Bangalore University, Bengaluru -560001

B.Sc. I Semester, chemistry – I (General chemistry)

Blue print of model question paper – II

Name of the topic	No. of hours	No. of short Answer questions(2 Marks)			No. of long Answer questions (4 Marks)	Total marks
		Part-A	Part -B	Total		
Mathematical concepts	4	1	1	**2**	**1**	**08**
Gaseous state	9	2	2	**4**	**2**	**16**
Photochemistry	4	1	1	**2**	**1**	**08**
Liquids and solutions	9	1	2	**3**	**3**	**18**
Periodic table and periodic properties	9	3	2	**5**	**2**	**18**
Analytical chemistry	4	1	1	**2**	**1**	**08**
Basic concepts of organic chemistry	4	1	1	**2**	**1**	**08**
Aliphatic hydrocarbons	9	2	3	**5**	**2**	**18**
Total	52	12	13	**25**	**13**	**102**

PART – A (12 x 2 =24)

1. Mathematical concepts
2. Gaseous state
3. Gaseous state
4. Photochemistry
5. Liquids and solutions
6. Periodic table and periodic properties
7. Periodic table and periodic properties
8. Periodic table and periodic properties
9. Analytical chemistry
10. Basic concepts of organic chemistry
11. Aliphatic hydrocarbons
12. Aliphatic hydrocarbons

PART – B (13 x 6 = 78)

13 a) Mathematical concepts
b) Mathematical concepts

14. a) Gaseous state
b) Gaseous state

15. a) Gaseous state
    b) Gaseous state
16. a) Photochemistry
    b) Photochemistry
17. a) Liquids and solutions
    b) Liquids and solutions
18. a) Liquids and solutions
    b) Liquids and solutions
19. a) Liquids and solutions
    b) Aliphatic hydrocarbons
20. a) Periodic table and periodic properties
    b) Periodic table and periodic properties
21. a) Periodic table and periodic properties
    b) Periodic table and periodic properties
22. a) Analytical chemistry
    b) Analytical chemistry
23. a) Basic concepts of organic chemistry
    b) Basic concepts of organic chemistry
24. a) Aliphatic hydrocarbons
    b) Aliphatic hydrocarbons
25. a) Aliphatic hydrocarbons
    b) Aliphatic hydrocarbons

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B. Sc. I Semester, chemistry – I (General chemistry)

Model question paper – II

Time: 3 Hours Max. Marks: 70

PART – A

Answer **any eight** of the following questions. Each question carries **two** marks. (8 x 2 = 16)

1. Define curve sketching
2. Define critical temperature of gas.
3. Write the mathematical expression of Maxwell –Boltzmann equation for velocity distribution and explain terms involved in it
4. Define luminescence. Give examples
5. Define viscosity of liquid and mention its SI unit.
6. What is electronegativity?
7. Explain the formation of oxides of alkaline earth metals.
8. Why the second ionization energy is greater than first ionization energy?
9. Define precision
10. Explain substituent reaction. Give an example
11. What is Diels-Alder reaction? Give an example
12. Write the reaction which shows acidic nature of terminal alkynes

PART – B

Answer **any nine** of the following questions. Each question carries **six** marks. (9 x 6 = 54)

13. a) i) If log 5=0.6990 and log7 = 0.8451, find value of log 35 ii) Define probability
    b) Write any two rules to find the differentiation (4 + 2)
14. a) Derive an expression for critical volume V_C from Van der waal's equation
    b) Calculate the critical temperature of nitrogen gas given van der Waals constants, a = 0.1408 $Nm^4\ mol^{-2}$, b = 3.91 X $10^{-5}\ m^3\ mol^{-1}$ R = 8.314 $JK^{-1}\ mol^{-1}$ (4 + 2)
15. a) Explain Andrew's isotherms of carbon dioxide gas
    b) State law of corresponding states (4 + 2)
16. a) Explain the determination of quantum yield of photochemical dissociation of HI
    b) A monochromatic radiation is incident on a solution of 0.05 molar concentration of absorbing substance. The intensity of radiation is reduced to one-fourth of the initial value after passing through 10 cm length of the solution. Calculate molar extension coefficient. (4 + 2)
17. a) Explain the determination of molecular mass of solute by Beckmann method
    b) Write Sugden equation and explain terms involved in it (4 + 2)
18. a) Explain steam distillation of a liquid mixture
    b) 0.001 kg of a solute dissolved in 0.1 kg of solvent gave depression in freezing point 0.2k. Calculate the molecular mass of the solute.(The cryoscopic constant for water is 5.0 k kg mol^{-1}) (4 + 2)

19. a) In the determination of surface tension of a liquid by the drop – number method, it gives 55 drops while water gave 25 drops for the same volume. The densities of the liquid and water are 0.996 and 0.800g/cm-3 respectively. Find the surface tension of the liquid if that of water is 72.0 dynes/cm.
    b) How alkanes are prepared Corey –House reaction (4 + 2)
20. a) Explain the properties of halogens with respective of electronic configuration and ionization energy
    b) Explain the formation of carbonates of alkali metals (4 + 2)
21. a) Explain the variation of periodic properties of elements with respective of ionic radii, electron affinity and electronegativity
    b) Write a note on hydrides of chalcogens (4 + 2)
22. a) Calculate the molarity and normality of a solution containing 5.3g of Na_2CO_3 dissolved in 500 cm^3 of solution
    b) Calculate equivalent mass of ferrous ammonium sulphate (4 + 2)
23. a) What is isomerism? Give its classification
    b) What are nucleophiles? Give examples (4 + 2)
24. a) Explain the stability of cycloalkanes based on heat of hydrogenation
    b) Calculate angle strain on cyclopentane (4 + 2)
25. a) How alkynes are prepared by dehydrohalogenation of vicinal dihalides and germinal dihalides
    b) Give hydroboration – oxidation reaction of alkenes (4 + 2)

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B. Sc. I Semester, chemistry – I (General chemistry)

Answer of model question paper – II

Time: 3 Hours Max. Marks: 70

PART – A

Answer **any eight** of the following questions. Each question carries **two** marks. (8 x 2 = 16)

Ans. 1) The representation of experimental values or quantities through charts or diagrams or pictures is called curve sketching.

Curve sketching is more effective in describing a phenomenon or understanding a problem than words of explanations.

Ans. 2) The temperature above which a gas cannot be liquefied no matter how great the pressure applied is called critical temperature of gas

Ans. 3) Mathematical expression of Maxwell – Boltzmann for velocity distribution is given as

$$\frac{dN_C}{N} = 4\pi\left(\frac{M}{2\pi RT}\right)^{3/2} e^{-\frac{MC^2}{2RT}} C^2 dc$$

Where, R = Real gas constant = 8.314 J/k/mol

$\frac{dN_C}{N}$ = Number of molecules having velocities between c and (c + dc)

N = Total number of molecules, M = Molecular mass, T = Temperature in Kelvin

Ans. 4)The emission of light as a result of chemical action is called chemiluminescence. The reaction is referred as chemiluminescence reaction.

Example: The glow of fireflies due to the aerial oxidation of luciferin in the presence of enzyme luciferase.

Ans. 5) Viscosity is the property of liquids and gases. The resistance offered by one part of the liquid to the flow on the other part is known as viscosity of liquid.

In S.I. unit viscosity is measured in Nsm^{-2}.

Ans. 6) The power of an atom in a molecule to withdraw both bonding electrons towards itself is called electronegativity

Ans. 7) The alkaline earth metals being less electropositive than alkali metals, are less reactive with oxygen. Thus they are slowly undergoes oxidation to form their oxides. However, they burn in oxygen to form ionic oxide MO.

$$Be + O_2 \longrightarrow \text{No reaction}$$

$$Mg + O_2 \xrightarrow{\Delta} MgO$$

$$M + O_2 \longrightarrow MO$$

Where M = Ca, Sr, Ba, Ra

Ans. 8) Amount of energy required to remove first electron from isolated gaseous atom is called first ionization energy. Amount of energy required to remove second electron from isolated gaseous unipositive ion is called second ionization energy. In a unipositve ion the effective nuclear charge is greater than the neutral gaseous atom. The outermost electrons are closely held by the nucleus. Hence Second ionization energy is greater than first ionization energy

Ans. 9) Degree of agreement between two or more replicate measurements made on a sample in an identical manner i.e. exactly in the same fashion is known as precision.

Ans. 10) Reactions which involve the replacement or substitution of one or more atoms or groups of a compound by other atom or groups are known as substitution reactions. These reactions may initiated by nucleophile, electrophile or free radical.

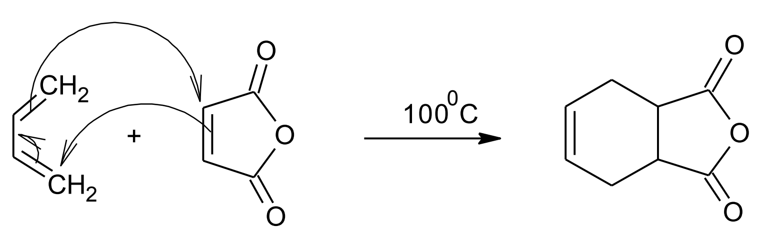
Example-

$$\underset{\text{Methane}}{CH_4} + \underset{\text{Chlorine gas}}{Cl_2} \xrightarrow[\text{Light}]{\text{UV}} \underset{\text{Methyl chloride}}{H_3C{-}Cl} + HCl$$

Ans. 11) Diels –Alder reaction involves the treatment of 1,3 –butadiene(conjugated diene) with an alkene or alkyne. No catalyst is required.

The alkene or alkyne used in Diels – Alder reaction is referred to as dienophile (Diene –lover). The product of Diels – Alder reaction is called the adduct. The net result is the formation of two new σ bonds and new π bond at the expense of the three original π bonds.

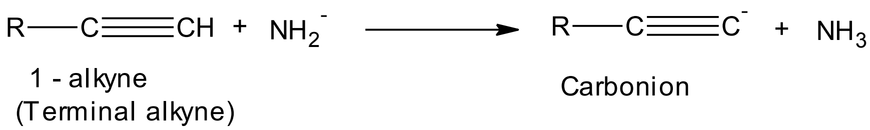
For example - Diels –Alder reaction of 1, 3 –butadiene with maleic anhydride:



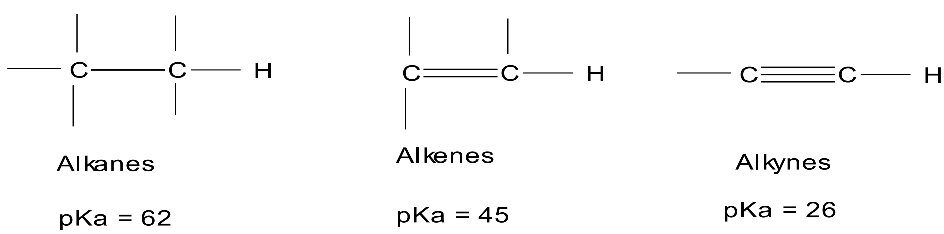
1, 3 -Butadiene (Diene)   Maleic anhydride (Dienophile)   (Adduct)

Ans. 12) Terminal alkynes are weak acidic in nature compare to strong base. This is due following reason.

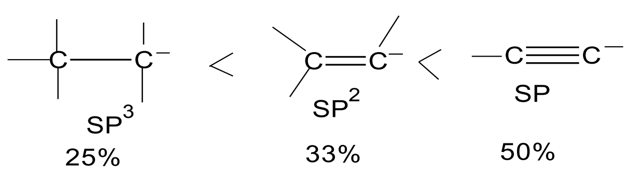
i) Terminal hydrogen of 1 – alkyne can be readily removed by means of strong base. Hence 1-alkyne is considered as weak acids.



ii) Terminal alkyne is more acidic than the alkene and alkane because pka value of these increases in that order.



iii) Greater the S – character in a hybrid orbital containing a pair of electrons, the basic is that pair of electrons and the more acidic in nature. S – Character is increases in the order of



Therefore terminal alkynes are more basic in nature the alkenes which is more than alkanes.

PART – B

Answer **any nine** of the following questions. Each question carries **six** marks. (9 x 6 = 54)

Ans 13. a) i) Given that log 5=0.6990 and log7 = 0.8451

Now log 35 = log (5x7) = log5+ log7 = 0.6990 + 0.8451

∴ Log 35 = 1.5441

ii) The ratio of total number of favorable events to the total number of trials is called probability.

i.e. Probability = $\frac{\text{Number of favorable of events}}{\text{Total number of trials}}$

b) Rules for finding the differentiation:

i) y = u ± v, u & v are the functions of x, then $\frac{dy}{dx} = \frac{du}{dx} \pm \frac{dv}{dx}$

ii) If y = uv, where u & v are the functions of x, then $\frac{dy}{dx}$ = u $\frac{dv}{dx}$ + v $\frac{du}{dx}$

iii) If y = $\frac{u}{v}$ where u & v are the functions of x, then $\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

iv) If y = ku where k is constant & u is the functions of x, then $\frac{dy}{dx}$ = k $\frac{du}{dx}$

Ans 14. a) The van der Waal's equation can be written as

$$(P + \frac{a}{V^2})(V - b) = RT \quad \text{------------ (1)}$$

$$PV - Pb + \frac{a}{V} - \frac{ab}{V^2} - RT = 0$$

Dividing this equation by by V^2

$$\frac{P}{V} - \frac{Pb}{V^2} + \frac{a}{V^3} - \frac{ab}{V^4} - \frac{RT}{V^2} = 0$$ ∵ Taking LCM

$$\frac{PV^3 - PbV^2 + aV - ab - RTV^2}{V^4} = 0$$

i.e. $PV^3 - PbV^2 + aV - ab - RTV^2 = 0$

$$PV^3 - (RT + Pb)V^2 + aV - ab = 0$$

Divide this equation by P

$$V^3 - (\frac{RT}{P} + b)V^2 + \frac{a}{P}V - ab\frac{ab}{p} = 0 \quad \text{----------- (2)}$$

At the critical point, $V = V_C$

$V - V_C = 0$ Cubing on both side

$(V - V_C)^3 = 0$ Expanding this equation

$$V^3 - 3V_CV^2 + 3V_C{}^2V - V_C^3 = 0 \quad \text{------------- (3)}$$

This equation is identical to van der Waals equation at the critical state i.e. When P = P_C and T = T_C Then equation (2) becomes

$$V^3 - (\frac{RT_C}{P_C} + b)V^2 + \frac{a}{P_C}V - \frac{ab}{P_C} = 0 \quad \text{----------- (4)}$$

Equating coefficient of equation (3) and equation (4) we get

$$3V_C = \frac{RT_C}{P_C} + b \quad \text{--------- (5)}$$

$$3{V_C}^2 = \frac{a}{P_C} \quad \text{-------- (6)}$$

$$V_C^3 = \frac{ab}{P_C} \quad \text{------ (7)}$$

From equations (6) and (7)

$$V_C = 3b \quad \text{--------- (8)}$$

Equation (8) gives the expression of critical volume of the gas

b) Given that a = 0.1408 $Nm^4\ mol^{-2}$, b = 3.91 X $10^{-5}\ m^3\ mol^{-1}$ R = 8.314 $JK^{-1}\ mol^{-1}$

Now we know that $T_C = \frac{8a}{27Rb}$

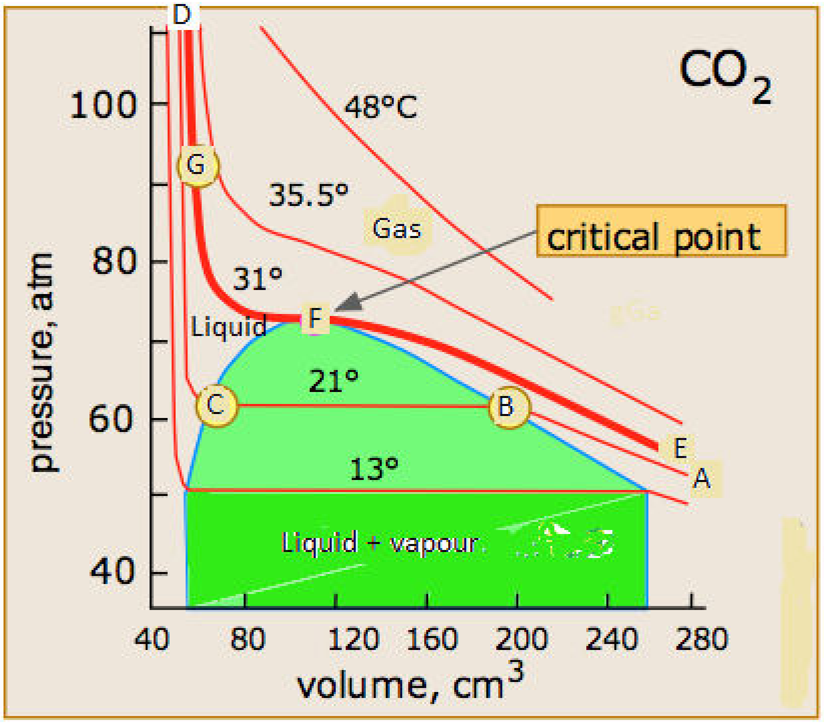
$$= \frac{8 \text{ x } 0.1408}{27\text{x}8.314 \text{ x } 3.91\text{x}10^{-5}}$$

= 128.33k

Ans 15. a) The P –V curves of a gas at constant temperature are called isotherms or isothermals. For an ideal gas PV = nRT and the product PV is constant if T is fixed. Hence the isotherms would be rectangular parabolas.

For an ideal gas PV = nRT and the product PV is constant if *T* is fixed. Hence the isotherms would be rectangular parabolas.

Andrews plotted the isotherms of carbon dioxide for a series of temperatures. From the figure we can see that there are three types of isotherms Viz. those above 31^0C, those below 31^0C; and the one at 31^0C.



a) Isotherms above 31^{0}C: The isotherm at 49^{0}C is a rectangular hyperbola and approximates to the isotherm of ideal gas. So are all other isotherms above 31^{0}C. Thus in the region above the isotherm at 31^{0}C, carbon dioxide always exists in the gaseous state.

b) Isotherms below 31^{0}C: The isotherms below 31^{0}C are discontinuous. For example, the isotherm of 21^{0}C consists of three parts.

i) The curve AB: It is a PV curve for gaseous carbon dioxide. Along AB, the volume decreases gradually with the increase of pressure. At B the volume decreases suddenly due to the formation of liquid carbon dioxide having higher density.

ii) The horizontal portion BC: Along the horizontal part BC of the isotherm, the liquefaction continues while the pressure is held constant. At C all the gas is converted to liquid.

iii) The vertical curve CD: This part of the isotherm is in fact, the P –V curve of liquid carbon dioxide. This is almost vertical since the liquid is not very compressible.

C) Isotherm at 31^{0}C: Andrews noted that above 31^{0}c there was no possibility of liquefaction of carbon dioxide however great the pressure applied. The critical temperature of carbon dioxide is therefore, 31^{0}C. The isotherm EFG at this temperature is called the critical isotherm. The EF portion of the critical isotherm represents the P – V curve of the carbon dioxide gas. At the point F, the curve records a twist which is coincident with the appearance of liquid carbon dioxide. Here the gas and the liquid have the same density and indistinguishable. The point is called the critical point and the nearly parallel to the vertical axis and marks the boundary between the gaseous carbon dioxide on the right and the liquid carbon dioxide on the left.

b) "When two substances have the same reduced temperature and pressure, they will have the same reduced volume". This is known as the law of corresponding states and when two or more substances are at the same reduced temperature and pressure, they are said to be in the corresponding states.

$$\frac{P}{P_C} = \pi, \quad \frac{V}{V_C} = \phi \quad , \quad \frac{T}{T_C} = \theta$$

Then $\left(\pi - \frac{3}{\phi^2}\right)(3\phi - 1) = 8\,\theta$ This equation called reduced equation

Ans 16. a) The decomposition of hydrogen iodide is brought about by the absorption of light of less than 4000A0. In the primary reaction, a molecule of hydrogen iodide absorbs a photon and dissociates to produce H and I. This is followed by secondary steps as shown below-

$HI + h\vartheta \longrightarrow H^* + I^*$ -----------(1) Primary reaction

$H^* + HI \longrightarrow H_2 + I^*$ -----------

$I^* + I^* \longrightarrow I_2$ ----------- } Secondary reaction

$2HI + h\vartheta \longrightarrow H_2 + I_2$ --------- Overall reaction

In the overall reaction, two molecules of hydrogen iodide are decomposed for one photon ($h\vartheta$)of light absorbed. Thus quantum yield is 2.

b) Given that $\frac{I}{I_o} = \frac{1}{4}$, $l = 10cm$ =0.1m, C =0.05 mol dm^{-3}

Now we know that $\log \frac{I}{I_o} = -\epsilon lc$

$$\log \frac{1}{4} = -\epsilon \; x \; 0.1 \; x \; 0.05 = -0.005\epsilon$$

$$\log 1 - \log 4 = -0.005\epsilon$$

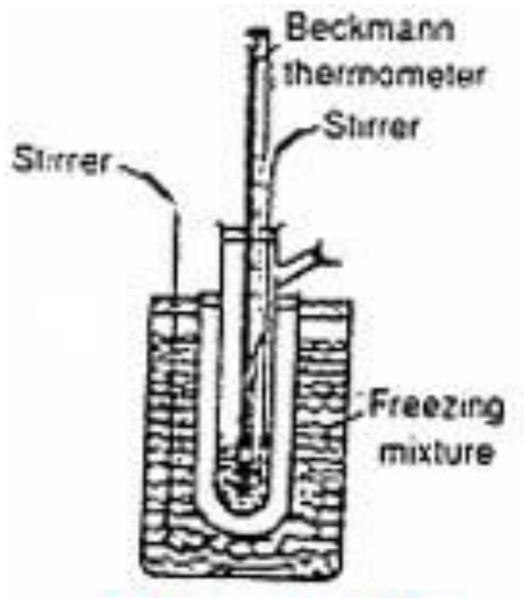
$$0.0000 - 0.6021 = -0.005\epsilon$$

$$-0.3979 = -0.005\epsilon$$

$$\epsilon = \frac{0.3979}{0.005}$$

$$\therefore Molar\ extinsion\ coeffiecint\ (\epsilon) = 79.58\ mol^{-1} dm^{3}\ m^{-1}$$

Ans 17. a) A simple Beckmann apparatus is as shown in figure. It consists of an inner freezing tube provided with a side tube for introducing the solute. It is fitted with Beckmann thermometer and a platinum stirrer. The inner tube is surrounded by an air jacket to ensure a slower and more uniform rate of cooling. The entire assembly is then placed inside a wide vessel containing freezing mixture at a temperature several degrees below the expected freezing point of the solution and provided with a stirrer.



Beckmann Method

A known mass of the pure solvent is placed in the inner tube. It is cooled with gentle continuous stirring. As a result of super cooling the temperature of the solvent will fall by 0.5K below the freezing point. The solvent is stirred vigorously when the solid separates. The temperature rises rapidly to the freezing point and remains constant for some time. The highest constant temperature reached is noted down. The inner tube is then removed, warmed to melt the solid and a weighed amount of the solute is then introduced the side tube. The freezing point of the solution is then determined as before. The difference between the two readings gives the depression of the freezing point ΔT_f.

The molecular weight (molar mass) of the solute is then calculated using the expression.

$$M_2 = \frac{K_f W_2}{\Delta T_f W_1}$$

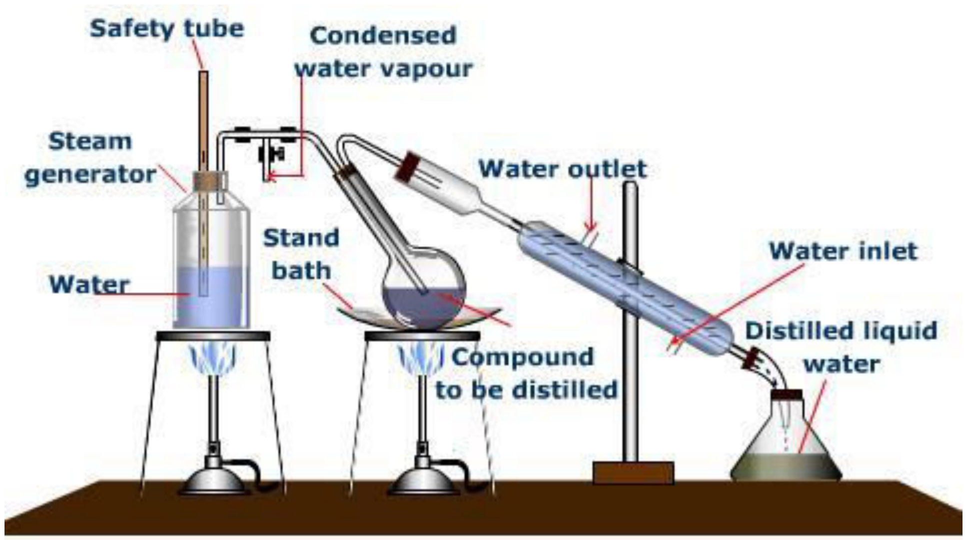
Where, W_1 = Mass of solvent W_2 = Mass of solute M_2 = Molar mass of solute

K_f = cryoscopic constant of water, ΔT_f = Depression in freezing point.

b) $V_m \gamma^{1/4} = [P]$, This equation is called Sugden equation
Where, P = Parachor, γ = Surface tension , V_m = molar volume

Ans 18. a) The process of steam distillation is quiet useful and is generally employed to immiscible liquids which have either higher boiling points or decompose before their normal boiling point is reached. The liquid to be steam distilled should have fairly high volatility near the boiling point of water. Steam is generally passed through the liquid to be steam distilled. When the temperature is raised high enough to make $P_A^0 + P_B^0 = 760$ mmof Hg the mixture distills with a composition given by the equation $\frac{W_A}{W_B} = \frac{P_A^0}{P_B^0} X \frac{M_A}{M_B}$

Where, w_A *and* w_B are the weights of A and B, M_A *and* M_B are the molecular masses of A and B



b) Given that w = 0.001 kg W= 0.1 kg $\Delta T = 0.2$k. Kf = 5.0 k kg mol^{-1} m = ?

We now that $m = \frac{1000 \, x \, Kf \, x \, w}{\Delta T \, x \, W}$

$= \frac{1000 \, x \, 5.0 \, x \, 0.001}{0.2 \, x \, 0.1}$

∴ $m = 250$

Ans 19. a) Given that n_l= 55, n_w= 25, γ_w=72.0 dynes/cm d_l= 0.996 g/cm^3, d_w= 0.800g/cm^3 γ_l=?

Now we know that $\gamma_l = \frac{d_l \, x \, n_w}{n_l \, x \, d_w} x \, \gamma_w$

$= \frac{0.996 \, x \, 25}{55 \, x \, 0.800} x \, 72$

∴ γ_l = 40.7 dynes/cm

b) In Corey – House method, an alkyl halide is first converted to lithium dialkyl copper, LiR_2Cu. This is then treated with an alkyl halide to give an alkane.

$$R-X \xrightarrow[-LiX]{2Li} R-Li \xrightarrow{CuI} (R)_2CuLi$$

Alkyl halide — Ethyl lithium — Lithium dialkyl copper

$$(R)_2CuLi + R'-X \longrightarrow R-R' + R-Cu + LiX$$

Alkyl halide — Alkane — Alkyl copper

Where, $R \neq R'$ = Alkyl group

Example 1) $R = CH_3CH_2-$, $R' = -CH_3$, $X = Br$

$$CH_3CH_2Br \xrightarrow[-LiBr]{2Li} CH_3CH_2Li \xrightarrow{CuI} (CH_3CH_2)_2CuLi + LiI$$

Ethyl bromide — Ethyl lithium — Lithium diethyl copper

$$(CH_3CH_2)_2CuLi + CH_3Br \longrightarrow CH_3CH_2CH_3 + CH_3CH_2Cu + LiBr$$

Methyl bromide — Propane — Ethyl cuperate

Ans 20. a) Fluorine, chlorine , bromine and iodine have closely related properties and are known collectively as the halogens.

Electronic configuration of halogens are given below

Element	Atomic number	Electronic configuration
Fluorine, F	9	$[He]2S^2 2P^5$
Chlorine, Cl	17	$[Ne]3S^2 3P^5$
Bromine ,Br	35	$[Ar]3d^{10} 4S^2 4P^5$
Iodine, I	53	$[Kr]\ 4d^{10} 5S^2 5P^5$
Astatine, At	85	$[He]4f^{14} 5d^{10} 6S^2 6P^5$

Ionization energies of the halogens are very high indicating that they have very small tendency to lose electrons. The values however, decrease on moving down the group, as expected. In the case of iodine, the value is comparatively low. This enables the iodine atom to lose an electron and form I^+ ion

Element	F	Cl	Br	I
Ionization energy In $KJmol^{-1}$	1680.8	1255.5	1142.8	1008.8

Astatine is radioactive halogen

b) Since the alkali metals are highly electropositive, their carbonates (M_2CO_3) and in most cases, bicarbonates are highly stable to heat. As the electropositive character increases on moving down the group, the stability of carbonate increases.

Ans 21. a) Atomic radius is defined as the distance from the centre of the nucleus to the outermost shell of the atom or ion.

Variation of atomic radii in a period: The size of atoms decreases from left to right across the period because as the atomic number increases, the magnitude of nuclear charge also increases while the corresponding addition of electrons takes place in the same quantum shell. As a result the increased nuclear charge pulls the electrons more strongly towards the nucleus thereby causing a decrease in the size of the atom.

Variation of atomic radii in a group: The size of the element increases on descending in a group. This may be attributed to the addition of electron in a new quantum shell at each step. This addition of extra shells of electron out weights the effect of increased nuclear charge.

b) Hydrides of formula H_2R. All the members of oxygen family form hydrides of the same type i.e. H_2O,H_2S, H_2Se , H_2Te and H_2Po. Hydrides of oxygen, viz. , water is available in abundance in nature. The hydrides of S, Se, and Te are readily obtained by the action of acids on metal sulhides, selenides and tellurides

H_2Po on other hand has been prepared only in traces by dissolving magnesium foil plated with Po in 0.2M HCl.

Ans 22. a) Given that mass of Na_2CO_3 (w) = 5.3g Volume of solution (V) = 500 cm^3 Molecular

mass of Na_2CO_3 = 2(23)+12+3(16) =106 , Equivalent mass of Na_2CO_3 = 106/2 = 53

Now we know that, Molarity = $\frac{Mass\ of\ sodium\ carbonate\ x\ 1000}{Molecular\ mass\ of\ sodium\ carbonate\ x\ volume\ of\ solution}$

$$= \frac{5.3\ x\ 1000}{106\ x\ 500}$$

$\therefore$ Molarity of sodium carbonate = 0.1M

Similarly, Normality = $\frac{Mass\ of\ sodium\ carbonate\ x\ 1000}{Equivalent\ mass\ of\ sodium\ carbonate\ x\ volume\ of\ solution}$

$$= \frac{5.3\ x\ 1000}{53\ x\ 500}$$

$\therefore$ Normality of sodium carbonate = 0.2N

b) Molecular formula of ferrous ammonium sulphate = Fe (SO_4) $(NH_4)_2SO_46H_20$

Molecular mass of FAS = 1(Fe)+2(S)+2(N) +14(O)+20(H)

= 1(Fe)+2(S)+2(N) +14(O)+20(H)

=1(55) +2(32)+2(14)+14(16)+20(1)

= 56+ 64 +28+224+20

$\therefore$ Molecular mass of FAS =392

$$Equivalent\ mass\ oF\ FAS = \frac{\text{Molecular mass of FAS}}{Oxidition\ number}$$

$$Equivalent\ mass\ oF\ FAS = \frac{392}{1}$$

$$\therefore\ Equivalent\ mass\ oF\ FAS = 392$$

Ans 23. a) Two or more compounds having same molecular formula but differ in physical and chemical properties due to different arrangement of atoms in two dimension or three dimension called isomers and the phenomenon is called isomerism.

Based on the arrangement of atoms in two dimensions or three dimensions, isomerisms are classified into two types namely structural isomerism and stereoisomerism.

Structural isomerism: Two or more compounds having same molecular formula but differs in physical and chemical properties due to different arrangement of atoms in two dimensions called structural and the phenomenon is called structural isomerism

Structural isomerisms are further classified into functional, chain, position isomerism.

Stereoisomerism: Two or more compounds having same molecular formula but differs in physical and chemical properties due to different (or special) arrangement of atoms in three dimensions called stereoisomer and the phenomenon is called stereoisomerism.

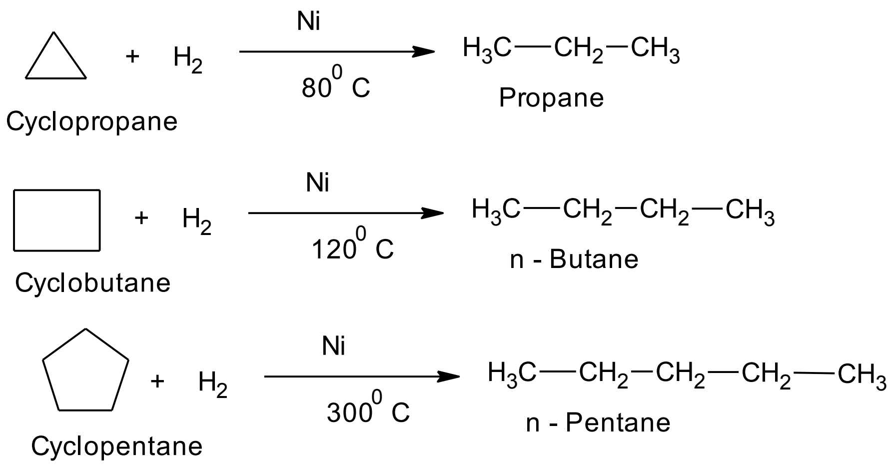
A branch of chemistry in which deals with the study of stereo-isomerism called stereochemistry

Classification of stereoisomerism are further classified into two types namely optical and geometrical isomerism

b) Electron rich species which are formed by heterolytic bond cleavage of reagent are called nucleophiles.

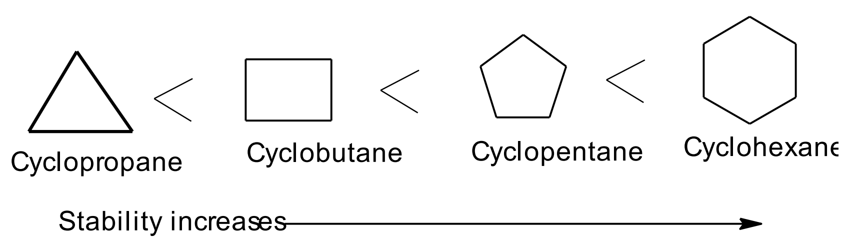
For examples – OH^-, X^-, NH_3, H_2O,etc.

Ans 24. a) Cycloalkane up to cyclopentane adds hydrogen in presence of nickel at the specific temperature.



Higher cycloalkanes are not affected by hydrogenation reaction in presence of nickel.

In the above hydrogenation reactions breaking of one of the C – C bond in cyclopropane requires small temperature, in cyclobutane requires more temperature , in cycopentane requires still more temperature and in higher cycloalkanes i.e. in cyclohexane, cycloheptane, etc. no bond is break. This indicates that cyclopropane is least stable than the cyclobutane, which less stable than cyclopentane. Therefore stability of cycloalkanes in the following order:



b) Angle of strain = $\frac{1}{2}$ [$109^0 28'$ – Angle on cyclopentane]

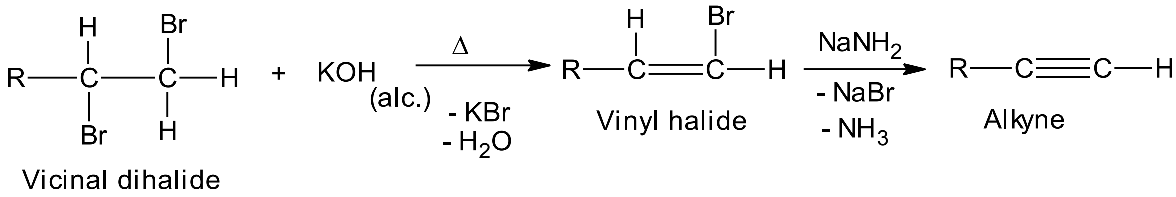
$= \frac{1}{2} [109^0 28' - 108^0]$ ∵ Angle on cyclopentane = 108^0

$= \frac{1}{2} [1^0 28']$

$= \frac{1}{2} [88']$ ∵ $1^0 = 60'$

∴ Angle of strain on cyclopentane = $0^0 44'$

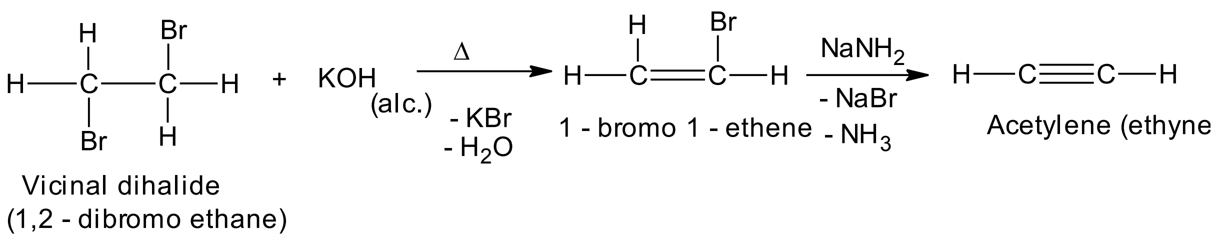
Ans 25. a) i) Compounds that contain halogen atoms on adjacent carbon atoms are called vicinal dihalides or vic – dihalides. Alkynes are obtained by treatment of vicinal dihalides with alcoholic KOH followed by sodium amide.



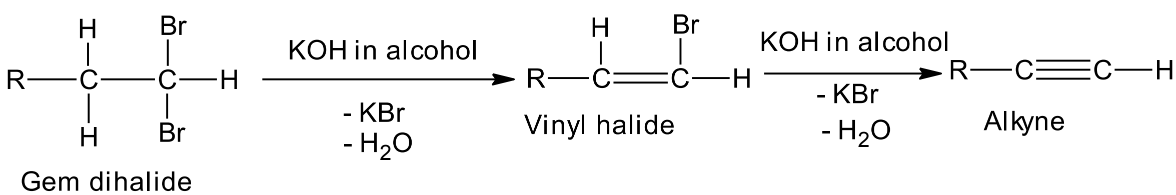
Where R = H or alkyl group.

This method is useful method since the vicinal dihalides are readily prepared from alkenes by the addition of halogens.

For example: 1) When R = H

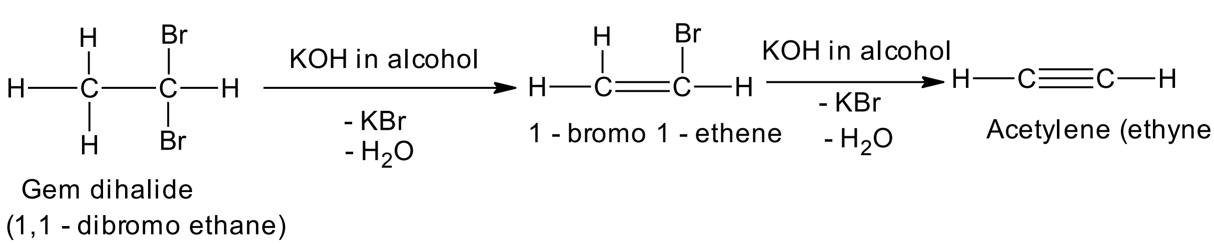


ii) Compounds that contain two halogen atoms on same carbon atom are called gem dihalides. Alkynes are obtained by treatment of gem dihalides with alcoholic KOH solution.



Where R = H or alkyl group.

For example: 1) When R = H



b) Alkenes react with diborane (B_2H_6) in tetrahydrofuran to give trialkylboranes, which is on treatment with alkaline hydrogen peroxide gives primary alcohol.

$$3\ R-CH=CH_2 \quad + \quad (BH_3)_2 \xrightarrow[\text{hydroboration}]{\text{THF}} (R\text{-}CH_2\text{-}CH_2)_3B$$

Alkene — Diborane — Trialkylborane

$$\xrightarrow[\text{Oxidation}]{H_2O_2\ /\ \text{Base}} R - CH_2 - CH_2 - OH \quad + B(OH)_3$$

1^0 alcohol

Where R = alkyl group

For example, R = - CH_3

$$3\ H_3C-CH=CH_2 \quad + \quad (BH_3)_2 \xrightarrow[\text{hydroboration}]{\text{THF}} (CH_3\text{-}CH_2\text{-}CH_2)_3B$$

Propene — Diborane — Tripropylborane

$$\xrightarrow[\text{Oxidation}]{H_2O_2\ /\ \text{Base}} CH_3 - CH_2 - CH_2 - OH \quad + B(OH)_3$$

1 - Propanol
