bond, therefore, Haloarenes are less reactive than haloalkanes towards nucleophilic substitution reaction.

28.



(equation 2) + (equation 3) - (equation 1) gives the required equation



$= -121 \text{ kJmol}^{-1}$

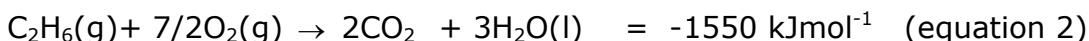
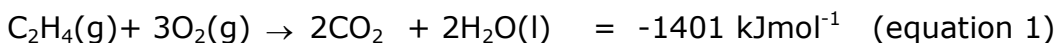
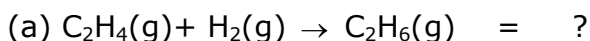
(b) Since $p_{\text{ext}} = 0$ work done = 0

(c) $H_2 \rightarrow 2H$ ΔH for the reaction = Bond enthalpy

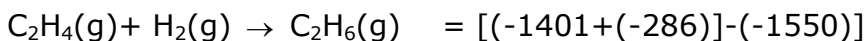
$1/2 H_2 \rightarrow H$ ΔH = enthalpy of formation of H atom

Hence, B.E of H-H bond = 2 x enthalpy of formation of H atom

Or



(equation 1) + (equation 3) - (equation 2) gives the required equation



$= -137 \text{ kJmol}^{-1}$

(b) q and w are path functions ΔU is a state function

(c)

(i) positive

(ii) negative

29.

(a) $NaBO_2$ and B_2O_3

(b) C-C bond is stronger than Si-Si bond due to small size of C hence C shows higher catenation.

(c) Al_2Br_6 is a covalent compound due to high ionization enthalpy of Al. Therefore it is poor conductor of electricity.

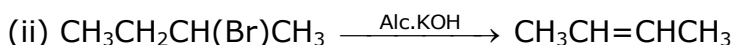
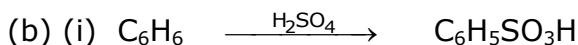
- (d) Si has vacant d orbitals in which back transfer of electrons from lone pair on N occurs. N-Si bond develops double bond character. There are no d orbitals in C, hence $N(CH_3)_3$ is pyramidal while $N(SiH_3)_3$ is planar.

Or

- (a) Due to similar polarizing power of ions, B and Si show diagonal relationship so they resemble in properties.
 (b) Due to inert pair effect, Pb(IV) is less stable. It has a tendency to attain its lower and more stable oxidation state. Thus is an oxidizing agent.
 (c) SiO_2 is acidic in nature as Si is less electropositive and the oxide is a nonmetallic oxide.
 (d) In BF_3 B is sp^2 hybridised while in $[BF_4]^-$, it is sp^3 . There is back donation of electron from F to B in BF_3 giving it partial double bond character. Thus reducing the length as compared to $[BF_4]^-$ which has single B-F bonds.

30.

- (a) Position isomerism.



- (c) (i) Bromine water

(ii) ammoniacal silver nitrate

Or

- (a) Even carbon alkanes have a symmetrical structure because of which they fit into lattice more tightly thus having a high melting point.

- (b) Staggered and eclipsed. Staggered is more stable.

- (c) Molar mass = 2 x vapour density

$$\text{Molar mass of A} = 2 \times 36 = 72$$

Also since it forms a mono chloro substituted product, therefore, it is an alkane.

It satisfies the general formula C_nH_{2n+2}

Hence, it is an alkane with the formula C_5H_{12} .

The isomer of pentane which forms monochloro product is

