Meghalaya Board
Class XI
Chemistry
Sample Paper 2 – Solution

PART-I

1.

(a)

(i) By Kolbe's electrolysis process we can prepare alkanes having even number of carbon atoms

(b)

(i) An organic compound will exhibit geometric isomerism only when each of its double bonded carbon is bonded to two different groups.

(c)

(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.

(d)

(ii) In Clark's method of water softening, hard water is treated with $Ca(OH)_2$ (Slaked lime)

(e)

(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.

(f)

(i)

The equilibrium constant expression depends on particular mechanism by which the reaction takes place so for a single substance can have different k values like k1, k2 etc for example dissociation of H3PO4 into H+ and PO4-3.

(g)

(iv)

When an ideal gas is allowed to expand into a vacuum , the process is spontaneous and there is no energy change at all as the system is isolated so q = 0. Also, due to vacuum there is no opposing force so no work is done.

(h)

(ii)

Given:

The ratio of the weights of the gases H_2 and O_2 are 1:4 (w/w)

Solution:

Molar masses of H_2 and O_2 are 4 and 32, respectively.

Hence, the mole ratio is as follows:

PART- II

2. A mixture of NH_4OH and NH_4Cl

3. Chloro acetic acid is a stronger because of –I effect of chloro group

4. Ionic product remains unchanged

5. Molecular mass = 28 x 0.78 + 32 x 0.22 = 28.88g

6. $2KClO_3(s) \xrightarrow{\Delta} 2KCl(s) + 3O_2(g)$

7. CCl_2F_2 and NO

8. Titanium,22

9. H-H bond is very strong. Energy required for its cleavage is very high. Hence dihydrogen is an inert gas

PART-III

10. 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.

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. 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:

$C_2H_5OH \rightarrow CH_3COOH + 4e^-$

Balance charge using H^+, H_2O

$C_2H_5OH + H_2O \rightarrow CH_3COOH + 4e^- + 4H^+$

Reduction half reaction

$MnO_4^- + 5\ e^- \rightarrow Mn^{2+}$

Balance charge using H^+, H_2O

$MnO_4^- + 5\ e^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$

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

$5C_2H_5OH + 4MnO_4^- + 12H^+ \rightarrow 4\ Mn^{2+} + 5CH_3COOH + 11H_2O$

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

17.

Molar mass of $CuFeS_2$ = 63.5 + 55.8 +(2 x 32)=183.3 gm $mole^{-1}$

Mass percentage of Cu =

$$\frac{63.5}{183.3} x100 = 34.64\%$$

Mass percentage of Fe =

$$\frac{55.8}{183.3} x100 = 30.44\%$$

Mass percentage of S =

$$\frac{64}{183.3} x100 = 34.92\%$$

PART-IV

18. Frequency (ν) of light

$$= \frac{1}{\text{Period}}$$

$$= \frac{1}{2.0\times10^{-10}\ \text{s}} = 5.0\times10^{9}\ \text{s}^{-1}$$

Wavelength (λ) of light $= \frac{c}{\upsilon}$

Where,

c = velocity of light in vacuum = 3×10^{8} m/s

Substituting the value in the given expression of λ:

$$\lambda = \frac{3\times10^{8}}{5.0\times10^{9}} = 6.0\times10^{-2}\ \text{m}$$

Wave number $(\bar{\nu})$ of light

$$= \frac{1}{\lambda}$$

$$= \frac{1}{6.0\times10^{-2}}$$

$$= 1.67\times10^{1}\ \text{m}$$

$$= 16.67\ \text{m}$$

19. Given data:

Molar mass of oxygen, M = 32 g mol-1 = 0.032 kg mol-1

Temperature, t = 27 ^{0}C *T* = (27 + 273) K = 300 K

Now, Root mean square speed =

$$c = \sqrt{\frac{3RT}{M}}$$

$$= \sqrt{\frac{3\times8.314\times300}{0.032}} = 483.6\ \text{m sec}^{-1}$$

Average speed =

$$\bar{c} = \sqrt{\frac{8RT}{\Pi M}}$$

$$= \sqrt{\frac{8\times8.314\times300}{3.14\times0.032}} = 445.6\ \text{m sec}^{-1}$$

20.

(a) $E_n = -1312\ Z^2/n^2$

For H atom Z =1,n=2

For Li^{2+} Z = 3 , n=n

$(E_2)H = (E_n)Li^{2+}$

$$\frac{-1312 \times 1^2}{2^2} = \frac{-1312 \times 3^2}{n^2}$$

$$\frac{1}{4} = \frac{9}{n^2}$$

n=6

(b) In the ground state of an atom, the electron enters the orbital of lowest energy first and the subsequent electrons are filled in orbitals of increasing energy.

Or

(a) Ionic product should be more than solubility product.

(b) In solution with pH 3.7, solubility will be more.

21.

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

22.

(a) Be and Mg has comparatively small sizes. Ionisation enthalpies are high. Energy of the flame is not sufficient to excite the electrons hence they impart no colour to the flame.

(b) Li^+ has a small size and very high charge density. It attracts and holds many water molecules and is so heavily hydrated.

23. $NaOH + HCl \rightarrow NaCl + H_2O$

Let the volume of NaOH neutralized by given HCl=V_1mL

NaOH HCl

$M_1V_1 = M_2V_2$

$1.0\ V_1 = 2.0 \times 200$

V_1 = 400 mL

Moles of NaOH used = 400 x 1.0 x 10^{-3}

M= n x 1000/v_1

1= n x 1000/400

n= 0.4 moles

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

Mass of NaCl = 0.4 x 58.5 = 23.4g

24.

(a) NaCl is more ionic. I^- being a bigger anion has high polarisablity 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.

25. Let initial conc. of B = a mol L^{-1}

$$A + B \rightleftharpoons C + D$$

	A	B	C	D
Initial conc.	2a	a	0	0
At Equilibrium	(2a-x)	(a-x)	x	x

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

At equilibrium,

[C] = 3[B]

x=3(a-x)

x=3a/4

$$K_c = \frac{(3a/4)^2}{[(2a-3a)/4]\ [(a-3a)/4]} = 1.8$$

26.

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

(b)Magnetic Quantum number

(c) 12 electrons

PART-V

27.

(a) $C_6H_{10}(g)+ H_2(g) \rightarrow C_6H_{12}(g)$ = ?

$C_6H_{12}(g)+ 9O_2(g) \rightarrow 6CO_2 + 6H_2O(l)$ = -3920 $kJmol^{-1}$ (equation 1)

$C_6H_{10}(g)+ 17/2O_2(g) \rightarrow 6CO_2 + 5H_2O(l)$ = -3800 $kJmol^{-1}$ (equation 2)

$H_2(g)+ 1/2O_2(g) \rightarrow H_2O(l)$ = -241 $kJmol^{-1}$ (equation 3)

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

$C_2H_4(g)+ H_2(g) \rightarrow C_2H_6(g)$ = [(-3800+(-241)]-(-3920)]

=-121 $kJmol^{-1}$

(b) Since p_{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

(a) $C_2H_4(g)+ H_2(g) \rightarrow C_2H_6(g)$ = ?

$C_2H_4(g)+ 3O_2(g) \rightarrow 2CO_2 + 2H_2O(l)$ = -1401 $kJmol^{-1}$ (equation 1)

$C_2H_6(g)+ 7/2O_2(g) \rightarrow 2CO_2 + 3H_2O(l)$ = -1550 $kJmol^{-1}$ (equation 2)

$H_2(g)+ 1/2O_2(g) \rightarrow H_2O(l)$ = -286 $kJmol^{-1}$ (equation 3)

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

$C_2H_4(g)+ H_2(g) \rightarrow C_2H_6(g)$ = [(-1401+(-286)]-(-1550)]

=-137 $kJmol^{-1}$

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

(ii) negative

28.
(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.

29.
(a) Position isomerism.

(b) (i) $C_6H_6 \xrightarrow{H_2SO_4} C_6H_5SO_3H$

(ii) $CH_3CH_2CH(Br)CH_3 \xrightarrow{Alc.KOH} CH_3CH=CHCH_3$

(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

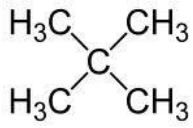
Molar mass of A = 2 x 36 = 72

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



(d) $CH_3COOH \xrightarrow{NaOH} CH_3COONa \xrightarrow{NaOH/CaO} CH_4$