FIRST YEAR HIGHER SECONDARY SECOND TERMINAL EXAMINATION

DECEMBER 2024 – ANSWER KEY

SUBJECT: CHEMISTRY **Qn. Code: FY 125**

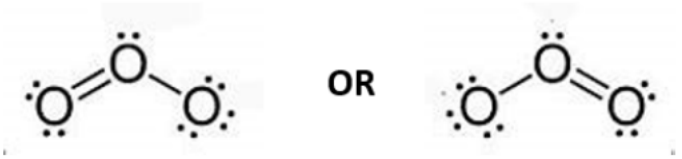
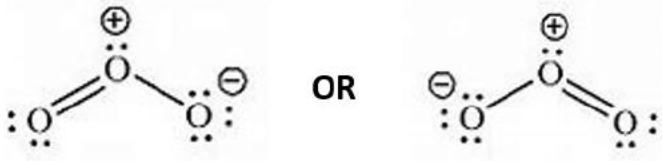
<table>
<tr><th>Qn. No.</th><th>Sub Qns</th><th>Answer Key/Value Points</th><th>Score</th><th>Total</th></tr>
<tr><td colspan="5">Answer any 4 questions from 1 to 5. Each carries 1 score</td></tr>
<tr><td>1.</td><td></td><td>c) S^{2-}</td><td>1</td><td>1</td></tr>
<tr><td>2.</td><td></td><td>b) F</td><td>1</td><td>1</td></tr>
<tr><td>3.</td><td></td><td>sp^2</td><td>1</td><td>1</td></tr>
<tr><td>4.</td><td></td><td>i) Both A and R are true and R is the correct explanation of A</td><td>1</td><td>1</td></tr>
<tr><td>5.</td><td></td><td>F^- (Fluoride ion)</td><td>1</td><td>1</td></tr>
<tr><td colspan="5">Answer any 8 questions from 6 to 15. Each carries 2 scores</td></tr>
<tr><td>6.</td><td></td><td>Law of multiple proportion.
It states that if two elements can combine to form more than one compound, the different masses of one of the elements that combine with a fixed mass of the other element, are in small whole number ratio.</td><td>1
1</td><td>2</td></tr>
<tr><td>7.</td><td></td><td>Here threshold frequency (ν_0) = $7.0 \times 10^{14}\ s^{-1}$ and
frequency of radiation (ν) = $1.0 \times 10^{15}\ s^{-1}$
K.E of emitted electron = $h\nu - h\nu_0 = h(\nu - \nu_0)$
$= 6.626 \times 10^{-34}(1.0 \times 10^{15} - 7.0 \times 10^{14}) =$ 19.878×10^{-20} J</td><td>

1
1</td><td>2</td></tr>
<tr><td>8.</td><td>i)

ii)</td><td>Modern periodic law states that the properties of elements are the periodic functions of their atomic numbers.
Unnilennium OR Meitnerium</td><td>1

1</td><td>2</td></tr>
<tr><td>9.</td><td></td><td>
<table>
<tr><th>σ Bond</th><th>π Bond</th></tr>
<tr><td>It is formed by axial overlapping of atomic orbitals.</td><td>It is formed by lateral overlapping of atomic orbitals.</td></tr>
<tr><td>It is present both in single bonds and in multiple bonds.</td><td>It is present only in multiple bonds.</td></tr>
<tr><td>The extent of overlapping is greater.</td><td>The extent of overlapping is lesser compared to σ bond.</td></tr>
<tr><td>Sigma bonds have independent existence.</td><td>Pi bond is always present along with sigma bond.</td></tr>
<tr><td>Sigma bonds are stronger bonds.</td><td>Pi bonds are weaker compared to sigma bond.</td></tr>
<tr><td>Only one sigma bond is formed between 2 atoms.</td><td>More than one pi bonds can be formed between two atoms.</td></tr>
<tr><td>Sigma bonds are symmetrical about the bond axis.</td><td>Pi bonds are not symmetrical about the bond axis.</td></tr>
</table>
[Any 2 differences required]
</td><td>2 x 1</td><td>2</td></tr>
</table>

10.		Inter molecular hydrogen bonding is the hydrogen bond formed by H atom of one molecule and the electronegative atom of another molecule of the same or different compound. E.g. Hydrogen bonding in HF ....H-F ..... H-F ..... H-F ..... H-F ..... OR, Any other example	1 1	2
11.		<table><tr><th>A</th><th>B</th></tr><tr><td>i) Adiabatic Process</td><td>d) No transfer of heat</td></tr><tr><td>ii) Free expansion</td><td>e) $p_{ext} = 0$</td></tr><tr><td>iii) $\Delta H = q$</td><td>b) At constant pressure</td></tr><tr><td>iv) Intensive property</td><td>a) Specific heat capacity</td></tr></table>	4 x ½	2
12.		Here $K_c = 6.3 \times 10^{14}$ For reverse reaction, $K_c = \frac{1}{6.3 \times 10^{14}}$ $= \mathbf{1.58 \times 10^{-15}}$	1 1	2
13.		Here $[H^+] = 3.8 \times 10^{-3}$ $p^H = -\log[H^+]$ $= -\log (3.8 \times 10^{-3}) = \mathbf{2.42}$	 1 1	2
14.		Oxidant = H_2 Reductant = Na	1 1	2
15.		It is a type of redox reaction in which an element in one oxidation state is simultaneously oxidised and reduced. In the reaction: $\overset{+1\ -1}{2H_2O_2\,(aq)} \rightarrow \overset{+1\ -2}{2H_2O(l)} + \overset{0}{O_2(g)}$ the oxygen in the reactant (H_2O_2) is in –1 oxidation state and it is increased to zero oxidation state in O_2 and decreased to –2 oxidation state in H_2O. i.e. oxygen is simultaneously oxidised and reduced. So it is a disproportionation reaction.	1 1	2
		Answer any 8 questions from 16 to 26. Each carries 3 scores		
16.		$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$		
	i)	No. of molecules of $H_2 = 2 \times 6.022 \times 10^{23}$ molecules	½	
		No. of molecules of $O_2 = 6.022 \times 10^{23}$ molecules	½	
	ii)	Number of moles of water formed = 2 mol, which contains		3
		4 mol H atoms OR, $4 \times 6.022 \times 10^{23}$ H atoms	½	
		2 mol O atoms OR, $2 \times 6.022 \times 10^{23}$ O atoms	½	
	iii)	$2 \times 6.022 \times 10^{23}$ molecules of water [If the reaction is completely occurred].	1	
17.		It is the phenomenon of ejection of electrons by certain metals (like potassium, rubidium, caesium etc.) when light of suitable frequency incident on them. The important results observed in photoelectric effect are: 1. The electrons are ejected from the metal surface as soon as the beam of light strikes the surface. i.e., there is no time lag between the striking of light beam and the ejection of electrons from the metal surface. 2. The number of electrons ejected is proportional to the intensity or brightness of light.	1 2 x 1 = 2	3

		3. For each metal, there is a minimum frequency (known as threshold frequency [ν_0]) below which photoelectric effect is not observed. 4. The kinetic energy of the ejected electrons is directly proportional to the frequency of the incident light. ***[Any 2 required]***		
18.	i) ii)	Radius of n^{th} orbit of H atom (r_n) = 52.9 x n^2 pm The orbit number is not specified in the question. If it is first orbit, n = 1 So, r_1 = **52.9 pm** Limitations of Bohr atom model 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 was unable to explain the splitting of spectral lines in the presence of electric field (Stark effect) and in magnetic field (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]***	1 2 x 1 = 2	3
19.		It is the enthalpy change when an electron is added to the outer most shell of an isolated gaseous atom. Sulphur has more negative electron gain enthalpy than oxygen. This is due to the smaller size and greater electron – electron repulsion in oxygen. **OR,** In oxygen, the incoming electron is added to the smaller 2^{nd} shell, but in sulphur, it is added to the larger 3^{rd} shell. So electronic repulsion is less in sulphur and hence it readily adds electron. Thus electron gain enthalpy of sulphur is more negative than that of oxygen.	1 1 1	3
20.		Lewis structure of O_3 is:  Lewis structure with formal charges is: 	2 3	3
21.		M.O configuration of N_2 is = $\sigma1s^2$ σ^*1s^2 $\sigma2s^2$ σ^*2s^2 $\pi2p_x^2$ $\pi2p_y^2$ $\sigma2p_z^2$ Bond order = ½ [$N_b - N_a$] = ½ [10 – 4] = ½ x 6 = 3 Due to the presence of only paired electrons, N_2 is diamagnetic.	1 ½ ½ 1	3
22.	i)	It states that energy can neither be created nor be destroyed. OR, the total energy in the universe is always a constant. OR, the total energy of an isolated system is always a constant.	1	

	ii)	From the mathematical form of first law, $\Delta U = q + w$ Here q = 0 and w is +ve, since work is done on the system. So, $\Delta U = w$ The system has ***adiabatic*** wall.	 1 1	3
23.		The required equation is: $C_{(graphite)} + 2H_{2(g)} + ½\ O_{2(g)} \longrightarrow CH_3OH_{(l)}$ The given data are: $CH_3OH_{(l)} + {}^3/_2\ O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}$; Δ_rH^0 = -726 kJ/mol ..... (1) $C_{(graphite)} + O_{2(g)} \longrightarrow CO_{2(g)}$; Δ_rH^0 = -393 kJ/mol ..... (2) $H_{2(g)} + ½\ O_{2(g)} \longrightarrow H_2O_{(l)}$; Δ_rH^0 = -286 kJ/mol ..... (3) On reversing equation (1), we get $CO_{2(g)} + 2H_2O_{(l)} \longrightarrow CH_3OH_{(l)} + {}^3/_2\ O_{2(g)}$; Δ_rH^0 = 726 kJ/mol ..... (4) On multiplying eqn. (3) by 2, we get $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$; Δ_rH^0 = -2 x 286 = -572 kJ/mol ..... (5) Now add equations (2) + (4) + (5) and simplify. Then we get, $C_{(graphite)} + 2H_{2(g)} + ½\ O_{2(g)} \longrightarrow CH_3OH_{(l)}$, Δ_rH^0 = -393 + 726 + -572 = **-239 kJ*/mol***	1 1 1	3
24.	i)	a) Entropy is the degree of disorderness or randomness of a system. b) Free energy or Gibb's energy is the maximum amount of available energy that can be converted to useful work. OR, G = H – TS	1 1	3
	ii)	a) $\Delta S > 0$, $\Delta G < 0$	1	
25.	i)	The applications of equilibrium constant are: 1. Prediction of the extent of a reaction. 2. Prediction of the direction of a reaction. 3. Calculation of equilibrium concentrations of reactants and products. ***[Any 2 Required]***	 2 x 1 = 2	3
	ii)	$K_p = K_c(RT)^{\Delta n}$	1	
26.		Solution which resists the change in p^H on dilution or with the addition of small amount of acid or alkali is called Buffer solution. There are two types of buffer solutions – acidic buffer and basic buffer. Acidic buffer is a mixture of a weak acid and its salt with a strong base. E.g. a mixture of acetic acid and sodium acetate. Basic buffer is a mixture of a weak base and its salt with a strong acid. E.g. a mixture of NH_4OH and NH_4Cl.	1 ½ ½ ½ ½	3
Answer any 4 questions from 27 to 31. Each carries 4 scores				
27.	i)	**Molarity** / **Molality** It is the no. of moles of solute present in 1 litre of the solution. / It is the no. of moles of solute present in 1 kg of the solvent. It is temperature dependent. / It is temperature independent. Unit of molarity is mol L^{-1} or, Molar (M) / Unit of molality is mol kg^{-1} or, molal (m) ***[Any one difference required]***	2	4
	ii)	The dilution equation is: $M_1V_1 = M_2V_2$ Here M_1 = 1 M, V_1 = ?, M_2 = 0.2M and V_2 = 1L = 1000 mL So, 1 x V_1 = 0.2 x 1000 OR, V_1 = 200 mL	1 1	

<table>
<tr><td>28.</td><td></td><td>There are 4 quantum numbers:
1. Principal Quantum Number (n): It gives the size the orbit, the energy of electron in an orbit, the shell in which the electron is found and the average distance between the electron and the nucleus.
The possible values of n are 1, 2, 3, 4, etc.
2. Azimuthal Quantum Number (l): It gives the shape of the orbital, the sub shell in which the electron is located and the orbital angular momentum of the electron.
The possible values of l are : l = 0, 1, 2, ... (n-1).
3. Magnetic Quantum Number (m or m_l): It gives the orientation of orbitals in space. The values of m are − l to 0 to + l. For a given 'l' value, there are 2l+1 possible values for m.
4. Spin Quantum Number (s or m_s): It gives the spin orientation of electrons. The values for s may be +½ or -½. +½ represents clock-wise spin and-½ represents anticlock-wise spin.</td><td>1

1

1</td><td>4</td></tr>
<tr><td>29.</td><td>i)

ii)</td><td>a) All of them contain same number of electrons OR, they are isoelectronic species.
b) Increasing order of ionic radii is: $Al^{3+} < Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$
Down a group ionisation enthalpy decreases due to increase in atomic size and shielding or screening effect.</td><td>1

1
2</td><td>4</td></tr>
<tr><td>30.</td><td></td><td><table>
<tr><th>Molecule</th><th>No. of bond pairs</th><th>No. of lone pairs</th><th>Shape of molecule</th><th>Bond angle</th></tr>
<tr><td>H_2O</td><td>2</td><td>2</td><td>v-shape</td><td>104.5^0</td></tr>
<tr><td>CH_4</td><td><u>4</u></td><td><u>0</u></td><td><u>Tetrahedral</u></td><td><u>109^028^l</u></td></tr>
<tr><td>NH_3</td><td><u>3</u></td><td><u>1</u></td><td><u>Pyramidal</u> OR <u>Trigonal pyramidal</u></td><td><u>107^0</u></td></tr>
</table></td><td>8 x ½ = 4</td><td>4</td></tr>
<tr><td>31.</td><td>i)

ii)</td><td>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.
$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$; $\Delta H = -92.38$ kJ mol^{-1}
i) Concentration: Increase the concentration of reactants (N_2 or H_2 or both) increases the rate of forward reaction.
ii) Temperature: Since the forward reaction is exothermic, low temperature favours it.
iii) Pressure: Here the forward reaction results in the decrease in no. of moles of gaseous species. So high pressure favours it.</td><td>1

1

1

1</td><td>4</td></tr>
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