CBSE Board
Class XI Chemistry

Time: 3 Hours **Total Marks: 70**

General Instructions

1. All questions are compulsory.
2. Question nos. 1 to 8 are very short answer questions and carry 1 mark each.
3. Question nos. 9 to 18 are short answer questions and carry 2 marks each.
4. Question nos. 19 to 27 are also short answer questions and carry 3 marks each
5. Question nos. 28 to 30 are long answer questions and carry 5 marks each
6. Use log tables if necessary, use of calculators is not allowed.

Q. 1 Which of these contain the largest number of atoms – 1.0 g Li(s) and 1g Na(s)? [1]

Q. 2 HI is put in a sealed glass bulb and is then heated to decompose HI into H_2 and I_2? What type of system does the reaction mixture represent? [1]

Q. 3 What is the difference between a vapour and a gas? [1]

Q. 4 Calculate the maximum number of electrons in f subshell with same spin. [1]

Q. 5 What is the direction of flow of electrons and of conventional current in the following cell? [1]

$Zn(s)|Zn^{2+}(aq)||Ag^{+}(aq)|Ag(s)$

Q. 6 Give IUPAC name of allyl alcohol. [1]

Q. 7 Calculate the pH of 0.001M NaOH. [1]

Q. 8 State "Law of multiple proportions" [1]

Q. 9 Convert [2]

(a)C and H_2 to benzene

(b) Calcium carbide to oxalic acid

Q. 10 Give reason for the following [2]

(a) F has lower electron gain enthalpy than Cl.

(b) Ionization enthalpy of N is higher than O

Q. 11 Arrange the following in increasing order of size. Give reason for your answer. [2]

Mg^{2+} O^{2-} Na^{+} F^{-} Al^{3+}

Q. 12 Write balance equation for: [2]

(i) BF_3 is reacted with ammonia.

(ii) Al is treated with dilute NaOH

Q. 13 Which of the two is steam volatile and why? o-nitrophenol or p-nitrophenol. [2]

OR

Which of the two as higher dipole moment and why? NF_3 or NH_3.

Q. 14 Calculate the enthalpy change when 2.38g of CO vaporizes at its normal boiling point? Enthalpy of vaporization of CO is 6.04 kJ/mol. [2]

Q. 15 Balance the following equation in acidic medium by half reaction method.

$$Cr_2O_7^{2-} + C_2H_4O \rightarrow C_2H_4O_2 + Cr^{3+}$$ [2]

Q. 16 Explain[3]

(a) LiCl is more covalent than KCl

(b) In aqueous solution Li^{+} has lowest mobility.

Q. 17 In the estimation of sulphur by Carius method, 0.468 g of an organic sulphur compound afforded 0.668 g of barium sulphate. Find out the percentage of sulphur in the given compound. [2]

Q. 18 How many neutrons and protons are there in following nuclei? [2]

(a) $^{56}_{26}Fe$

(b) $^{88}_{38}Sr$

Q. 19 [3]

(i) Which of the two is more stable and why? H_2^{+} or H_2^{-}
(ii) All bonds in PCl_5 are not equal. Explain.
(iii) Which of the two is more ionic and why? NaCl or NaI

Q. 20 Give reasons: [3]

(i) Evaporation causes cooling
(ii) Falling liquids drops are spherical.
(iii) Vapour pressure of acetone is less than that of ether at same temperature.

Q. 21 The combustion of one mole of methanol takes place at 298 K and 1 atm. After combustion CO_2 (g) and H_2O(l) are produced and 726 kJ of heat is liberated. Calculate the standard enthalpy of formation of one mole of CH_3OH(l). Standard enthalpies of formation of CO_2(g) and H_2O(l) are -393 kJ mol^{-1} and -286 kJ mol^{-1} respectively. [3]

Q. 22 [3]

(a) Name the class of hydrides to which H_2O and NaH belong.
(b) What is understood by hydride gap ?
(c) What do you mean by 15 volume H_2O_2 solution?

Q. 23 Comment on each of the following observations: [3]

(a) Lithium forms a nitride directly like magnesium. Give equation involved.
(b) BaO is soluble but $BaSO_4$ is insoluble in water.

Q. 24 (a)Explain: [3]

(i) Boron is unable to form BF_6^{3-} ion.
(ii) $[SiF_6]^{2-}$ is known whereas $[SiCl_6]^{2-}$ not known.
(iii) Conc. HNO_3 can be stored in aluminium container.

Q. 25 How much energy is required to ionize a H – atom if the electron occupies n = 5 orbit? Compare your answer with the ionization enthalpy of H – atom (energy required to remove the electron from n = 1 orbit). [3]

OR

(a) Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range. If the radiation source has the duration of 2 ns and the number of photons emitted during the pulse source is 2.5×10^{15}, calculate the energy of the source.
(b) Calculate the wavenumber for the longest wavelength transition in the Balmer series of atomic hydrogen

Q. 26 The density of 3M solution of NaCl is 1.25g/mL. Calculate the molality of the solution. [3]

Q. 27 Manju and her father were going in a boat in the river. Manju's father threw away the cell used in watches and hearing aids into the water. Manju prevented him from doing so. [3]

a. As a student of chemistry, why would you advise Manju's father not to throw the cell in the water body.

b. What is the value associated with the above decision?

Q.28 (a) The species H_2O, HCO_3, HSO_4^- and NH_3 can act both as Bronsted acids and bases. For each case give the corresponding conjugate acid and base.

(b) Consider the following endothermic reaction: [5]

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

(i) Write expression for K_p for the above reaction.
(ii) How will the equilibrium be affected by 1. Increasing the pressure 2. Using a catalyst?

OR

(a) Predict the acidic, basic or neutral nature of the following salt :
NaCN, KBr, $NaNO_2$, NH_4NO_3

(b) How many grams of KBr be added to 1 L of 0.05 M solution of silver nitrate just to start the precipitation of AgBr? K_{sp} of AgBr = 5.0×10^{-13}

Q. 29 [5]

(a) In which C-C bond of $CH_3CH_2CH_2Br$, the inductive effect is expected to be least?
(b) (b)Which of the following compound shows geometrical isomerism?
(i) Pent-1-ene
(ii) Pent-2-ene
(iii) 2-Methylbut-2-ene
(c) What type of isomerism is present in the following pairs?

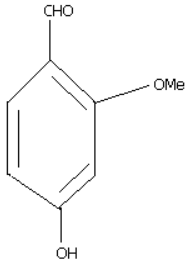
(i) $CH_3CH_2CH_2OH$ and $CH_3\underset{\displaystyle OH}{\underset{|}{C}}H\ CH_3$

(ii) $CH_3CH_2COCH_2CH_3$ and $CH_3COCH_2CH_2CH_3$

(iii) CH_3CH_2OH and CH_3OCH_3

OR

(a) Identify the functional groups in the following:



(b) Draw the bondline formula of heptan-4-one

(c) How many isomers are possible for mono substituted and di substituted benzene?

Q. 30 [5]

(a) Do the following conversions:

(i) Benzene to p-nitrobromobenzene

(ii) Ethyl chloride to ethene

(b) Give mechanism of addition of HBr to propene.

(c) Write a note on Friedel-Crafts alkylation.

OR

(a) Out of n-hexane and ethyne which will be more acidic. Also give reason for this behaviour.

(b) Explain with example

(i) Wurtz reaction

(ii) Acidic dehydration

(c) Convert propyne to propanone

CBSE Board
Class XI Chemistry

Time: -3 hrs **Total Marks :- 70**

Solution

Ans.1 1 g Li(s) (1)

Ans.2 Closed system (1)

Ans.3 Gas below its critical temperature is called a vapour. Vapour is unstable and becomes a liquid while gas is stable and can be liquefied at low temperature and high pressure. (1)

Ans.4 Total number of electrons in f subshell is 14 but half of them will have the same spin i.e. 7 electrons will have same spin. (1)

Ans.5 (a)Direction of flow of electrons: From Zn to Ag $\left(\frac{1}{2}\right)$

(b)Conventional current: from Ag to Zn $\left(\frac{1}{2}\right)$

Ans.6 Prop-2-en-1-ol (1)

Ans.7

$[NaOH]= [OH^-] = 0.001M$

$[H_3O^+][OH^-]=1.0x10^{-14}$

$[H_3O^+] = 1.0x10^{-14}/0.001 = 10^{-11}$

$pH= -log[H_3O^+]= -log\ 10^{-11}$

$=11$ (1)

Ans.8 This law states that" When two elements combine to form two or more than two compounds, then the masses of one of the elements which combine with a fixed mass of the other, are in a simple whole number ratio." (1)

Ans.9

(a) $2C + H_2 \xrightarrow{\text{Electric arc}} C_2H_2 \xrightarrow{\text{red hot Fe}}$ benzene (1 mark)

(b) $CaC_2 + H_2O \longrightarrow C_2H_2 \xrightarrow{\text{Hot } KMnO_4}$ $\begin{matrix} COOH \\ | \\ COOH \end{matrix}$ (1 mark)

Ans.10

(a) Less negative electron gain enthalpy value of F is due to very small size of F atom. As a consequence of small size there are strong interelectronic repulsions in relatively compact 2p-subshell of fluorine and thus electron does not feel much attraction. Cl is comparatively bigger in size than F and can accommodate electron easily. (1)

(b) Due to exactly half filled configuration of N ($1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$), it is more stable than O (electronic configuration for which is $1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$), ionization enthalpy of N is higher than O. (1)

Ans.11

Increasing order of size: $Al^{3+} < Mg^{2+} < Na^{+} < F^{-} < O^{2-}$ (1)

This is an isoelectronic series i.e. the number electrons are the same in all the elements. Thus, as the effective nuclear charge decreases, electrons are held away from the nucleus and thus size increases. (1)

Ans.12

(i) $BF_3 + :NH_3 \rightarrow H_3N \rightarrow BF_3$ (1)

(ii) $2Al + 2NaOH + 6H_2O \rightarrow 2Na[Al(OH)_4] + 3H_2$ (1)

Ans.13 o-nitrophenol is steam volatile. $\left(\frac{1}{2}\right)$

o-nitrophenol has intramolecular hydrogen bonding and results in cyclisation of molecule .p-nitrophenol has intermolecular hydrogen bonding and results in association of molecules. Molecules which are associated require larger energy to separate them before they melt or boil. Thus p-nitrophenol has higher boiling point and o-nitrophenol has lower boiling point. Consequently o-nitrophenol is more volatile than p-nitrophenol. $\left(1\frac{1}{2}\right)$

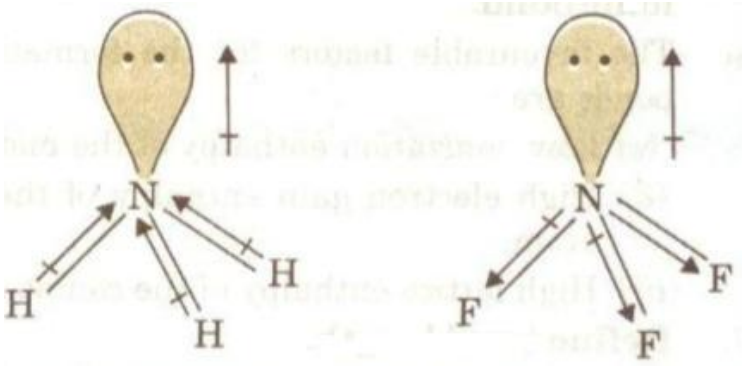
OR

Ans.13

NH_3 has a higher dipole moment than NF_3. $\left(\frac{1}{2}\right)$

In case of NH_3 orbital dipole due to lone pair is in same direction as resultant dipole due to three N-H bonds. Therefore lone pair moment adds on the resultant dipole of N-H bonds. $\left(\frac{1}{2}\right)$

In case of NF_3 orbital dipole due to lone pair is in opposite direction as resultant dipole due to three N-F bonds. Therefore lone pair moment cancels the resultant dipole of N-F bonds. $\left(\frac{1}{2}\right)$



$\left(\frac{1}{2}\right)$

Ans.14

Enthalpy of vaporization of CO = 6.04 kJ mol^{-1}

Molar mass of CO = 28 g mol^{-1} $\left(\frac{1}{2}\right)$

Enthalpy change for vaporization of 28 g of CO at boiling point = 6.04 kJ

$\therefore$ Enthalpy change for vaporization of 2.38 g of CO at boling point

$= \frac{6.04 \times 2.38}{28}$ $\left(\frac{1}{2}\right)$

$= 0.5134$ kJ

$= 513.4$ J (1)

Ans.15

a) Write down the oxidation number of each atom

$$\underset{+6}{Cr_2O_7^{2-}} + \underset{-1}{C_2H_4O} \rightarrow \underset{0}{C_2H_4O_2} + \underset{+3}{Cr^{3+}}$$

b) Write separately oxidation & reduction half reactions

Oxidation half reaction:

$$\underset{-1}{C_2H_4O} \rightarrow \underset{0}{C_2H_4O_2}$$

Reduction half reaction:

$$\underset{+6}{Cr_2O_7^{2-}} \rightarrow \underset{+3}{Cr^{3+}} \qquad \left(\frac{1}{2}\right)$$

c)Balance Cr atoms in reduction half reaction

$$Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$$

d) Balance O atoms and H atoms

$$C_2H_4O + H_2O \rightarrow C_2H_4O_2 + 2H^+$$

$$Cr_2O_7^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 7H_2O \qquad \left(\frac{1}{2}\right)$$

e) Balance charges :

$$C_2H_4O + H_2O \rightarrow C_2H_4O_2 + 2H^+ + 2e^-$$

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O \qquad \left(\frac{1}{2}\right)$$

f) Equalise the electrons lost and gained by multiplying the oxidation half reaction with 3.

$$3C_2H_4O + 3H_2O \rightarrow 3C_2H_4O_2 + 6H^+ + 6e^-$$

Adding the oxidation half reaction and reduction half reaction we get

$$3C_2H_4O + 3H_2O \rightarrow 3C_2H_4O_2 + 6H^+ + 6e^-$$

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$$

$$3C_2H_4O + Cr_2O_7^{2-} + 8H^+ \rightarrow 3C_2H_4O_2 + 2Cr^{3+} + 4H_2O \qquad \left(\frac{1}{2}\right)$$

Ans.16

(a) According to Fajan's rule smaller the size of cation and larger the size of anion, greater is the covalent character of ionic bond. Li is small in size than K, thus Li^+ has a high charge density. Thus polarizing power of Li^+ is higher than K^+, hence LiCl is more covalent than KCl. (1)

(b) Smaller the size of ion greater is the degree of hydration. In aqueous medium, Li^+ gets heavily hydrated. Thus mobility of hydrated Li^+ is low. (1)

Ans.17

Mass of organic compound = 0.468 g
Mass of $BaSO_4$ formed = 0.668 g

233 g of $BaSO_4$ contains S = 32 g $\left(\frac{1}{2}\right)$

0.668 g of $BaSO_4$ contains S = $\frac{32 \times .668}{233}$

= 0.917 g $\left(\frac{1}{2}\right)$

% of sulphur = $\frac{0.0917}{0.468} \times 100$ $\left(\frac{1}{2}\right)$

= 19.59 % $\left(\frac{1}{2}\right)$

Ans.18

No.	Nuclei	No. of protons	No. of neutrons
1	$^{56}_{26}Fe$	26 $\left(\frac{1}{2}\text{mark}\right)$	30 $\left(\frac{1}{2}\text{mark}\right)$
2	$^{88}_{38}Sr$	38 $\left(\frac{1}{2}\text{mark}\right)$	50 $\left(\frac{1}{2}\text{mark}\right)$

Ans.19

(i) H_2^+ is more stable than H_2^- as it contains no electron in antibonding MO while latter contains an electron in antibonding MO making it less stable. (1)

(ii) PCl_5 contains axial and equatorial bonds. Axial bonds are longer than equatorial bonds as they face more repulsion from equatorial bonds. Hence axial bonds are weaker than equatorial bonds. (1)

(iii) NaI is more covalent due to high polarizability of iodide ion due to its bigger size than chloride ion. (1)

Ans.20

(i) This is due to the reason that the molecules which undergo evaporation are high energy molecules and therefore, the kinetic energy of the remaining molecules becomes less. Since the remaining molecules have lower average kinetic energy, their temperature becomes low. (1)

(ii) This is due to surface tension of liquids. Due to surface tension, the molecules of a liquid, try to make surface area to be minimum and for a given volume, sphere has the minimum surface area. Therefore the falling liquid drops are spherical. (1)

(iii) Intermolecular forces are stronger in acetone than in ether. Thus the vapour pressure of acetone is less than ether. (1)

Ans.21

i) Combustion of methanol

$CH_3OH\ (l) + \frac{3}{2}\ O_2\ (g) \rightarrow CO_2\ (g) + 2\ H_2O(l)$; ΔH= -726 kJ/mol (Eq-1) $\left(\frac{1}{2}\right)$

(ii) Enthalpy of formation of CO_2

$C\ (graphite) + O_2\ (g) \rightarrow CO_2\ (g)$; ΔH= -393 kJ/mol (Eq-2) $\left(\frac{1}{2}\right)$

(iii) Enthalpy of formation of H_2O

$H_2\ (g) + \frac{1}{2}\ O_2\ (g) \rightarrow H_2O\ (l)$; ΔH= -286 kJ/mol (Eq-3) $\left(\frac{1}{2}\right)$

Required reaction :

$C(graphite) + 2H_2\ (g) + \frac{1}{2}\ O_2 \rightarrow CH_3OH(l)$; ΔH= ? (Eq-4) $\left(\frac{1}{2}\right)$

(Eq-2) + (2 x Eq-3) - (Eq-1) gives the required enthalpy for formation of methanol $\left(\frac{1}{2}\right)$

$\Delta H = (-572-393)+726$

$= -239\ kJ\ mol^{-1}$ $\left(\frac{1}{2}\right)$

Ans.22

(a) H_2O is covalent hydride whereas NaH is ionic or saline hydride. (1)

(b) Group 7 to group 9 elements do not form hydrides. This region of periodic table from group 7 to 9 is called as hydride gap. (1)

(c) 1 L of H_2O_2 gives 15 L of O_2 at NTP. (1)

Ans.23

(a) Lithium and magnesium follow diagonal relationship and so lithium like magnesium forms nitride while other alkali metals do not. (1)

$$6Li(s) + N_2(g) \xrightarrow{Heat} 2Li_3N(s) \quad (1)$$

(b) Size of O^{2-} ion is smaller than SO_4^{2-}. Since a bigger anions stabilizes bigger cation more than a smaller cation stabilizes a bigger anion, lattice enthalpy of BaO is smaller than $BaSO_4$. BaO is soluble as hydration energy is more than lattice energy but $BaSO_4$ (as hydration energy is less than lattice energy) is insoluble in water. (1)

Ans.24

(i) Due to non-availability of *d* orbitals, boron is unable to expand its octet. Therefore, the maximum covalence of boron cannot exceed 4 and it cannot form BF_6^{3-} ion. (1)

(ii) $[SiF_6]^{2-}$ is known whereas $[SiCl_6]^{2-}$ is not known since six large size atoms i.e. six chlorine atoms cannot be accommodated around Si but six small size atoms (F atoms) can be comfortably accommodated. (1)

(iii) Conc. HNO_3 can be stored in aluminium container because of the formation of protective layer of oxide which prevents subsequent layers from undergoing reaction with nitric acid. (1)

Ans.25

$$E_n = \frac{-21.8 \times 10^{-19}}{n^2} \text{ J atom}^{-1} \qquad \left(\frac{1}{2}\right)$$

For ionization from 5th orbit, $n_1 = 5$, $n_2 = \infty$

$$\Delta E = E_2 - E_1 = -21.8 \times 10^{-19}\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right) \qquad \left(\frac{1}{2}\right)$$

$$= -21.8 \times 10^{-19}\left(\frac{1}{\infty} - \frac{1}{5^2}\right)$$

$$= -21.8 \times 10^{-19} \times \left(-\frac{1}{25}\right)$$

$$= 8.72 \times 10^{-20} \text{ J} \qquad \left(\frac{1}{2}\right)$$

For ionization from 1st orbit, $n_1 = 1$, $n_2 = \infty$

$$\Delta E' = -21.8 \times 10^{-19}\left(\frac{1}{\infty} - \frac{1}{1^2}\right) \qquad \left(\frac{1}{2}\right)$$

$$= 21.8 \times 10^{-19} \text{ J} \qquad \left(\frac{1}{2}\right)$$

$$\frac{\Delta E'}{\Delta E} = \frac{21.8 \times 10^{-19} \text{ J}}{8.72 \times 10^{-20}} \qquad \left(\frac{1}{2}\right)$$

$$= 25$$

OR

(a)

Frequency(v) $= \dfrac{1}{2\times10^{-9}}$ $\left(\frac{1}{2}\right)$

$= 0.5\times10^{9}s^{-1}$ $\left(\frac{1}{2}\right)$

Energy $=$ Nhv $\left(\frac{1}{2}\right)$

$= (2.5\times10^{15})\times(6.62\times10^{-34}\ \text{Js})\times(0.5\times10^{9}s^{-1})$

$= 8.275\times10^{-10}$J $\left(\frac{1}{2}\right)$

(b)

$\bar{v} = R\left(\dfrac{1}{n_1^2}-\dfrac{1}{n_2^2}\right)$ $\left(\frac{1}{2}\right)$

For Balmer series $n_1 = 2$, for longest wavelenght,

$\bar{v}$ should be minimum so that $n_2 = 3$

$\bar{v} = (1.097\times10^{7}m^{-1})\left(\dfrac{1}{2^2}-\dfrac{1}{3^2}\right)$

$= 1.097\times10^{7}\times\dfrac{5}{36}$

$= 1.523\times10^{6}\ m^{-1}$ $\left(\frac{1}{2}\right)$

Ans.26

Molarity = 3M
Density = 1.25g/mL

Mass of NaCl in 1L solution = Molarity x molar mass $\left(\frac{1}{2}\right)$

= 3x58.5

= 175.5g $\left(\frac{1}{2}\right)$

Density = $\dfrac{\text{Mass}}{\text{Volume}}$

Mass of 1L NaCl solution
= 1.25 x 1000

= 1250g $\left(\frac{1}{2}\right)$

Mass of water in solution
= 1250-175.5
= 1074.5g

= 1.0745 kg $\left(\frac{1}{2}\right)$

$$\text{Molality} = \frac{\text{Number of moles of solute}}{\text{Mass of water in solution (in kg)}} \qquad \left(\frac{1}{2}\right)$$

$$= \frac{3}{1.0745}$$

$$= 2.79 \text{ mole kg}^{-1} \qquad \left(\frac{1}{2}\right)$$

Ans.27

a. The watch cells are mercury cells. The mercury will pollute the water. Water contaminated with mercury leads to accumulation of mercury in the body of the fishes and other aquatic life. (2)

b. Keeping the environment safe from pollution due to mercury. (1)

Ans.28

(a)

	Conjugate acid	Conjugate base	Marks
H_2O	H_3O^+	OH^-	$\left(\frac{1}{2}\text{mark}\right)$
HCO_3^-	H_2CO_3	CO_3^{2-}	$\left(\frac{1}{2}\text{mark}\right)$
HSO_4^-	H_2SO_4	SO_4^{2-}	$\left(\frac{1}{2}\text{mark}\right)$
NH_3	NH_4^+	NH_2^-	$\left(\frac{1}{2}\text{mark}\right)$

(b) For the reaction $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$

(i) $K_p = \frac{(p_{CO})(p_{H_2})^3}{(p_{CH_4})(p_{H_2O})}$ (1)

(ii)

1. On increasing pressure, the reaction equilibrium will shift in the backward direction. (1)

2. There is no effect of catalyst in equilibrium composition; however the equilibrium will be attained faster. (1)

OR

Ans.28

(a)

(1) NaCN , $NaNO_2$ – Solutions are basic as they are salts of strong base and weak acid. (HCN and HNO_2 are weak acids and NaOH is strong base). (1)

(2) KBr- This solution is neutral as it is salt of strong acid HBr and strong base KOH.

$\left(\frac{1}{2}\right)$

3) NH_4NO_3- Its solution is acidic as it is salt of strong acid (HNO_3) and weak base (NH_4OH).

$\left(\frac{1}{2}\right)$

(b) For AgBr, $K_{sp} = 5.0 \times 10^{-13}$

Precipitation of AgBr will occur when ionic product $[Ag^+]\,[Br^-]$ becomes larger than K_{sp}. (1)

$$AgNO_3 \rightleftharpoons Ag^+ + NO_3^-$$

$$[Ag^+] = 0.05M$$

The concentration of Br^- required to start precipitation.

$$[Br^-] = \frac{K_{sp}}{[Ag^+]} = \frac{5.0 \times 10^{-13}}{0.05} = 1.0 \times 10^{-11}$$ (1)

Now, $[Br^-] = [KBr] = 1.0 \times 10^{-11}$

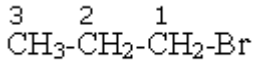
Molar mass of KBr = 120

Therefore, the amount of KBr required $= 1.0 \times 10^{-11} \times 120$

$= 1.20 \times 10^{-9}$ g (1)

Ans.29

(a) The inductive effect is least in C_2-C_3 bond because the magnitude of inductive effect decreases as the number of intervening bonds increases.



(1)

(b)Pent-2- ene will show geometrical isomerism. (1)

(c)

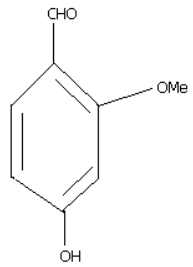
(i) Position isomerism (1)

(ii) Metamerism (1)

(iii)Functional group isomerism (1)

OR

(a)

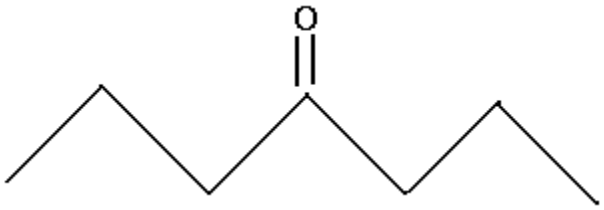


The principal functional group is aldehydic group (-CHO)

The secondary functional groups are alcoholic (-OH) and methoxy (-OMe) group.

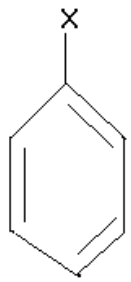
(1)

(b) Bondline structure of heptan-4-one:



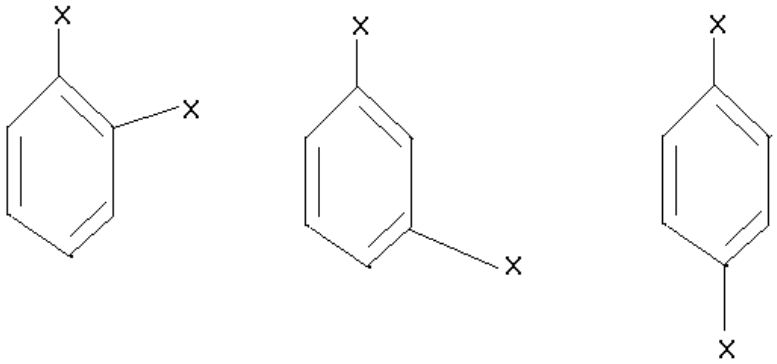
(1)

(c) There is one isomer for monosubstituted benzene



(1)

There are three isomers for disubstituted benzene

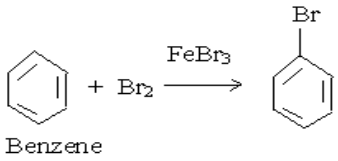


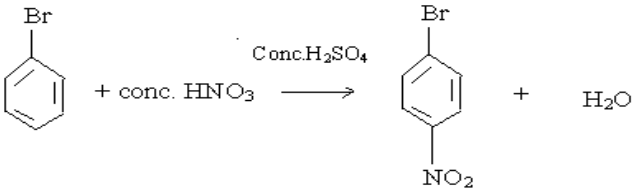
(2)

Ans.30

(a)

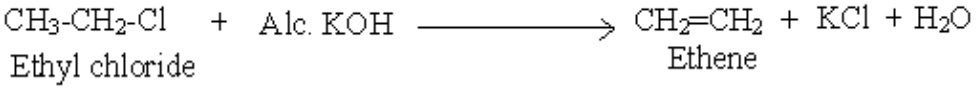
(i) Benzene to p-Nitrobromobenzene





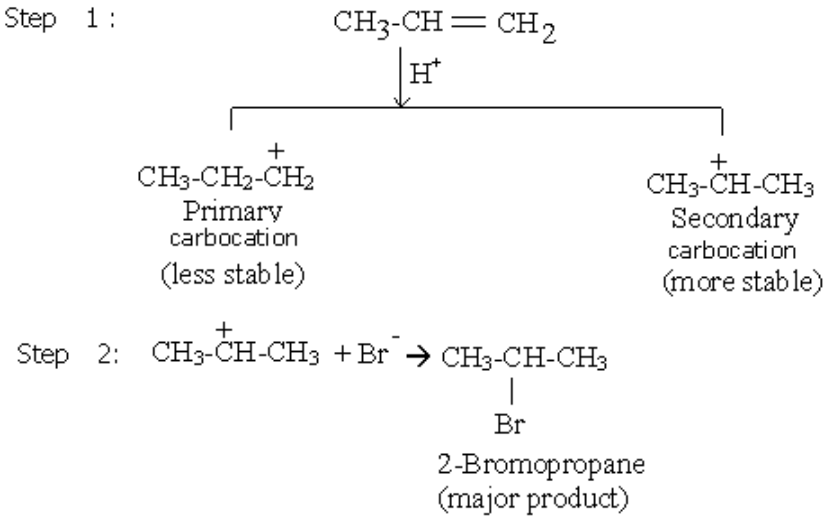
(1)

(ii) Ethyl chloride to ethene



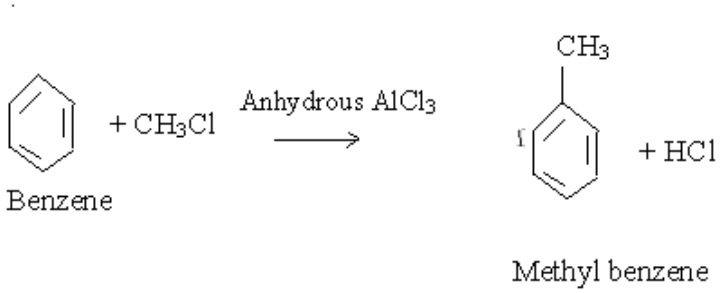
(1)

(b) Mechanism of addition of HBr to propene



(2)

(c) Friedel- Crafts alkylation- It is the reaction of benzene with alkyl halide in presence of anhydrous aluminium chloride. The reaction results in the formation of alkyl benzene.



(1)

OR

$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$	$CH \equiv CH$
n-hexane	Ethyne
sp^3 hybridised carbon	sp hybridized carbon
s-character 25%	s-character 50%

Since s-orbital are closer to the nucleus, hence due to more s character in ethyne (sp hybridized) the hybridized orbital is nearest to this carbon atom in comparison to

sp^2 hybridised carbon. This leads to the movement of C-H bond pair more towards sp hybridized carbon, leading to the development of partial positive charge on the hydrogen attached to sp hydridised carbon and eventually helps in release of proton (H^+). Thus, ethyne is more acidic than n-hexane. (1)

(b)

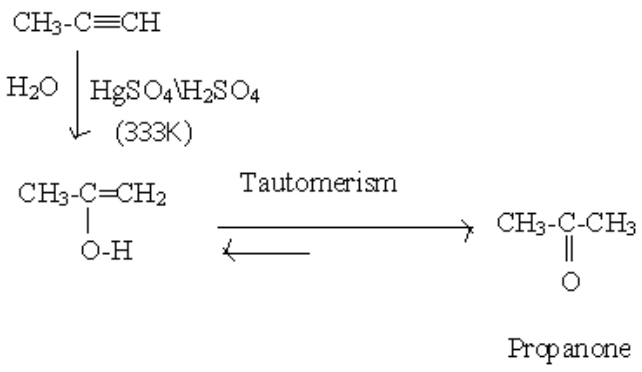
(i)Wurtz reaction: Alkyl halides on treatment with sodium metal in dry ether medium give higher alkanes. This is called Wurtz reaction and is used for the preparation of alkanes with even number of carbon atoms. $\left(\frac{1}{2}\right)$

$$\underset{\text{Bromomethane}}{CH_3Br} + 2Na + BrCH_3 \xrightarrow{\text{Ether}} \underset{\text{Ethane}}{CH_3\text{-}CH_3} + 2NaBr \qquad \left(\frac{1}{2}\right)$$

(ii)Acidic dehydration: Alcohols on heating with conc. H_2SO_4 at 443 K form alkenes with elimination of one water molecule. Since a water molecule is lost in the presence of acid, the reaction is called acidic dehydration of alcohols. $\left(\frac{1}{2}\right)$

$$CH_3\text{-}CH_2OH \xrightarrow{\text{conc. } H_2SO_4} CH_2{=}CH_2 + H_2O \qquad \left(\frac{1}{2}\right)$$

(c)



(2)