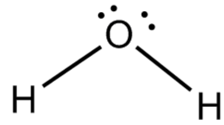
FIRST YEAR HIGHER SECONDARY 2nd TERMINAL EXAMINATION DEC 2022

CHEMISTRY - *ANSWER KEY (Question Code: FY 1025)*

Qn. No.	Sub Qns.	Answer Key/Value Points	Score	Total
Answer any 4 questions from 1 to 5. Each carries 1 score. (4 x 1 = 4)				
1.		CH_2O	1	1
2.		c) 45	1	1
3.		d) Chalcogens	1	1
4.		sp^3	1	1
5.		a) Work	1	1
Answer any 8 questions from 6 to 15. Each carries 2 scores. (8 x 2 = 16)				
6.		Antoin Lavoisier The law of conservation of mass states that matter can neither be created, nor be destroyed. **OR**, In a chemical reaction, the total mass of the reactants = the total mass of the products.	1 1	2
7.	(i) (ii)	Molarity is the no. of moles of solute present per litre of the solution. **OR**, Molarity (M) = $\frac{\text{No. of moles of solute}}{\text{Volume of solution in litre}}$ Molality is the no. of moles of solute present per kilogram of the solvent. **OR**, Molality (M) = $\frac{\text{No. of moles of solute}}{\text{Mass of solvent in kilogram}}$	1 1	2
8.		Drawback's of Bohr model of atom are: 1. It could not explain the fine spectrum of hydrogen atom. 2. It could not explain the spectrum of atoms other than hydrogen. 3. It could not explain Stark effect and Zeeman effect. 4. It could not explain the ability of atoms to form molecules by chemical bonds. 5. It did not consider the wave character of matter and Heisenberg's uncertainty principle. ***[Any 2 Required]***	2x1	2
9.		Energy of electron in the n^{th} orbit (E_n) = $-R_H (Z^2/n^2)$ For the first orbit of He^+, Z = 2 and n = 1. Also $R_H = 2.18 \times 10^{-18}$ J So, $E_1 = -2.18 \times 10^{-18} \times (2^2/1^2)$ J = **-8.72×10^{-18} J**	1 1	2
10.	(i) (ii)	Mendeleev's periodic law states that the properties of elements are the periodic functions of their atomic weights. 18 groups and 7 periods	1 1	2
11.		Down a group, ionization enthalpy decreases. Along a period, ionization enthalpy increases from left to right.	1 1	2
12.		Water molecule contains 4 Valence shell electron pairs – 2 bond pairs and 2 lone pairs. Hence the expected shape of the molecule is tetrahedral. But due to the greater repulsion between lone pairs, the shape is distorted to bent or angular structure or inverted 'v' shape and the bond angle is 104.5^0.	2	2

<table>
<tr><td></td><td></td><td>
</td><td></td><td></td></tr>
<tr><td>13.</td><td></td><td>No.
In PCl_5, there are 2 types of P-Cl bonds – axial bonds and equatorial bonds. The axial bond pairs are more repelled by the equatorial bond pairs. So the axial bond length is greater than the equatorial bond length.</td><td>1

1</td><td>2</td></tr>
<tr><td>14.</td><td></td><td>These are properties which depend on the amount of matter present in a system.
OR, these are properties which change when a system is further divided.
E.g.: Mass, area, volume, length, heat capacity, internal energy, enthalpy, entropy, Gibb's energy etc. [Any one example is required]</td><td>1

1</td><td>2</td></tr>
<tr><td>15.</td><td></td><td>Gibb's equation is: $\Delta G = \Delta H - T\Delta S$
Where ΔG is the Gibb's energy change, ΔH is the enthalpy change, ΔS is the entropy change and T is the absolute temperature.</td><td>1

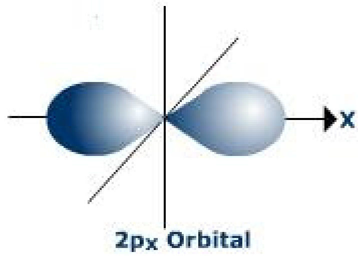
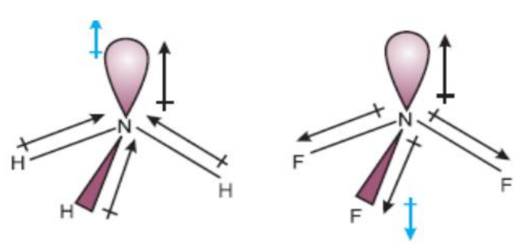
1</td><td>2</td></tr>
<tr><td colspan="5">Answer any 8 questions from 16 to 25. Each carries 3 scores. (8 x 3 = 24)</td></tr>
<tr><td>16</td><td>(i)

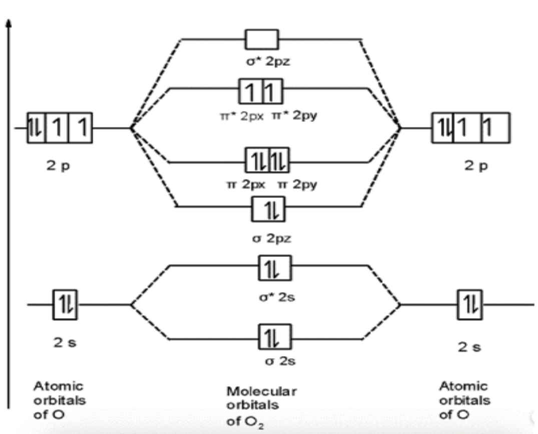
(ii)</td><td>(a) 2
(b) 3
Mixtures having same composition throughout are called homogeneous mixtures. Here the components completely mix with each other.
E.g. Air, all solutions.
Mixtures having different compositions at different parts are called heterogenous mixtures. Here the components do not completely mix with each other.
E.g. Muddy water, sea water etc.
[Any one difference or example is required]</td><td>½
½

2</td><td>3</td></tr>
<tr><td>17.</td><td></td><td><table>
<tr><th>Element</th><th>Percentage</th><th>Atomic mass</th><th>Percentage/Atomic mass</th><th>Simple ratio</th><th>Simplest whole no. ratio</th></tr>
<tr><td>C</td><td>24.27</td><td>12</td><td>24.27/12 = 2.02</td><td>2.02/2.02 = 1</td><td>1</td></tr>
<tr><td>H</td><td>4.07</td><td>1</td><td>4.07/1 = 4.07</td><td>4.07/2.02 = 2</td><td>2</td></tr>
<tr><td>Cl</td><td>71.65</td><td>35.5</td><td>71.65/35.5 = 2.02</td><td>2.02/2.02 = 1</td><td>1</td></tr>
</table>
Empirical Formula = CH_2Cl
Empirical Formula Mass (EFM) = 12+2+35.5 = 49.5
Molar mass (MM) = 98.96
n = MM/EFM = 98.96/49.5 = 2
Molecular formula = Empirical formula x n
= $(CH_2Cl) \times 2 = C_2H_4Cl_2$</td><td>1

1

1</td><td>3</td></tr>
<tr><td>18.</td><td></td><td>The important observations made by Rutherford are:
1. Most of the α– particles passed through the gold foil without any deviation.
2. A small fraction of the α–particles was deflected by small angles.
3. A very few α– particles (~1 in 20,000) bounced back, that is, were deflected by nearly 180°.</td><td>3 x 1</td><td>3</td></tr>
</table>

19.	(i) (ii)	 There are 3 unpaired electrons in Nitrogen atom. The rule behind this is Hund's rule of Maximum multiplicity.	1 1 1	3
20.	(i) (ii)	It is the heat change (enthalpy change) when an electron is added to the outer most shell of an isolated gaseous atom. This is because, when an electron is added to F, it enters into the smaller 2^{nd} shell. Due to the smaller size, the electron suffers more repulsion from the other electrons. But for Cl, the incoming electron goes to the larger 3^{rd} shell. So the electronic repulsion is low and hence Cl adds electron more easily than F.	1 2	3
21.	(i) (ii)	The similarities in properties shown by the diagonally placed elements of the 2^{nd} and 3^{rd} periods in the Modern periodic table are called Diagonal relationship. The anomalous properties are due to their small size, large charge to radius ratio, high electronegativity and absence of vacant d orbitals.	1 2	3
22.		The important postulates of VSEPR theory are: • The shape of a molecule depends on the number of valence shell electron pairs around the central atom. • The valence shell electron pairs repel each other. • To reduce the repulsion, the electron pairs stay at maximum distance. • Presence of lone pairs of electron causes distortion in the expected geometry of the molecule. • The repulsion between two lone pairs of electrons is different from those between two bond pairs or between a lone pair and bond pair. The repulsion decreases in the order lone pair - lone pair repulsion > lone pair – bond pair repulsion> bond pair - bond pair repulsion. • As the angle between the electron pairs increases, the repulsion decreases.	3	3
23.	(i) (ii)	Lattice enthalpy is the energy required to completely separate one mole of an ionic compound into corresponding gaseous ions. **OR**, it is the energy liberated when one mole of an ionic compound is formed from corresponding gaseous ions. This is because in NH_3, the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the three N – H bonds. But in NF_3, the orbital dipole is in the opposite direction to the resultant dipole moment of the three N-F bonds. So the dipole moments get partially cancelled. OR, 	1 2	3

24.	(i)	It is defined as the half of the difference between the number of bonding electrons (N_b) and the number of anti-bonding electrons (N_a) in a molecule.		
		OR, Bond order (B.O) = ½ [$N_b - N_a$]	1	
		OR, It is the number of bonds between 2 atoms in a molecule.		3
	(ii)	As the bond order increases, bond length decreases.	1	
	(iii)	M.O configuration of F_2 is: $\sigma 1s^2\ \sigma^*1s^2\ \sigma 2s^2\ \sigma^*2s^2\ \sigma 2pz^2\ \pi 2px^2\ \pi 2py^2\ \pi^*2px^2\ \pi^*2py^2$.		
		Bond order (B.O) = ½ [$N_b - N_a$] = ½ [10 – 8] = ½ x 2 = 1	1	
25.	(i)	It states that the total enthalpy change for a process is the same whether the reaction is taking place in a single step or in several steps.	1	
		OR, the total enthalpy change for a process is independent of the path followed.		
	(ii)	The chemical equation is:		
		$CaCO_3\ (s) \longrightarrow CaO\ (s) + CO_2\ (g)$		
		Given $\Delta_f H^0$ $CaCO_3$ (s) = -1206.92 kJ/mol, $\Delta_f H^0$ CaO (s) = -635.09 kJ/mol and $\Delta_f H^0$ CO_2(g) = -393.51 kJ/mol		3
		Enthalpy of reaction ($\Delta_r H^0$) = $\sum \Delta_f H^0_{(P)} - \sum \Delta_f H^0_{(R)}$		
		= [$\Delta_f H^0$(CaO) + $\Delta_f H^0$(CO_2)] - [$\Delta_f H^0$($CaCO_3$)]	2	
		= [-635.09 + -393.51] – [-1206.92] = **<u>178.32 kJ/mol</u>**		
Answer any 4 questions from 26 to 30. Each carries 4 scores. (4 x 4 = 16)				
26.	(i)	$N_2(g) + 3\ H_2(g) \longrightarrow 2\ NH_3\ (g)$		
		28g 6g 34g		
		According to the equation, 28 g N_2 requires 6 g H_2 for complete reaction.		
		So 2000 g N_2 requires $\frac{6 \times 2000}{28}$ = 428.57 g H_2	2	4
		Here there is enough H_2 (1000 g)		
		So, 2000 g N_2 reacts with 428.57 g H_2 to form **2428.57 g NH_3 (Or, 2.43 kg NH_3)**		
	(ii)	Some H_2 remains unreacted.	1	
		Amount of unreacted H_2 = 1000 – 428.57 = **571.43 g**	1	
27.	(i)	The Schrödinger equation. It is written as: $\hat{H}\psi = E\psi$	1	
	(ii)	Principal Quantum number (n), Azimuthal Quantum number (l), Magnetic Quantum number (m or m_l) and Spin Quantum number (s or m_s).	2	4
	(iii)	(a) 2p	½	
		(b) 5f	½	
28.	(i)	M.O configuration of O_2 : $\sigma 1s^2\ \ \sigma^*1s^2\ \ \sigma 2s^2\ \ \sigma^*2s^2\ \ \sigma 2p_z^2\ \ \pi 2p_x^2\ \ \pi 2p_y^2\ \ \pi^*2p_x^1\ \ \pi^*2p_y^1$	2	
	(ii)		2	4

29.	(i) (ii)	$_{24}Cr$: [Ar] $3d^5 4s^1$ **OR**, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$ **OR**, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$ $_{29}Cu$: [Ar] $3d^{10} 4s^1$ **OR**, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$ **OR**, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$ *a)* ***Aufbau principle:*** *It states that* ***the orbitals are filled in the increasing order of their energies****.* ***OR****, the orbitals are filled in the increasing order of their (n+l) value.* *b)* ***Pauli's Exclusion Principle:*** *It states that* ***no two electrons in an atom can have the same set of four quantum numbers****.* ***OR****, an orbital can accommodate a maximum of only 2 electrons with opposite spin.*	1 1 1 1	4
30.	(i) (ii) (iii)	These are elements which contain partially filled d-orbitals in their ground state or in any one of their common oxidation states. OR, d block elements are called transition elements. They include elements from groups 3 to 12. $(n-1)d^{1-10}\ ns^{0-2}$ Some of the properties of transition elements are: a) They are all metals. b) They form coloured compounds or ions in aqueous solution. c) They show variable oxidation states and valencies. d) They are generally paramagnetic. e) They show catalytic properties. ***[Any 2 required]***	1 1 2	4

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