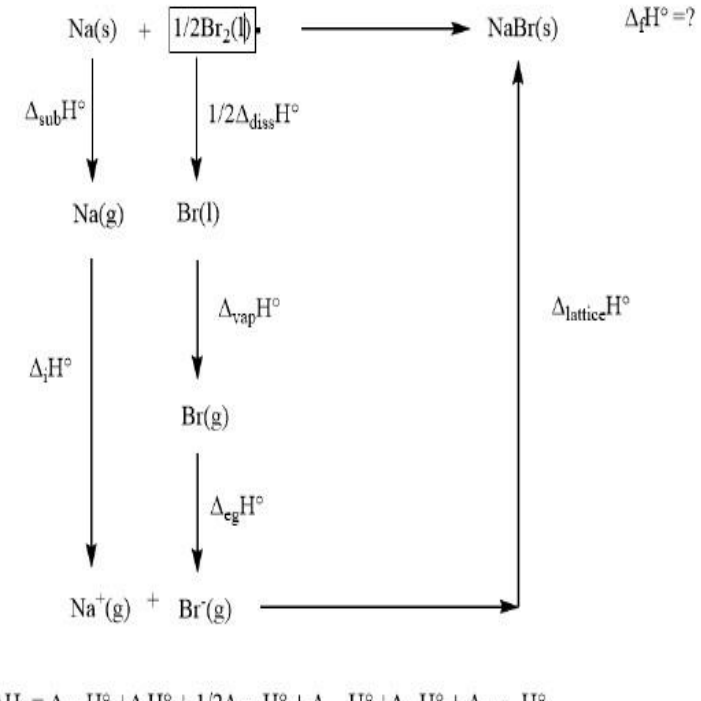
Marking Scheme
Sample Question Paper
Chemistry XI
2024-25

Q. No	Sub part	Value Points	Step wise marks	Total Marks
1		(C) 2	1	1
2		(C) The wavelength of the incident radiation required for ejection of electrons is the same for all the metals.	1	1
3		(D) 496, 737, 577 , 786	1	1
4		(D) $NH_3 > NF_3 > BF_3$	1	1
5		(D) ΔH is positive and ΔS is negative	1	1
6		(B) I^-	)1	1
7		(B) $[Sn^{4+}] [S^{2-}]^2$	1	1
8		(D) P_4	1	1
9		(B) 2- Methylpropene	1	1
10		(D) -315 kJ	1	1
11		(C) 3	1	1
12		(B) Steam Distillation	1	1

13		(B) Both A and R are true but R is not the correct explanation of A	1	1
14		(A) Both A and R are true and R is the correct explanation of A	1	1
15		(A) Both A and R are true and R is the correct explanation of A	1	1
16		(D) A is false but R is true	1	1
17		$\lambda = \frac{h}{mv} = \frac{6.626\ x\ 10^{-34}\ Js}{9.1\ x\ 10^{-31} Kg\ x\ 2.19\ x\ 10^{6} ms^{-1}}$ **= 0.332 x 10^{-9} m = 0.332 nm**	1 1	2
18		(a) S has more negative first electron gain enthalpy. The size of O is much smaller than that of sulphur. As a result, electron electron repulsions in the smaller 2p subshell of oxygen are comparatively larger than those present in the bigger 3p-subshell of sulphur. Therefore, S has a higher tendency to accept an additional election than oxygen. (b) C has more negative electron gain enthalpy than Si. This is because C-atom has smaller size than Si atom and electron - electron repulsions in carbon and silicon unlike oxygen and sulphur are not very large because they contain only four electrons in the outermost shell.	1 1	2
19		(a) Molecular orbital electronic configuration of Be_2 = $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2$ Bond order =½(4-4) =0 Hence, Be_2 doesn't exist (b) p- nitrophenol has a higher boiling point due to the presence of intermolecular hydrogen bond and that's why it is not steam volatile.	1 1	2

20.		overall reaction: $XeO_6^{4-} + F^- \longrightarrow XeO_3 + F_2$ (Acidic medium) $XeO_6^{4-} + 2e^- \longrightarrow XeO_3$ (Reduction) $2F^- \longrightarrow F_2 + 2e^-$ (Oxidation) $XeO_6^{4-} + 2F^- \longrightarrow XeO_3 + F_2$ Acidic medium: $XeO_6^{4-} + 2F^- + 6H^+ \longrightarrow XeO_3 + F_2 + 3H_2O$ OR Overall reaction :- $Cl_2(l) \rightarrow Cl^-(aq) + ClO^-(aq)$ Half cell reaction at anode :- $Cl_2(l) + 2H_2O(l) + 4OH^-(aq) \rightarrow 2ClO^-(aq) + 4H_2O(l) + 2e^-$ Half cell reaction at cathode :- $Cl_2(l) + 2e^- \rightarrow 2Cl^-(aq)$ Adding above two half cell reaction, we get :- $Cl_2(l) + 2OH^-(aq) \rightarrow ClO^-(aq) + 4H_2O(l) + Cl^-(aq)$	½ ½ 1 ½ ½ 1	2

21		Carbanion A is more stable Reason:- B is destabilized by electron withdrawing effect of $-NO_2$.	1 1	2
22.	(a)	$2H_2 + O_2 \rightarrow 2\ H_2O$ According to the above equation 2 vol. Of H_2 requires 1 vol of O_2 Therefore, 16 vol of H_2 will require 8 vol of O_2 Amount of O_2 in the reaction mixture is 6 vol , hence O_2 is the limiting reagent 1 vol of O_2 produces 2 vol of H_2O Hence, 6 vol of O_2 will produce 12 vol of H_2O	1 1	
	(b)	Law of multiple proportions.	1	3
23.		(i) $Al^{3+} < Mg^{2+} < Li^{+} < K^{+}$ (ii) Formation of Cl^- from Cl (g) is exothermic because its first electron gain enthalpy is negative. $Cl\ (g) + e^- \rightarrow Cl^-\ (g)$ ΔH = - ve Formation of O^{2-} involves two processes : $O\ (g) + e^- \rightarrow O^-$ ΔH_1 = -ve $O^-(g) + e^- \rightarrow O^{2-}$ ΔH_2 = +ve $\Delta H_2 > \Delta H_1$ So, ΔH For the formation of O^{2-} (g) from O(g) gas is positive.	1 2	3

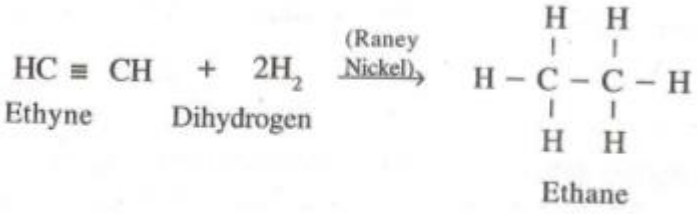
24.			2 1	3
25.		Mass of H_2SO_4 = volume x density = 100mL x 1.84gmL^{-1} = 184 g Solution contains 98% H_2SO_4 by mass Hence , amount of H_2SO_4 in the solution = $\frac{98 \times 184}{100}$ =180.32g Molar mass of H_2SO_4 = 2 + 32 + 64 = 98 g mol^{-1} $n = \frac{given\ mass}{molar\ mass} = \frac{180.32}{98} = 1.84\ moles$ According to the equation 1 mole of H_2SO_4 reacts with 2 moles of NaOH Therefore, 1.84 moles of H_2SO_4 requires 2 x 1.84 = 3.68 moles of NaOH	1 1	3

$$Molarity = \frac{no.of\ moles}{Volume\ of\ solution\ in\ litres}$$

$$Volume = \frac{3.68}{0.1} = 36.8\ L$$

1

26



$\Delta_{reaction}H = \Sigma$ Bond Enthalpy(r) - Σ Bond Enthalpy (p)

½

Bond Enthalpies of Reactants	Bond Enthalpies of Products
C≡C = 600 KJ mol^{-1} 2xC-H = 2x410 = 820 KJ mol^{-1} 2xH-H = 2x400 = 800 KJ mol^{-1} Total Bond Enthalpy of Reactants = 2220 KJ mol^{-1}	C-C = 350 KJ mol^{-1} 6xC-H = 6x410 = 2460 KJ mol^{-1} Total Bond Enthalpy of Reactants = 2810 KJ mol^{-1}

1 + 1

$\Delta_{reaction}H$ = 2220 - 2810 = - 590 KJ mol^{-1}

½

OR

3

26

As work is being done against external pressure, the process is irreversible hence,

½

$W = -P_{ext}\ \Delta V$

½

= 2.5 (6 - 4) = -5.0 atm-L (1atm-L = 101.3J)

½

W = -5.0 x 101.3 = -506.5 J

For isothermal expansion ΔU = 0

So, q = -W = 506.5J

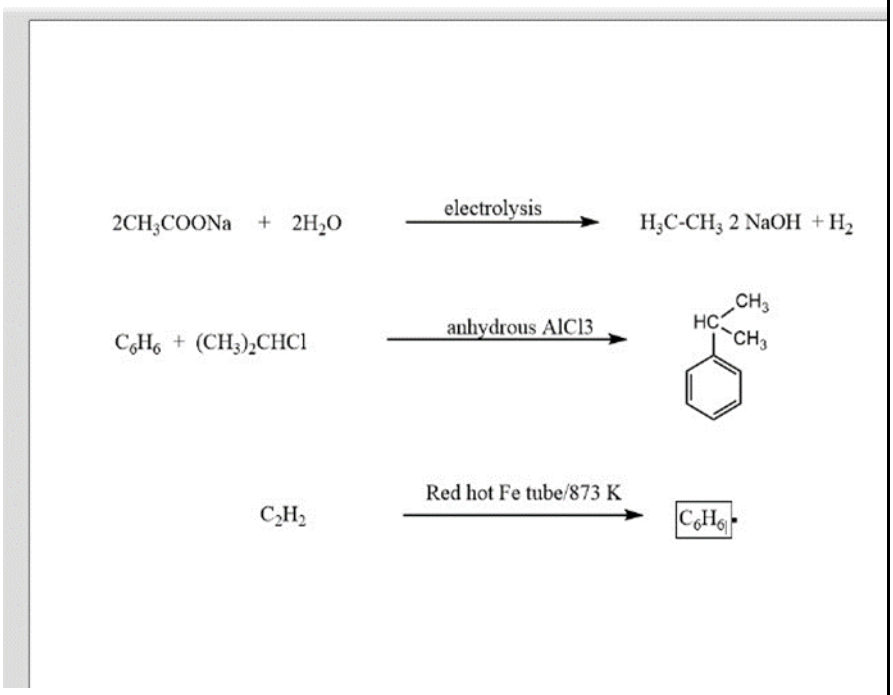
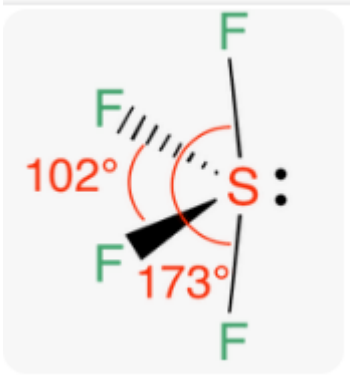
½

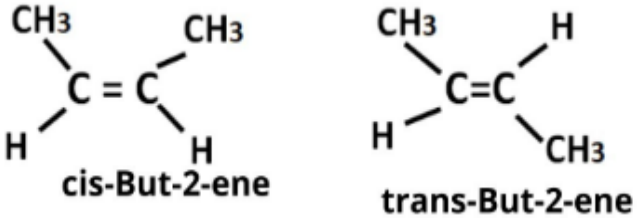
This heat is used to heat 1 mole of water

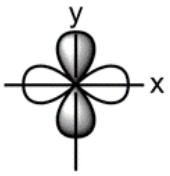
½

So, q = m c ΔT

		506.5 = 18 x 4.2 x ΔT ΔT = 6.725 ^{0}C Final Temperature = ΔT + Initial Temperature Final Temperature = 20 + 6.725 = 26.725 ^{0}C	½	
27.		Element 'X' is Sulphur The white ppt formed is of BaSO4 which has a molar mass =233 g/mol $n = \frac{given\ mass}{molar\ mass} = \frac{0.5}{233} = 0.00215\ moles$ **Since 1 mole of barium sulphate contains 1 mole of sulphur ,** **the number of moles of sulfur is also 0.00215 mol.** **The mass of sulfur is= number of moles x molar mass** **= 0.00215 mol x 32 g/mol** **= 0.0688 g** **The percentage of sulfur in the organic compound is:** $\%S = \frac{mass\ of\ sulphur}{mass\ of\ organic\ compound}\ x\ 100 = \frac{0.0688}{0.16}\ x\ 100 = 42.5\ \%$	1 ½ ½ 1	3

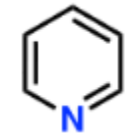
28.			1 1 1	 3
29.		1. Based on VSEPR (valence shell electron pair repulsion theory), the four bond pairs of electrons on nitrogen will repel each other. As a result, they will be pushed apart giving the ammonium ion-molecule a tetrahedral shape. Therefore, it has tetrahedral electron geometry. 2. The central atom in the Sulphur tetrafluoride molecule has 5 electron pairs. There are 4 bond pairs and one lone pair. It has a trigonal bipyramidal geometry (or structure). The lone pair is in the equatorial plane giving an overall see-saw shape.  3. The atomic number of phosphorus is 15. The electronic configuration of phosphorus is:	1 1 2	4

		P=$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^3$ The hybridization in PCl_5 is sp^3d. Therefore, the shape of PCl_5 is trigonal bipyramidal. The two axial bond pairs experience more repulsion than the three equatorial bond pairs. This makes the axial bond relatively weaker than the equatorial bond and they get easily broken. OR (i) This is mainly due to the presence of a lone pair which usually exerts greater repulsion on the bonding orbitals. Hence bond angle is less than $109^O28''$. (ii) The bond angle in NH_3 is larger than in PH_3 because of the lower electronegativity of P which permits electron-density to be displaced towards hydrogen to a greater extent than in the case of NH_3.	2	
30.		1. Trans-but-2-ene 2. Geometrical Isomerism 3.  OR The melting point of trans isomers is generally higher than that of cis isomers because in trans isomer, bulky groups lie on the opposite side of the double bond. Therefore, the molecule is symmetrical and hence packed well in the crystal lattice. Boiling point of cis isomers is higher than trans isomers because cis isomers is more polar and hence they have strong intermolecular forces between the molecules.	1 1 2 2	4

31.	(a)	**l=2 and m=0**	1	1X5 =5
	(b)	$no.of\ emission\ lines = \frac{(n_2-n_1)(n_2-n_1+1)}{2} = \frac{(5-2)(5-2+1)}{2} = 6$	1	
	(c)	$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$	1	
	(d)	Hund's Rule of Maximum Multiplicity: Pairing of electrons in the orbitals belonging to the same subshell (p, d or f) does not take place until each orbital belonging to that subshell has got one electron each , that is , it is singly filled with parallel spin.	1	
	(e)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \ 3d^{10}\ 4s^1$	1	
	(f)	 $d_{x^2-y^2}$	1	
	(g)	(i) 4d (ii) 6s	½ ½	
32.	(a)	aA + bB ⇋ cC + dD $K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b}$ • ideal gas law: $PV = nRT$ $P = \frac{n}{V}RT$ $K_p = \frac{(P_C)^c(P_D)^d}{(P_A)^a(P_B)^b} = \frac{(\frac{n}{V}RT)^c(\frac{n}{V}RT)^d}{(\frac{n}{V}RT)^a(\frac{n}{V}RT)^b}$ Plugging this into the expression for K_p So, $K_P = K_C (RT)^{\Delta n}$	½ ½ 1	5

	(b)	$H_2SO_4(aq) \rightarrow 2H^+ + SO_4^{2-}$ 0.1M, 100 ml 10 millimoles 20 millimoles	½	
		$NaOH \rightarrow Na^+ + OH^-$ 0.1M, 100 ml 10 millimoles 10 millimoles	½	
		Number of millimoles of H^+ and OH^- neutralized in the mixture = 10 millimoles		
		Number of millimoles of H^+ ion left unreacted in the mixture = 20 - 10 = 10 millimoles	½	
		$[H^+]$ in the mixture = millimoles of H^+ ion / total volume of mixture 10 / 200 = 0.05 M pH = -log$[H^+]$ pH = - log($5x10^{-2}$) pH = 1.3010	½	
	(c)	Common ion effect - It is a phenomenon in which the degree of dissociation of any weak electrolyte is suppressed by addition of a small amount of strong electrolyte containing a common ion.	1	
		OR		
	(a)	Buffer solution - It is a water solvent-based solution which consists of a mixture containing a weak acid and the conjugate base of the weak acid or a weak base and the conjugate acid of the weak base. They resist a change in pH upon dilution or upon the addition of a small amount of acid/alkali to them.	1	
	(b)	$\Delta G^0 = -2.303\ R\ T\ \log K_c$ $\Delta G^0 = -2.303x8.314x300\ \log(2x10^{13})$ $\Delta G^0 = -7.64 \times 10^4\ J\ mol^{-1}$	1 ½ ½	
	(c)	$HF < H_2O < NH_3$ (Increasing order of pH) Reason:- Fluorine, oxygen and nitrogen belong to the same row of the periodic table. H-A bond priority becomes the deciding factor for determining the acidic strength. As the	1	

		electronegativity of A increases, the strength of acid also increases and pH decreases.	1	

33.	a)	a) and d) i.e.  . and  are aromatic as are planar, show complete delocalisation and follow Huckel's rule .	½ ½	
	b)	1. **Generation of the Acylium Ion:** $\mathrm{RCOCl} + \mathrm{AlCl_3} \rightarrow \mathrm{RCO^+} + \mathrm{AlCl_4^-}$ 2. **Electrophilic Attack on Benzene:** $\mathrm{C_6H_6} + \mathrm{RCO^+} \rightarrow \mathrm{C_6H_6RCO^+}$ 3. **Restoration of Aromaticity:** $\mathrm{C_6H_6RCO^+} \rightarrow \mathrm{C_6H_5RCO} + \mathrm{H^+}$ $\mathrm{H^+} + \mathrm{AlCl_4^-} \rightarrow \mathrm{HCl} + \mathrm{AlCl_3}$	1 1 1	
	a)	OR Nitro group is electron withdrawing group. Due to resonance the ortho and para positions get positive charges hence incoming electrophile attacks at meta position whereas amino group is electron donating group, ortho and para positions develop negative charge hence the incoming electrophile is directed at ortho and para positions.	1	

	b)	1. **Formation of free radicals:** Benzoyl peroxide decomposes upon heating to form benzoyloxyl radicals: $$(C_6H_5CO)_2O_2 \rightarrow 2C_6H_5CO\cdot$$ $$C_6H_5\cdot + HBr \rightarrow C_6H_6 + Br\cdot$$ 2.Addition of bromine radical to but-1-ene: The bromine radical adds to the double bond of but-1-ene, forming a secondary radical (because the secondary radical is more stable than the primary radical): $$CH_2 = CH - CH_2 - CH_3 + Br\cdot \rightarrow CH_2\cdot - CHBr - CH_2 - CH_3$$ 3. **Formation of the final product:** The secondary radical reacts with another molecule of HBr to form 1-bromobutane and regenerate the bromine radical, allowing the chain reaction to continue: CH2· – CHBr – CH2 – CH3+HBr→CH3 – CHBr – CH2 – CH3+Br·	1 1 1 1 1	5