BSEH MARKING SCHEME

CLASS- XII **Chemistry (March-2024)** **Code: A**

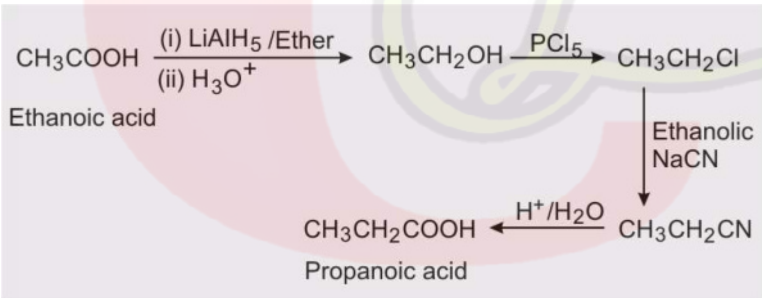
- **The answer points given in the marking scheme are not final. These are suggestive and indicative. If the examinee has given different, but appropriate answers, then he should be given appropriate marks.**

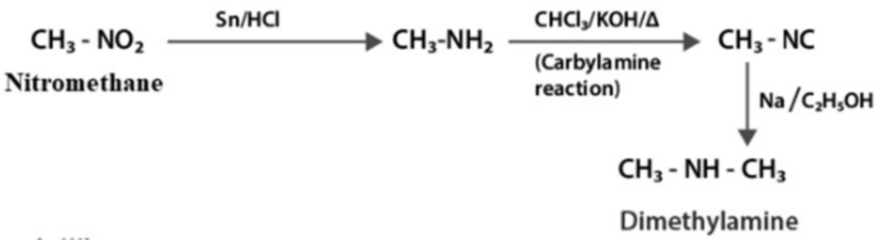
Q. No.	Answers	Marks
1.	a) Copper dissolved in Gold.	1
2.	b) Increases with increase in temperature	1
3.	d) $S\ m^{-1}$	1
4.	d) All of these	1
5.	a) 0	1
6.	b) Frequency factor	1
7.	a) Sc	1
8.	a) Vitamin B_{12}	1
9.	c) NaI	1
10.	b) n-Butane	1
11.	b) 3-Phenylprop-2-en-1-al	1
12.	c) Position isomerism	1
13.	b) Ribose	1
14.	d) Vitamin K	1
15.	a) Both A and R are true, and R is the correct explanation of A.	1

<table>
<tr><td>16.</td><td>a) Both A and R are true, and R is the correct explanation of A.</td><td>1</td></tr>
<tr><td>17.</td><td>a) Both A and R are true, and R is the correct explanation of A.</td><td>1</td></tr>
<tr><td>18.</td><td>d) A is false but R is true</td><td>1</td></tr>
<tr><td>19.</td><td>
<table>
<tr><td>Ideal Solutions</td><td>Non-ideal solutions</td></tr>
<tr><td>1. Those liquid-liquid solutions which obey Raoults' law at each concentration.</td><td>1. Those liquid-liquid solutions which do not obey Raoults' law at each concentration.</td></tr>
<tr><td>2. The molecular interactions of solution is same as that of solute and solvent.</td><td>2. The molecular interactions of solution is not same as that of solute and solvent.</td></tr>
<tr><td>3. $\Delta V_{mix} = 0$</td><td>3. $\Delta V_{mix} \neq 0$</td></tr>
<tr><td>4. $\Delta H_{mix} = 0$</td><td>4. $\Delta H_{mix} \neq 0$</td></tr>
</table>
(any two differences, 1 mark each)
Or
Given molarity (M) = 0.15 M
Volume (V) = 250 mL
Molar mass of solute (M_2) = 122 g/mol
Mass of solute (w_2) =?
$$\because\ M = \frac{w_2 \times 1000}{M_2 \times V}$$
$(^1/_2\ mark)$
$$\therefore\ w_2 = \frac{M \times M_2 \times V}{1000}$$
</td><td>2</td></tr>
</table>

	$$\Rightarrow w_2 = \frac{122 \times 250 \times 0.15}{1000} g$$ $(^1/_2 \, mark)$ $$\Rightarrow w_2 = 4.575 \, g$$ $(^1/_2 \, mark \; for \; correct \; answer, {}^1/_2 \, mark \; for \; unit)$	
20.	First Law: The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte. (1 mark) Second Law: The amounts of different substances liberated by the same quantity of electricity passing through the electrolytic solution are proportional to their chemical equivalent weights. (1 mark)	2
21.	The reaction which is not of first order but behaves like first order is called pseudo first order reaction. (1 mark) Example: acid hydrolysis of ethyl acetate or inversion of cane sugar	2

	(Any one, 1 mark)	
22.	Interstitial compounds are those which are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals. (1 mark) Interstitial compounds are well known for transition compounds due to their closed crystalline structure with voids in them. The atomic size of transition metals is very large hence have large voids to occupy these small atoms. (1 mark)	2
23.	Alkyl halides react with sodium in dry ether to give hydrocarbons containing double the number of carbon atoms present in the halide. This reaction is known as Wurtz reaction. (1 mark) $\underset{\text{Methyl bromide}}{2CH_3Br} + 2Na \xrightarrow{dry\ eth} \underset{\text{Ethane}}{CH_3CH_3} + 2NaBr$ (1 mark) Or Groups which possess two different nucleophilic centres and are called ambident nucleophiles. (1 mark) nitrite ion represents an ambident nucleophile with two different points of linkage. The linkage through	2

<table>
<tr><td></td><td>oxygen results in alkyl nitrites while through nitrogen atom, it leads to nitroalkanes.
(1 mark)</td><td></td></tr>
<tr><td>24.</td><td>i) Methanoic acid is used in rubber, textile, dyeing, leather and electroplating industries.
ii) Ethanoic acid is used as solvent and as vinegar in food industry.
iii) Hexanedioic acid is used in the manufacture of nylon-6, 6.
iv) Esters of benzoic acid are used in perfumery.
v) Sodium benzoate is used as a food preservative.
vi) Higher fatty acids are used for the manufacture of soaps and detergents.
(Any two, 1 mark each)</td><td>2</td></tr>
<tr><td>25.</td><td>i)


(1 mark)
ii)


(1 mark)</td><td>2</td></tr>
</table>

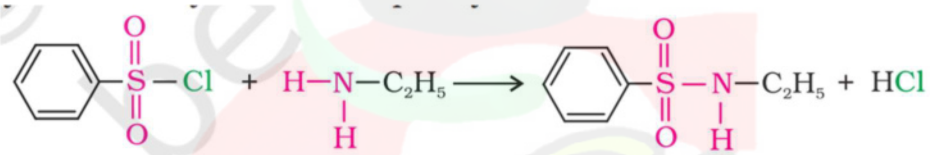
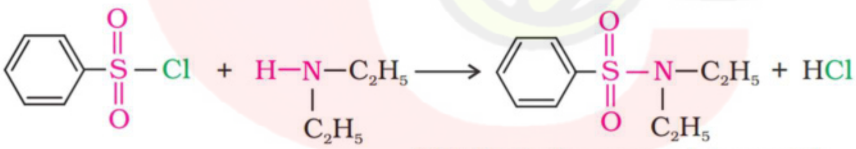
26.	Here Vapour Pressure of solution at normal boiling point (p_1) = 1.004 bar Vapour Pressure of pure water at normal boiling point (p^o_1) = 1.013 bar (½ mark) Let mass of solution (W) = 100 g (½ mark) Mass of solute (w_2) = 2 g Mass of solvent (w_1) = 98 g Molar mass of solvent (water) (M_1) = 18 g/mol According to Raoult's law: $\frac{p_1^o - p_1}{p_1^o} = \frac{\frac{w_2}{M_2}}{\frac{w_1}{M_1} + \frac{w_2}{M_2}}$ (½ mark) $\Rightarrow \frac{1.013-1.004}{1.013} = \frac{\frac{2}{M_2}}{\frac{98}{18}+\frac{2}{M_2}}$ (½ mark) $\Rightarrow M_2 = 40.98\ g/mol$ (½ mark for answer, ½ mark for unit)	3
27.	T_1=298K After the increase in temperature by 10K	3

	$T_2=(T_1+10)K$ $T_2=298+10=308K$ (½ mark) Let us take the value of $K_1=K$ Now, $K_2=2K$ Also, $R=8.314JK^{-1}mol^{-1}$ Now, substituting these values in the Arrhenius equation: $$log(\frac{k_2}{k_1}) = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$ (1 mark) We get: $$log(\frac{2k}{k}) = \frac{E_a}{2.303 \times 8.314}\left[\frac{308 - 298}{308 \times 298}\right]$$ (½ mark) $\therefore E_a = 52897.78Jmol^{-1}$ $=52.9kJmol^{-1}$ (½ mark for answer, ½ mark for unit)	

28.	When a particular oxidation state becomes less stable relative to other oxidation states, one lower, one higher, it is said to undergo disproportionation. (1 mark) For example, manganese (VI) becomes unstable relative to manganese (VII) and manganese (IV) in acidic solution. $3MnO_4^{2-} + 4H^+ \rightarrow MnO_4^- + MnO_2 + 2H_2O$ (1 mark) copper (I) compounds are unstable in aqueous solution and undergo disproportionation. $2Cu^+ \rightarrow Cu^{2+} + Cu$ (1 mark) Or Chromates are obtained by the fusion of chromite ore ($FeCr_2O_4$) with sodium or potassium carbonate in free access of air. The reaction with sodium carbonate occurs as follows: $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$ (1 mark) The yellow solution of sodium chromate is filtered and acidified with sulphuric acid to give a solution	3

	from which orange sodium dichromate can be crystallised. $2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$ (1 mark) Sodium dichromate is more soluble than potassium dichromate. The latter is therefore, prepared by treating the solution of sodium dichromate with potassium chloride and orange crystals of potassium dichromate crystallise out. $Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$ (1 mark)	
29.	Aryl halides are extremely less reactive towards nucleophilic substitution reactions due to the following reasons: (i) <u>Resonance effect</u>: In haloarenes, the electron pairs on halogen atom are in conjugation with p-electrons of the ring and the resonating structures are possible. C–Cl bond acquires a partial double bond character due to resonance. As a result, the bond cleavage in haloarene is difficult than haloalkane and therefore, they are less	3

	reactive towards nucleophilic substitution reaction. (ii) <u>Difference in hybridisation of carbon atom in C–X bond:</u> The sp^2 hybridised carbon with a greater s-character is more electronegative and can hold the electron pair of C–X bond more tightly than sp^3-hybridised carbon in haloalkane with less s-character. Thus, C–Cl bond length is shorter in haloarene. Since it is difficult to break a shorter bond than a longer bond, therefore, haloarenes are less reactive towards nucleophilic substitution reaction. (iii) <u>Instability of phenyl cation:</u> In case of haloarenes, the phenyl cation formed as a result of self-ionisation will not be stabilised by resonance and therefore, S_N1 mechanism is ruled out. (iv) Because of the possible <u>repulsion</u>, it is less likely for the electron rich nucleophile to approach electron rich arenes. (any three, 1 mark each)	

30.	The Hinsberg test is used for the identification of primary, secondary and tertiary amines. (½ mark) Benzenesulphonyl chloride ($C_6H_5SO_2Cl$), which is also known as Hinsberg's reagent, reacts with primary and secondary amines to form sulphonamides. (1 mark) Tertiary amines do not react with Hinsberg's reagent. (½ mark)  *N*-Ethylbenzenesulphonamide (soluble in alkali) (½ mark)  N,N-Diethylbenzenesulphonamide (Insoluble in alkali) (½ mark) Or i) Amines undergo protonation to give amide ion. Similarly, alcohol loses a proton to give alkoxide ion.	3

		In an amide ion, the negative charge is on the N-atom whereas in alkoxide ion, the negative charge is on the O-atom. Since O is more electronegative than N, O can accommodate the negative charge more easily than N. As a result, the amide ion is less stable than the alkoxide ion. Hence, amines are less acidic than alcohols of comparable molecular masses. (1 mark)	
	ii)	Intermolecular hydrogen bonding is present in primary amines but not in tertiary amines (H-atom absent in amino group) so primary amines have higher boiling point than tertiary amines. (1 mark)	
	iii)	In aromatic amines, the $-NH_2$ group is attached to a $-C_6H_5$ group, which is an electron withdrawing group. So, the availability of a lone pair of electrons on N is decreased. Therefore, aliphatic amines are more basic than aromatic amines.	

	(1 mark)	
31.	i) Phenol (1mark) ii) 8 (1 mark) Or Salicylic Acid (1 mark) iii) Reimer-Tiemann reaction (1 mark) iv) Aspirin possesses analgesic, anti-inflammatory and antipyretic properties. (any one, 1 mark)	4
32.	i) Amino acids have amino ($-NH_2$) group, basic in nature and accepts a proton and COOH group loses a proton forming a dipolar ion, called the Zwitter ion. In this form, amino acids behave both as acids and bases, so they are amphoteric in nature. (1 mark) ii) Peptide bond (1 mark) iii) If more than ten α-amino acids are joined together by peptide bond the structure thus formed is called Polypeptides. (1 mark)	

	iv) Glycine/ Alanine/ Glutamic acid/ Aspartic acid/ Glutamine/ Asparagine/ Serine/ Cysteine/ Tyrosine/ Proline (Any one, 1 mark) Or 20 (1 mark)	
33.	Nernst equation: $$E_{cell} = E^{o}_{cell} - \frac{0.0591}{n} log \frac{Mg^{2+}}{Cu^{2+}}$$ (1 mark) Calculation of E_{cell}: $$E_{cell} = 2.70 - \frac{0.0591}{2} log \frac{0.001}{0.0001}$$ (½ mark) $$E_{cell} = 2.70 - \frac{0.0591}{2} log 10$$ (½ mark) $$E_{cell} = 2.67\, V$$ (½ mark for answer, ½ mark for unit) Calculation of $\Delta_r G^o$: $$\Delta_r G^\circ = -nFE^\circ_{cell}$$ (½ mark) $$\Delta_r G^\circ = -2 \times 96500 \times 2.70$$ (½ mark) $$\Delta_r G^\circ = -521100\, Jmol^{-1} = -521.1\, kJmol^{-1}$$ (½ mark for answer, ½ mark for unit) Or	5

	Given $\kappa = 7.896\times10^{-5}$ S cm^{-1} c = 0.00241 M Λ_m^0 = 390.5 S cm^2 mol^{-1} Molar conductivity $\Lambda_m = \frac{\kappa \times 1000}{c}$ (½ mark) $$\Lambda_m = \frac{7.896 \times 10^{-5} \times 1000}{0.00241}$$ (½ mark) $$\Lambda_m = 32.76\, S\, cm^2\, mol^{-1}$$ (½ mark for answer, ½ mark for unit) Degree of dissociation; $\alpha = \frac{\Lambda_m}{\overset{\circ}{\Lambda}_m}$ (½ mark) $$\alpha = \frac{32.76}{390.5} = 0.084$$ (½ mark) Dissociation constant; $K_a = \frac{c\alpha^2}{1-\alpha}$ (½ mark) $$K_a = \frac{0.00241 \times (0.084)^2}{1 - 0.084}$$ (½ mark) $$K_a = 1.86 \times 10^{-5}$$ (1 mark)	
34.	i) 3 (1 mark) ii) 3 (1 mark)	5

iii) 2

(1 mark)

iv) 3

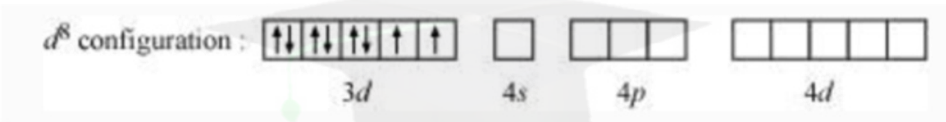
(1 mark)

v) 3

(1 mark)

Or

Ni is in the +2 oxidation state i.e., in d^8 configuration.



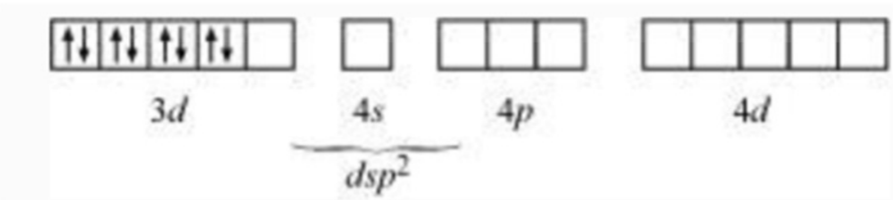
(½ mark)

There are 4 CN^- or Cl^- ions. Thus, it can either have a tetrahedral geometry or square planar geometry.

(1 mark)

Since CN^- ion is a strong field ligand, it causes the pairing of unpaired 3*d* electrons.

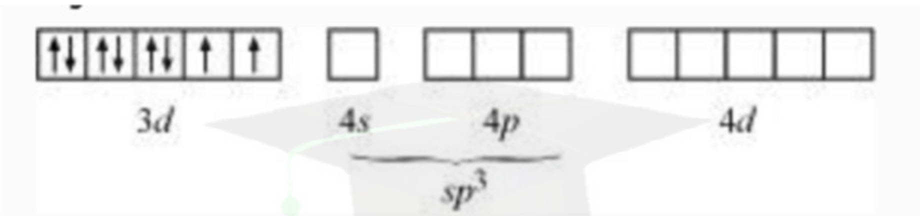
(½ mark)

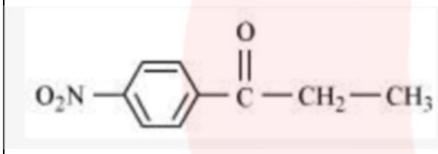
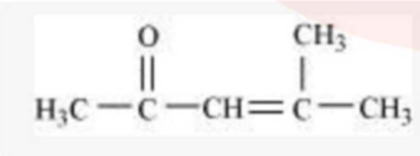
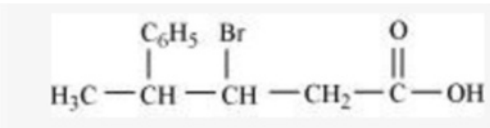


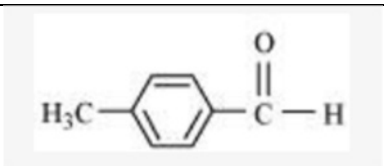
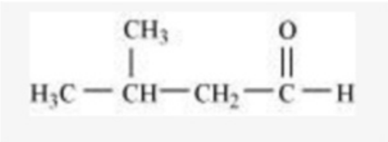
(½ mark)

It now undergoes dsp^2 hybridization.

(½ mark)

	Since all electrons are paired, it is diamagnetic. (½ mark) In case of $[NiCl_4]^{2-}$, Cl^- ion is a weak field ligand. Therefore, it does not lead to the pairing of unpaired 3*d* electrons. (½ mark) Therefore, it undergoes sp^3 hybridization.  (½ mark) Since there are 2 unpaired electrons in this case, it is paramagnetic in nature. (½ mark)	
35.	Case I Propanal + Propanal + dil. NaOH → $CH_3CH_2CH{=}C(CH_3)CHO$ (2-Methylpent-2-en-1-al) (½ mark + ½ mark) Case II Butanal + Butanal + dil. NaOH → $CH_3CH_2CH_2CH{=}C(C_2H_5)CHO$ (2-Ethylhex-2-en-1-al) (½ mark + ½ mark) Case III Butanal + Propanal + dil. NaOH → $CH_3CH_2CH_2CH{=}C(CH_3)CHO$ (2-Methylhex-2-en-1-al)	5

	(½ mark + ½ mark) Case IV Propanal + Butanal + dil. NaOH → $CH_3CH_2CH=C(C_2H_5)CHO$ (2-Ethylpent-2-en-1-al) (½ mark + ½ mark) In case III butanal act as electrophile and propanal act as nucleophile Or In case IV propanal act as electrophile and butanal act as nucleophile (any one, ½ mark + ½ mark) Or i)  (1 mark) ii)  (1 mark) iii)  (1 mark) iv)	

	 (1 mark) v)  (1 mark)		