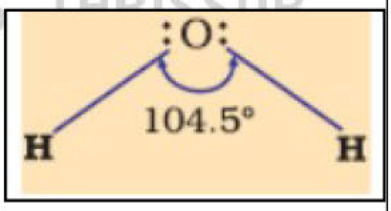
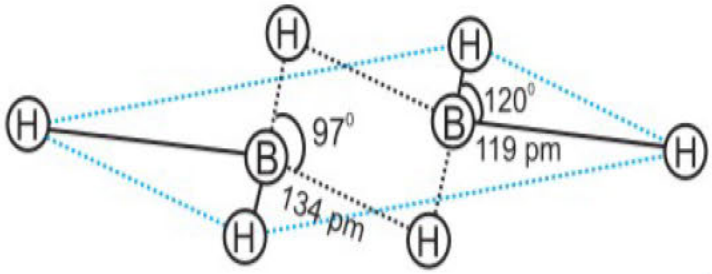
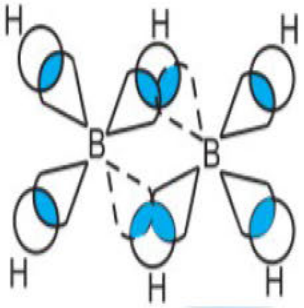
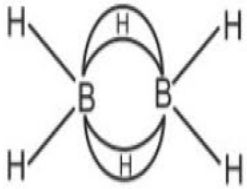
FIRST YEAR HIGHER SECONDARY MODEL EXAMINATION JUNE 2022

Part III

CHEMISTRY

CODE No. ME-625 **ANSWER KEY** **MAXIMUM SCORE : 60**

Q. No.		SECTION 1 : Answer any 6 questions from 1 to 11. Each carries 2 scores (8 x 2 = 16) MAXIMUM MARKS : 16	Split Score	Total Score
1		They start from cathode, more rays are produced from the space between cathode and anode and move towards anode They are material particles They travel in straight lines. They are deflected by both electric and magnetic field. Deflection in the electric field is towards positive plate shows that they are negatively charged particles They does not depend on the nature of the gas inside discharge tube The charge to mass ratio (e/m) is same for all gases (Any Two)		2
2	i)	Pauli's exclusion principle	1	2
	ii)	An orbital is the region in space around the nucleus where there is maximum probability of finding an electron having a specific energy.	1	
3		Here one s orbital and three p orbitals undergo hybridisation, and four sp^3 hybridized orbitals are formed.	1	2
		CH_4 OR CCl_4 OR NH_3 OR H_2O OR Any suitable example	1	
4		O → atomic number 8 , Electronic configuration 2,6 . Oxygen has six valance electrons. Bonded with two hydrogen atoms. So Oxygen has two bond pairs and two lone pairs around it. There are three type repulsions. Bond pair-bond pair repulsion < bond pair- lone pair repulsion < lone pair – lone pair repulsion. Due to these repulsions bond angle is reduced from tetrahedral angle to 104.5 ^{0}.  Geometry is bent shape or inverted V shape.		2
5	i)	Oxidation: Increase in oxidation number. Reduction: Decrease in oxidation number.	½ + ½	2
	ii)	Zn is reducing agent (reductant) Cu^{2+} is oxidizing agent (oxidant).	½ + ½	
6	i)	(a) CH_4	1	2
	ii)	Sodium hexa meta phosphate is commercially known as calgon	1	

7			Column A	Column B	½ X 4	2
			(a) Quick lime	CaO		
			(b) Plaster of Paris	$CaSO_4.\ ½\ H_2O$		
			(c) Dead burned plaster	$CaSO_4$		
			(d) Gypsum	$CaSO_4.\ 2\ H_2O$		
8		In diborane, each boron is in sp^3 hybridisation. The two boron atoms and four hydrogen atoms lie in one plane. These four hydrogen atoms are called terminal hydrogen atoms. The other two hydrogen atoms lie above and below this plane. These hydrogen atoms are called bridging hydrogen atoms. The four terminal B-H bonds are 2centre 2 electron bonds (2c – 2e). The two bridged B-H-B bonds are 3centre 2 electron bonds (3c – 2e). Thus diborane is an electron deficient compound.   			2
9	i)	3-chloropropanal		1	2
	ii)	OH $CH_3 – CH – CH=CH – CH_3$ Pent-3-en-2-ol		1	
10	i)	$CH_3+ < CH_3-CH_2+ < (CH_3)_2CH+ < (CH_3)_3C+$		1	2
	ii)	Inductive effect , Hyper conjugation		1	
11		(i) For dry cleaning of cloths liquid carbon dioxide is used. (ii) For bleaching of paper hydrogen peroxide is used.			2

SECTION 2 : Answer any 8 questions from 12 to 23. Each carries 3 scores | **Split Score** | **Total Score**

(8 x 3 =24) **MAXIMUM MARKS : 24**

12

Elements	Atomic mass	Percentage (%)	$Relative\ number\ of\ moles = \frac{Percentage}{Atomic\ mass}$	Simple ratio	Whole number ratio
Hydrogen	1	4.07%	4.07/1 =4.07	4.07/2.01 = 2.02	2
Carbon	12	24.27%	24.27/12 =2.02	2.02/2.01 =1	1
Chlorine	35.5	71.65 %	71.65/35.5=2.01	2.01/2.01 =1	1

3

Empirical formula = CH_2Cl

Empirical formula mass = (12 x1) + (1 x 2) + (35.5 x 1) = 49.5

Molecular mass = 98.96

$$n = \frac{Molecular\ mass}{Empirical\ formula\ mass} = \frac{98.96}{49.5} = 2$$

Molecular formula = n x Empirical formula =2 (CH_2Cl) = $C_2H_4Cl_2$

13 (i) **3**

Molarity	**Molality**	**2**
Molarity is defined as the number of moles of solute in one litre of the solution.	Molality is defined as the number of moles of solute in one kilogram of the solvent.	
$Molarity = \frac{Number\ of\ moles\ of\ solute}{Volume\ of\ solution\ in\ litre} = \frac{W_B\ X\ 1000}{M_B\ X\ V_{(in\ ml)}}$	$Molality = \frac{Number\ of\ moles\ of\ solute}{Mass\ of\ solvent\ in\ kilogram} = \frac{W_B\ X\ 1000}{M_B\ X\ W_{A(in\ gram)}}$	
Molarity depends on temperature because it is related to volume, which changes with temperature.	Molality does not depend on temperature	

(ii) Molarity **1**

14 (i) s and p block elements (except noble gases) are called representative elements. **1** **3**

(ii) Atoms and ions which contain same number of electrons are called isoelectronic species. **1**

N^{3-} , O^{2-} , F^- , Na^+ , Mg^{2+} , Al^{3+} (These have different nuclear charge , But contain 10 electrons each) **1**

15 (i) The amount of energy released when an electron is added to isolated gaseous atom is called electron gain enthalpy. **1** **3**

(ii) In fluorine atom , inter electronic repulsion in the 2p sub shell is more, due to the very small size of fluorine atom **2**

But in chlorine ,electrons are added to relatively larger 3p sub shell . That is relatively easy. So chlorine has more negative electron gain enthalpy

16 **3**

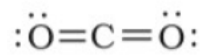
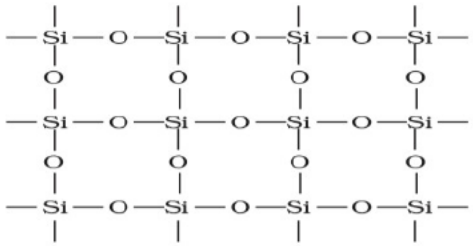
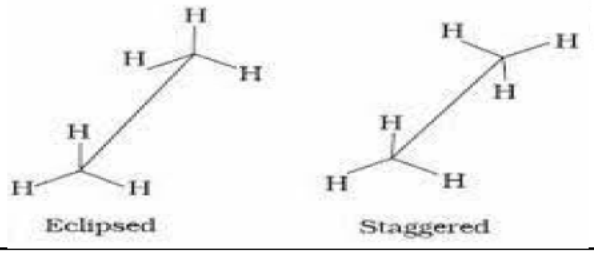
(I) All the gases are made up of extremely small particles called molecules.

(II) The molecules are separated by large distance and so there is no attractive force between the gas molecules.

		(III) The volume of the gas molecule is negligible as compared to the total volume of the gas. (IV) The molecules are in random and rapid motion. During their motion, they collide with each other and on the walls of the container. (V) The pressure of the gas is due to the collision of molecules on the walls of the container. (VI) Molecular collisions are perfectly elastic ie. There is no net loss or gain energy in their collisions. However, there may be redistribution of energy during such collisions. (VII) Different molecules possess different speed and hence different energies. However, the average kinetic energy of the molecules is directly proportional to its absolute temperature.		
17	(i)	$P_1V_1 = P_2V_2$ $1.2 \times 120 = P_2 \times 180$ $\therefore P_2 = \frac{1.2 \times 120}{180} = 0.8\ bar$	2	3
	(ii)	Viscosity decreases with rise in temperature.	1	
18	(i)	Density	1	3
	(ii)	$\Delta H_f^0 = -393.5 - (-283.0) = -110.5\ kJmol^{-1}$	2	
19	i)	$AlCl_3$ is electron deficient compound , can accept electron pair and so Lewis acid	1	3
	ii)	NH_4Cl on hydrolysis gives HCl and NH_4OH. HCl is strong acid and ionize completely and so H+ concentration is high . Acidic solution. So P^H is less than 7	1	
	iii)	Due to common ion effect	1	
20	(i)	Combination reactions Decomposition reactions Displacement reactions Disproportionation reactions	2	3
	(ii)	$Zn + 2\ HCl \rightarrow ZnCl_2 + H_2$	1	
21	(i)	Hardness can be removed by boiling is called temporary hardness. It is due to the presence of bicarbonates of calcium and magnesium.	1	3
	(ii)	(i) Boiling: Insoluble magnesium hydroxide and calcium carbonates are produced. Filtered. $M(HCO_3)_2 \rightarrow MCO_3 + H_2O + CO_2$, (M= Mg, Ca) (ii) Clarks method: By adding lime , bicarbonates are converted as magnesium hydroxide and calcium carbonates. Filtered. $Mg(HCO_3)_2 + 2\ Ca(OH)_2 \rightarrow 2\ CaCO_3 + Mg(OH)_2 + 2\ H_2O$	2	
22	i)	$CH_3 - CH = CH_2 + HBr \rightarrow CH_3 - \underset{Br}{CH} - CH_3 + CH_3 - CH_2 - CH_2 - Br$ 1- propene 2- bromopropane (Major) 1-bromopropane (Minor)	2	3
	ii)	Markownikkov's rule	1	
23	i)	Green house effect is the phenomenon in which earth's atmosphere traps the heat from the sun and prevents it from escaping into outer space resulting in the rise of atmospheric temperature.	1	3
	ii)	It is the amount of oxygen required by micro organism to oxidize organic matter present in the polluted water.	1	
	iii)	Pollution of water by nutrients such as phosphate from detergents and fertilizers accelerate the growth of algae and other plants in river water. This reduces the dissolved oxygen and adversely affect aquatic life. This phenomenon is known as	1	

		eutrophication.		

QNo.			SECTION 3 : Answer any 5 questions from 24 – 31. Each carries 4 scores (5 x 4 = 20) MAXIMUM MARKS : 20	Split Score	Total Score
24	(i)	(I)	The electrons in an atom revolve around the nucleus in circular paths called orbits. These orbits have definite energies called energy shells or energy levels. These are numbered 1,2,3,4,... or designated as K,L,M,N,....	3	4
		(II)	As long as electrons remain in a particular orbit, it does not lose or gain energy. Therefore these orbits are called stationary states.		
		(III)	Only those orbits are permitted in which the angular momentum of the electron is a whole number multiple of $h/2\pi$. i.e. Angular momentum, $mvr = nh/2\pi$ n = 1,2,3,.....		
		(IV)	Energy is emitted or absorbed by an atom only when an electron in it moves from one orbit to other. The difference in energy , $\Delta E = E_2 - E_1 = h\nu$		
	(ii)		2p 3d	½ ½	
25	(i)		$\sigma 1s^2$ $\sigma^* 1s^2$ $\sigma 2s^2$ $\sigma^* 2s^2$ $\pi 2p_x^2 = \pi 2p_y^2$ $\sigma 2p_z^2$	2	4
	(ii)		There are two types of hydrogen bonds (I) Inter molecular hydrogen bond :- Hydrogen bond between different molecules of same type or different type. It increases the boiling point. e.g., H bonding in HF, ...H-F.....H-F.....H-F.....H-F..... (II) Intra molecular hydrogen bond:- Hydrogen bond within the same molecule. It decreases the boiling point. e.g., Hydrogen bonding in Ortho nitro phenol	2	
26	i)		First law of thermo dynamics :- It is law of conservation of energy. It states that energy can neither be created nor destroyed $\Delta U = q + w$	2	4
	ii)		Gibbs energy is defined as the maximum amount of available energy that can be converted to useful work.	1	
	iii)		$\Delta G = \Delta H - T\Delta S$	1	
27	i)		If a system in equilibrium is subjected to change in concentration, temperature or pressure, the equilibrium shifts in the direction that tends to reduce the effect of the change.	1	4
	ii)		$$Kp = \frac{p(CO)p^3(H_2)}{p(CH_4)p(H_2O)}$$	1	
	iii)	a	Here as a result of forward reaction, the no. of moles of gaseous species increases. So high pressure favours backward reaction.	1	
		b	Here forward reaction is endothermic So high temperature favours forward reaction.	1	
28	(i)		Raw materials : Lime stone($CaCO_3$), ammonia (NH_3) and brine solution (NaCl). In this process, carbon dioxide obtained by the decomposition of lime stone is passed through brine solution saturated with ammonia. Sodium bicarbonate is precipitated. It is filtered and heated to get sodium carbonate. By product in this process is calcium chloride. $2\,NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2\,CO_3$ $(NH_4)_2\,CO_3 + CO_2 + H_2O \rightarrow 2\,NH_4HCO_3$	2	4

		$NH_4HCO_3 + NaCl \rightarrow NaHCO_3 + NH_4Cl$ $2\,NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$		
	(ii)	Due to its small size, high ionisation enthalpy and absence of vacant d-orbitals, Be exhibits anomalous properties.	2	
29	i)	When borax is heated with transition metals, metaborates with characteristic colours are formed.This is known as Borax bead test.	2	4
	ii)	In CCl_4 , there is no vacant d-orbital in carbon atom. Thus it cannot accommodate lone pair of electrons donated by the oxygen atom of water molecule. So CCl_4 cannot be hydrolysed.	1	
	iii)	In CO_2 molecule, C atom undergoes undergoes sp hybridization. So it has linear shape. It exist as discrete (separate) molecules and there is only weak attractive between the different CO_2 molecules. So CO_2 is gas.  But in silica, each silicon atom undergoes sp^3 hybridisation . Here each silicon atom is tetrahedrally surrounded by four oxygen atoms. So it has three dimensional net work structure and hence it is solid. 	1	
30	i)	Dumas method OR Kjeldahl's method	1	4
	ii)	Sodium fusion extract + nitric acid + silver nitrate → White precipitate (Presence of chlorine)	2	
	iii)	Distillation	1	
31	(i)	A cyclic , conjugated , planar system is aromatic if it contains (4n +2) pi electrons in the ring. Where n = 1,2,3 etc	2	4
	(ii)	 Eclipsed Staggered	2	

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