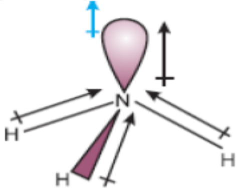
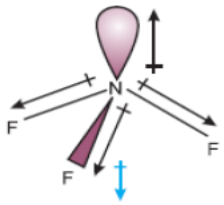
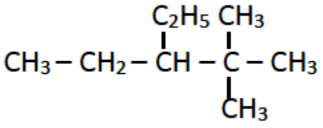
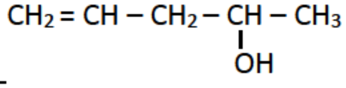
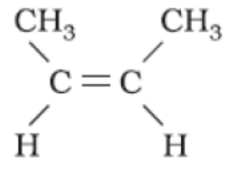
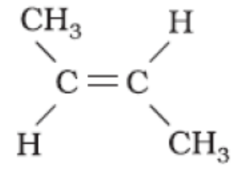
FIRST YEAR HIGHER SECONDARY EXAMINATION MARCH 2024 – ANSWER KEY

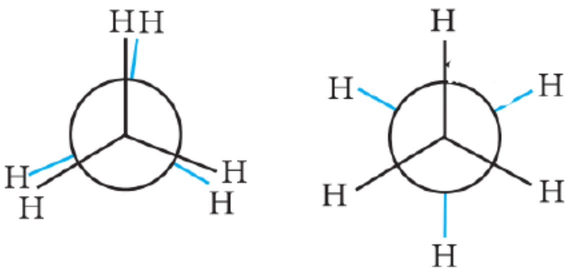
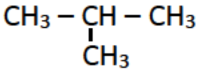
(UNOFFICIAL) **SUBJECT: CHEMISTRY** **Qn. Code: FY 425**

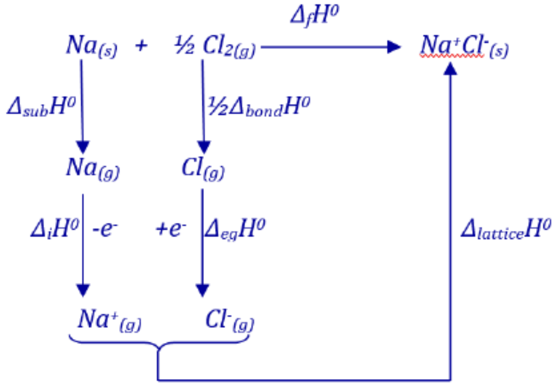
Qn. No.	Sub Qns	Answer Key/Value Points	Score	Total
		Answer any 4 questions from 1 to 5. Each carry 1 score		
1.		(a) Molarity	1	1
2.		p-Block	1	1
3.		sp hybridisation OR, Diagonal hybridisation	1	1
4.		(b) BF_3	1	1
5.		(b) -OH	1	1
		Answer any 8 questions from 6 to 15. Each carry 2 scores		
6.	(i) (ii)	Law of Multiple proportions It states that if two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in the ratio of small whole numbers.	1 1	2
7.		According to de Broglie equation, $\lambda = \frac{h}{mv}$ Here $v = 1.6 \times 10^6$ m/s, $h = 6.626 \times 10^{-34}$ Js and $m = 9.1 \times 10^{-31}$ kg (mass of electron) So, $\lambda = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 1.6 \times 10^6}$ **$= 0.455 \times 10^{-9}$ m OR, 4.55×10^{-10} m OR, $4.55\ A^0$**	1 1	2
8.		Heisenberg's uncertainty principle states that "it is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of an electron." Mathematically, $\Delta x. \Delta p \geq \frac{h}{4\pi}$ OR, $\Delta x. m\Delta v \geq \frac{h}{4\pi}$ OR, $\Delta x. \Delta v \geq \frac{h}{4\pi m}$	1 1	2
9.		This is because in the case of NH_3, the orbital dipole due to lone pair and the resultant dipole moment of the three N – H bonds are in the same direction. So, they get added together. But in NF_3, the orbital dipole is in the opposite direction to the resultant dipole moment of the three N–F bonds. So they get partially cancelled. So NH_3 has higher dipole moment than NF_3. **OR,**  NH_3  NF_3	2 2	
10.	(i)	It is defined as the maximum amount of available energy that can be converted to useful work. **OR,** G = H – TS	1	2

	(ii)	Gibb's equation is: $\Delta G = \Delta H - T\Delta S$ OR, Gibbs energy change = enthalpy change – temperature × entropy change	1	
11.	(i) (ii)	Le Chatelier's Principle states that a change in any of the factors that determine the equilibrium conditions of a system will cause the system to change in such a manner so as to reduce or to counteract the effect of the change. OR, Le Chatelier's principle states that whenever there is a change in concentration, pressure or temperature of a system at equilibrium, the system will try to readjust in such a way, so as to cancel the effect of that change. Common ion effect is defined as a shift in equilibrium on adding a substance that provides more of an ionic species already present in the dissociation equilibrium. OR, It is the suppression of the dissociation of a weak electrolyte by the addition of a strong electrolyte containing a common ion. OR, Consider the dissociation of the weak electrolyte acetic acid. $CH_3COOH_{(aq)} \rightleftharpoons CH_3COO^-{}_{(aq)} + H^+{}_{(aq)}$ If we add some strong electrolyte like sodium acetate (CH_3COONa) to the above equilibrium reaction, the concentration of acetate ion increases. Then according to Le-Chatelier's principle, the equilibrium will shift towards left or, the rate of forward reaction decreases. i.e. the dissociation rate of acetic acid decreases. OR, Explanation with another example	1 1	2
12.	(i) (ii)	+7 According to this concept, oxidation is the process of increase in the oxidation number of an element and reduction is the process of decrease in the oxidation number of an element. OR, explanation with example.	1 1	2
13.	(i) (ii)	 $CH_3-CH_2-\overset{C_2H_5}{\overset{\vert}{CH}}-\underset{\underset{CH_3}{\vert}}{\overset{CH_3}{\overset{\vert}{C}}}-CH_3$  $CH_2=CH-CH_2-\underset{\underset{OH}{\vert}}{CH}-CH_3$	1 1	2
14.		 *cis*-But-2-ene  *trans*-But-2-ene	2 x 1 = 2	2
15.	(i) (ii)	Benzene OR, C_6H_6 OR,  Wurtz reaction: Alkyl halides react with metallic sodium in dry ether to form alkanes. This reaction is known as Wurtz reaction. OR, $2\ R\text{-}X + 2\ Na \xrightarrow{Dry\ ether} R-R + 2\ NaX$ OR, $2\ CH_3\text{-}Br + 2\ Na \xrightarrow{Dry\ ether} CH_3-CH_3 + 2\ NaBr$ OR, Any other example.	1 1	2

Answer any 8 questions from 16 to 26. Each carry 3 scores

16.	(i)	(a) Silver – Element (b) Air – Homogeneous mixture (c) Muddy water – Heterogeneous mixture (d) Water – Compound	4 x ½ = 2	3
	(ii)	Limiting reagent is a reagent that is completely consumed in a chemical reaction. OR, it is a reagent that limits a reaction.	1	
17.	(i)	Principal Quantum number, Azimuthal or Subsidiary Quantum number, Magnetic Quantum number and Spin Quantum number.	4 x ½ = 2	3
	(ii)	Pauli's exclusion principle states that no two electrons in an atom can have the same set of 4 quantum numbers. OR, an orbital can accommodate a maximum of only 2 electrons with opposite spin.	1	
18.	(i)	Unnilpentium	1	3
	(ii)	Electronegativity is the ability of an atom in a molecule to attract the shared pair of electrons to itself.	1	
	(iii)	*This question is incomplete* It is due to the small size of fluorine/Greater electron-electron repulsion in fluorine/ Larger size of chlorine compared to fluorine/Lesser electron-electron repulsion in chlorine/smaller size of 2p subshell in fluorine/I agree with this statement.	1	
19.	(i)	$(n-1)d^{1-10}ns^{0-2}$ OR, $(n-1)d^{1-10}ns^{1-2}$	1	3
	(ii)	Transition elements are metals, they form coloured compounds or ions, they show variable oxidation states and valencies, most of them are paramagnetic, they show catalytic properties, they form alloys, they form interstitial compounds. **[Any 2 required]**	2	
20.		The salient features of Molecular orbital theory are: 1) In molecules, the electrons are present in some special type of orbitals called molecular orbitals (M.Os). 2) The atomic orbitals (A.Os) of comparable energy and proper symmetry combine to form molecular orbitals. 3) Atomic orbitals are monocentric, while molecular orbitals are polycentric. 4) The number of molecular orbitals formed = the number of atomic orbitals combined. i.e. if 2 atomic orbitals combined, 2 molecular orbitals are formed. One is called bonding molecular orbital (BMO) and the other is called anti-bonding molecular orbitals (ABMO) 5) The BMO has lower energy and greater stability than the corresponding ABMO. 6) The molecular orbitals give the electron probability distribution around a group of nuclei. 7) The molecular orbitals are filled according to 3 rules – Aufbau principle, Pauli's exclusion principle and Hund's rule. ***[Any 3 required]***	3 x 1	3
21.	(i)	It states that energy can neither be created nor be destroyed. OR, the total energy in the universe is always constant. OR, the total energy of an isolated system is always constant.	1	3
		Mathematically, $\Delta U = q + w$ OR, $\Delta U = q - p\Delta V$	1	
	(ii)	(c) Evaporation of water	1	

22.	(i)	p^H is defined as the negative logarithm of the hydrogen ion or hydronium ion concentration in moles per litre (or, molarity). OR, $p^H = -\log[H^+]$ OR, $p^H = -\log[H_3O^+]$	1	3
	(ii)	Given pK_a of acetic acid = 4.76 and pK_b of NH_4OH is 4.75 $p^H = 7 + ½\,[pK_a - pK_b]$ $= 7 + ½\,[4.76 - 4.75]$ $= 7 + ½\,[0.01] = 7 + 0.005 = \mathbf{7.005}$	 1 1	
23.	(i)	Disproportionation reaction is a special type of redox reaction in which an element in one oxidation state is simultaneously oxidised and reduced. E.g. The decomposition of hydrogen peroxide. $2\,\overset{+1\ -1}{H_2O_2}{}_{(aq)} \rightarrow 2\,\overset{+1\ -2}{H_2O}{}_{(l)} + \overset{0}{O_2}{}_{(g)}$ OR, any other example	1 1	3
	(ii)	Cu(II)O	1	
24.	(i)	Heterolytic fission is a type of bond fission in which the shared pair of electrons remains with one of the fragments.	1	3
	(ii)	Column chromatography and Thin layer chromatography (TLC).	1	
	(iii)	Fractional distillation.	1	
25.	(i)	 (i) Eclipsed (ii) Staggered	2 x 1 = 2	3
	(ii)	Staggered conformation is more stable than eclipsed form.	1	
26.	(i)	I is the major product and II is the minor product. OR, major product:- 2-Bromopropne OR,  $CH_3-\underset{\overset{\mid}{CH_3}}{CH}-CH_3$ minor product:- 1-Bromopropane OR, $CH_3-CH_2-CH_2Br$	2	3
	(ii)	Markovnikov's rule OR, Markownikoff's rule.	1	
		Answer any 4 questions from 27 to 31. Each carry 4 scores		
27.	(i)	The important postulates of Bohr atom model are: (i) The electron in the hydrogen atom can move around the nucleus in a circular path of fixed radius and energy. These paths are called orbits and are numbered as 1, 2, 3, ….. or K, L, M, ……… . (ii) The energy of an electron in the orbit does not change with time. However when an electron absorbs energy, it will move to an orbit away from the nucleus and when it emits energy, it will move to an orbit near to the nucleus. The energy change does		

<table>
<tr><td></td><td></td><td>not take place in a continuous manner.
(iii) The frequency of radiation absorbed or emitted when transition occurs between two stationary states that differ in energy by ΔE, is given by:
$\nu = \frac{\Delta E}{h} = \frac{E_2 - E_1}{h}$ [Bohr frequency rule]
(iv) The angular momentum of an electron is quantized. i.e. it is an integral multiple of $\frac{h}{2\pi}$.
(v) The radius of orbits can be given by the equation: $r_n = a_0 n^2$ where a_0 = 52.9 pm.
(vi) The energy of electron in an orbit is given by the expression: $E_n = -R_H\left(\frac{1}{n^2}\right)$, where n = 1,2,3 .. and R_H is a constant called Rydberg constant. [Any 2 postulates required]</td><td>2</td><td rowspan="3">4</td></tr>
<tr><td></td><td>(ii)</td><td>Drawbacks of Rutherford's atom model are:
(i) He could not explain the stability of the atom.
(ii) He could not explain the electronic structure of atom.</td><td>1</td></tr>
<tr><td></td><td>(iii)</td><td>Photoelectric effect is the phenomenon of ejection of electrons by certain metals (like potassium, rubidium, caesium etc.), when light of suitable frequency incident on them.</td><td>1</td></tr>
<tr><td>28.</td><td>(i)</td><td><table>
<tr><th></th><th>Column-I</th><th></th><th>Column-II</th></tr>
<tr><td>(1)</td><td>PCl_5</td><td>(B)</td><td>Trigonal bipyramidal</td></tr>
<tr><td>(2)</td><td>SF_6</td><td>(C)</td><td>Octahedral</td></tr>
<tr><td>(3)</td><td>CH_4</td><td>(D)</td><td>Tetrahedral</td></tr>
<tr><td>(4)</td><td>NH_3</td><td>(A)</td><td>Trigonal pyramidal</td></tr>
</table></td><td>4 x ½
= 2</td><td rowspan="3">4</td></tr>
<tr><td></td><td>(ii)</td><td>Bond order is defined as one half the difference between the number of electrons present in the bonding and the antibonding orbitals.
OR, Bond order (B.O) = ½ [$N_b - N_a$]
OR, Bond order is the number of bonds between the two atoms in a molecule.</td><td>1</td></tr>
<tr><td></td><td>(iii)</td><td>Intermolecular hydrogen bonding and intramolecular hydrogen bonding.</td><td>1</td></tr>
<tr><td>29.</td><td>(i)</td><td>The lattice enthalpy of an ionic compound is the enthalpy change when one mole of an ionic compound dissociates into its ions in gaseous state.
OR, It is the enthalpy change when 1 mol of an ionic compound is formed from corresponding gaseous ions.</td><td>1</td><td rowspan="2">4</td></tr>
<tr><td></td><td>(ii)</td><td>Born-Haber cycle for the determination of lattice enthalpy of NaCl.
 </td><td>3</td></tr>
</table>

		$\Delta_f H^0 = \Delta_{sub}H^0 + \Delta_i H^0 + \frac{1}{2} \Delta_{bond}H^0 + \Delta_{eg}H^0 + \Delta_{lattice}H^0$ OR, $\Delta_{lattice}H^0 = \Delta_f H^0 - [\Delta_{sub}H^0 + \Delta_i H^0 + \frac{1}{2} \Delta_{bond}H^0 + \Delta_{eg}H^0]$		
30.	(i)	Solutions which resist the change in p^H on dilution or with the addition of small amount of acid or alkali is called Buffer solution. E.g. A mixture of acetic acid and sodium acetate around p^H 4.75 OR, a mixture of ammonium chloride and ammonium hydroxide around p^H 9.25 OR, Blood OR, a mixture of any weak acid and its salt with a strong base. OR, a mixture of any weak base and its salt with a strong acid.	1 1	4
	(ii)	According to Bronsted- Lowry concept, acids are proton (H^+) donors and bases are (H^+) acceptors. OR, example: $NH_{3(g)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$ Here NH_3 is a base since it accepts an H^+ ion to form NH_4^+ and H_2O is an acid since it donates an H^+ ion to form OH^-. OR, Another example.	1	
	(iii)	$K_p = K_c.(RT)^{\Delta n}$	1	
31.	(i)	Electrophiles are reagents that take away an electron pair from the reactive site. OR, they are electron deficient species attacks at electron rich centre. OR, they are electron seeking reagents. E.g. carbocations (R^+), Cl^+, Br^+, NO_2^+, >CO, SO_2 etc. **[Any one example is required]** Nucleophiles are reagents that bring an electron pair to the reactive site. OR, they are electron rich species attacks at electron deficient centre. OR, they are nucleus seeking reagents. Example: OH^-, CN^-, NO_2^-, Cl^-, Br^-, I^-, H_2O, NH_3, $R{-}NH_2$ etc. **[Any one example is required]**	½ ½ ½ ½	4
	(ii)	(a) Functional Group isomerism: The phenomenon of existence of two or more compounds with same molecular formula but different functional groups is termed as functional group isomerism. OR, Isomers which differ in the functional group are called functional group isomers and the phenomenon is called functional group isomerism. OR, E.g. C_2H_6O may be an alcohol, ethanol ($CH_3{-}CH_2{-}OH$) or an ether, methoxymethane ($CH_3{-}O{-}CH_3$). (b) Metamerism: Isomerism arising due to different alkyl chains on either side of the functional group is called metamerism. It is commonly shown by ethers. OR, E.g.: $C_4H_{10}O$ represents methoxypropane ($CH_3OC_3H_7$) and ethoxyethane ($C_2H_5OC_2H_5$)	1 1	

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