

## 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 <sub>12</sub>	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

16.	a) Both A and R are true, and R is the correct explanation of A.	1										
17.	a) Both A and R are true, and R is the correct explanation of A.	1										
18.	d) A is false but R is true	1										
19.	<table border="1"> <thead> <tr> <th>Ideal Solutions</th> <th>Non-ideal solutions</th> </tr> </thead> <tbody> <tr> <td>1. Those liquid-liquid solutions which obey Raoult's law at each concentration.</td> <td>1. Those liquid-liquid solutions which do not obey Raoult's 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. <math>\Delta V_{mix} = 0</math></td> <td>3. <math>\Delta V_{mix} \neq 0</math></td> </tr> <tr> <td>4. <math>\Delta H_{mix} = 0</math></td> <td>4. <math>\Delta H_{mix} \neq 0</math></td> </tr> </tbody> </table> <p>(any two differences, 1 mark each)</p> <p>Or</p> <p>Given molarity (M) = 0.15 M  Volume (V) = 250 mL  Molar mass of solute (<math>M_2</math>) = 122 g/mol  Mass of solute (<math>w_2</math>) = ?</p> $\therefore M = \frac{w_2 \times 1000}{M_2 \times V}$ <p style="text-align: right;">(<math>\frac{1}{2}</math> mark)</p> $\therefore w_2 = \frac{M \times M_2 \times V}{1000}$	Ideal Solutions	Non-ideal solutions	1. Those liquid-liquid solutions which obey Raoult's law at each concentration.	1. Those liquid-liquid solutions which do not obey Raoult's law at each concentration.	2. The molecular interactions of solution is same as that of solute and solvent.	2. The molecular interactions of solution is not same as that of solute and solvent.	3. $\Delta V_{mix} = 0$	3. $\Delta V_{mix} \neq 0$	4. $\Delta H_{mix} = 0$	4. $\Delta H_{mix} \neq 0$	2
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	$\Rightarrow w_2 = \frac{122 \times 250 \times 0.15}{1000} g$ <p style="text-align: right;">(1/2 mark)</p> $\Rightarrow w_2 = 4.575 g$ <p style="text-align: center;">(1/2 mark for correct answer, 1/2 mark for unit)</p>	
20.	<p>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.</p> <p style="text-align: right;">(1 mark)</p> <p>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.</p> <p style="text-align: right;">(1 mark)</p>	2
21.	<p>The reaction which is not of first order but behaves like first order is called pseudo first order reaction.</p> <p style="text-align: right;">(1 mark)</p> <p>Example: acid hydrolysis of ethyl acetate or inversion of cane sugar</p>	2



	oxygen results in alkyl nitrites while through nitrogen atom, it leads to nitroalkanes.  (1 mark)	
24.	<p>i) Methanoic acid is used in rubber, textile, dyeing, leather and electroplating industries.</p> <p>ii) Ethanoic acid is used as solvent and as vinegar in food industry.</p> <p>iii) Hexanedioic acid is used in the manufacture of nylon-6, 6.</p> <p>iv) Esters of benzoic acid are used in perfumery.</p> <p>v) Sodium benzoate is used as a food preservative.</p> <p>vi) Higher fatty acids are used for the manufacture of soaps and detergents.</p> <p>(Any two, 1 mark each)</p>	2
25.	<p>i)</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <math display="block">\text{CH}_3\text{COOH} \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) LiAlH}_5/\text{Ether}} \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{PCl}_5} \text{CH}_3\text{CH}_2\text{Cl}</math> <p style="text-align: center;">Ethanoic acid</p> <div style="display: flex; justify-content: center; align-items: center;"> <div style="text-align: center;"> <math>\downarrow</math>            Ethanolic            NaCN         </div> <div style="margin: 0 10px;"> <math>\downarrow</math> </div> <div style="text-align: center;"> <math>\text{CH}_3\text{CH}_2\text{CN}</math> </div> </div> <div style="display: flex; justify-content: center; align-items: center; margin-top: 10px;"> <div style="text-align: center;"> <math>\xleftarrow{\text{H}^+/\text{H}_2\text{O}}</math> </div> <div style="margin: 0 10px;"> <math>\text{CH}_3\text{CH}_2\text{COOH}</math> </div> </div> <p style="text-align: center;">Propanoic acid</p> </div> <p>(1 mark)</p> <p>ii)</p> <div style="text-align: center; margin: 10px 0;"> <math display="block">\text{CH}_3 - \text{NO}_2 \xrightarrow{\text{Sn/HCl}} \text{CH}_3 - \text{NH}_2 \xrightarrow[\text{(Carbylamine reaction)}]{\text{CHCl}_3/\text{KOH}/\Delta} \text{CH}_3 - \text{NC}</math> <p style="text-align: center;">Nitromethane</p> <div style="display: flex; justify-content: center; align-items: center; margin-top: 10px;"> <div style="text-align: center;"> <math>\downarrow</math>            Na/C<sub>2</sub>H<sub>5</sub>OH         </div> <div style="margin: 0 10px;"> <math>\downarrow</math> </div> <div style="text-align: center;"> <math>\text{CH}_3 - \text{NH} - \text{CH}_3</math> </div> </div> <p style="text-align: center;">Dimethylamine</p> </div> <p>(1 mark)</p>	2

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

<p><math>T_2=(T_1+10)K</math></p> <p><math>T_2=298+10=308K</math></p> <p>(½ mark)</p> <p>Let us take the value of <math>K_1=K</math></p> <p>Now, <math>K_2=2K</math></p> <p>Also, <math>R=8.314JK^{-1}mol^{-1}</math></p> <p>Now, substituting these values in the Arrhenius equation:</p> $\log\left(\frac{k_2}{k_1}\right) = \frac{E_a}{2.303R} \left[ \frac{T_2 - T_1}{T_1 T_2} \right]$ <p>(1 mark)</p> <p>We get:</p> $\log\left(\frac{2k}{k}\right) = \frac{E_a}{2.303 \times 8.314} \left[ \frac{308 - 298}{308 \times 298} \right]$ <p>(½ mark)</p> <p><math>\therefore E_a = 52897.78Jmol^{-1}</math></p> <p><math>= 52.9kJmol^{-1}</math></p> <p>(½ mark for answer, ½ mark for unit)</p>	
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28.	<p>When a particular oxidation state becomes less stable relative to other oxidation states, one lower, one higher, it is said to undergo disproportionation.</p> <p style="text-align: right;">(1 mark)</p> <p>For example, manganese (VI) becomes unstable relative to manganese (VII) and manganese (IV) in acidic solution.</p> $3\text{MnO}_4^{2-} + 4\text{H}^+ \rightarrow \text{MnO}_4^- + \text{MnO}_2 + 2\text{H}_2\text{O}$ <p style="text-align: right;">(1 mark)</p> <p>copper (I) compounds are unstable in aqueous solution and undergo disproportionation.</p> $2\text{Cu}^+ \rightarrow \text{Cu}^{2+} + \text{Cu}$ <p style="text-align: right;">(1 mark)</p> <p style="text-align: center;">Or</p> <p>Chromates are obtained by the fusion of chromite ore (<math>\text{FeCr}_2\text{O}_4</math>) with sodium or potassium carbonate in free access of air. The reaction with sodium carbonate occurs as follows:</p> $4\text{FeCr}_2\text{O}_4 + 8\text{Na}_2\text{CO}_3 + 7\text{O}_2 \rightarrow 8\text{Na}_2\text{CrO}_4 + 2\text{Fe}_2\text{O}_3 + 8\text{CO}_2$ <p style="text-align: right;">(1 mark)</p> <p>The yellow solution of sodium chromate is filtered and acidified with sulphuric acid to give a solution</p>	3
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	<p>from which orange sodium dichromate can be crystallised.</p> $2\text{Na}_2\text{CrO}_4 + 2\text{H}^+ \rightarrow \text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{Na}^+ + \text{H}_2\text{O}$ <p style="text-align: right;">(1 mark)</p> <p>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.</p> $\text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{KCl} \rightarrow \text{K}_2\text{Cr}_2\text{O}_7 + 2\text{NaCl}$ <p style="text-align: right;">(1 mark)</p>	
29.	<p>Aryl halides are extremely less reactive towards nucleophilic substitution reactions due to the following reasons:</p> <p>(i) <u>Resonance effect</u>:</p> <p>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</p>	3

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

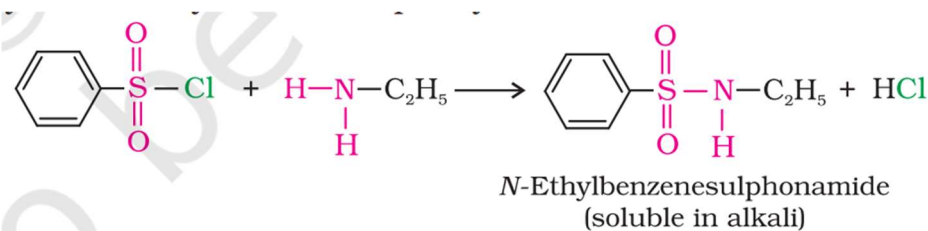
(½ mark)

Benzenesulphonyl chloride ( $C_6H_5SO_2Cl$ ), which is also known as Hinsberg's reagent, reacts with primary and secondary amines to form sulphonamides.

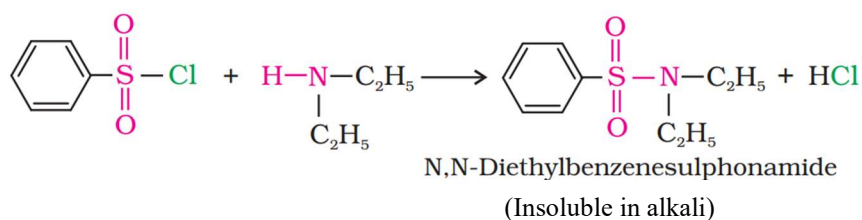
(1 mark)

Tertiary amines do not react with Hinsberg's reagent.

(½ mark)



(½ mark)



(½ mark)

Or

- i) Amines undergo protonation to give amide ion. Similarly, alcohol loses a proton to give alkoxide ion.

3

	<p>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.</p> <p style="text-align: right;">(1 mark)</p> <p>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.</p> <p style="text-align: right;">(1 mark)</p> <p>iii) In aromatic amines, the <math>\text{-NH}_2</math> group is attached to a <math>\text{-C}_6\text{H}_5</math> 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.</p>	
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		(1 mark)	
31.	i) Phenol	(1mark)	4
	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)	
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 $\alpha$ -amino acids are joined together by peptide bond the structure thus formed is called Polypeptides.	(1 mark)	

20	<p>iv) Glycine/ Alanine/ Glutamic acid/ Aspartic acid/ Glutamine/ Asparagine/ Serine/ Cysteine/ Tyrosine/ Proline</p> <p style="text-align: right;">(Any one, 1 mark)</p> <p style="text-align: center;">Or</p>	
33.	<p>Nernst equation:</p> $E_{cell} = E_{cell}^{\circ} - \frac{0.0591}{n} \log \frac{Mg^{2+}}{Cu^{2+}}$ <p style="text-align: right;">(1 mark)</p> <p>Calculation of <math>E_{cell}</math>:</p> $E_{cell} = 2.70 - \frac{0.0591}{2} \log \frac{0.001}{0.0001}$ <p style="text-align: right;">(½ mark)</p> $E_{cell} = 2.70 - \frac{0.0591}{2} \log 10$ <p style="text-align: right;">(½ mark)</p> $E_{cell} = 2.67 V$ <p style="text-align: center;">(½ mark for answer, ½ mark for unit)</p> <p>Calculation of <math>\Delta_r G^{\circ}</math> :</p> $\Delta_r G^{\circ} = -nFE_{cell}^{\circ}$ <p style="text-align: right;">(½ mark)</p> $\Delta_r G^{\circ} = -2 \times 96500 \times 2.70$ <p style="text-align: right;">(½ mark)</p> $\Delta_r G^{\circ} = -521100 Jmol^{-1} = -521.1 kJmol^{-1}$ <p style="text-align: center;">(½ mark for answer, ½ mark for unit)</p> <p style="text-align: center;">Or</p>	5

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

iii) 2

(1 mark)

iv) 3

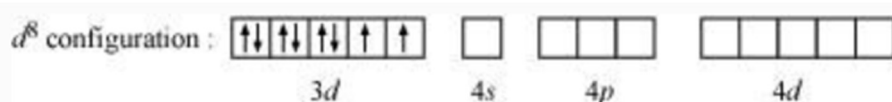
(1 mark)

v) 3

(1 mark)

Or

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



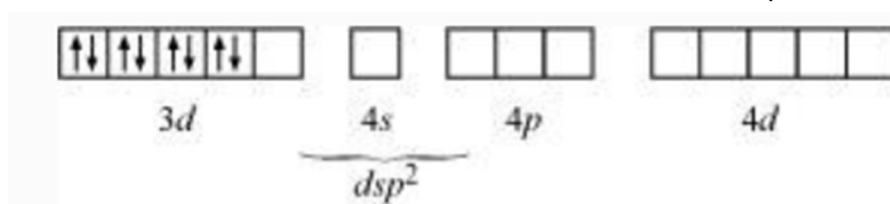
(½ mark)

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  $3d$  electrons.

(½ mark)

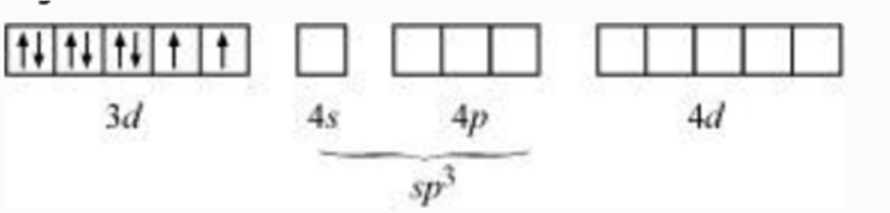


(½ mark)

It now undergoes  $dsp^2$  hybridization.

(½ mark)



	<p>Since all electrons are paired, it is diamagnetic. (½ mark)</p> <p>In case of <math>[\text{NiCl}_4]^{2-}</math>, <math>\text{Cl}^-</math> ion is a weak field ligand. Therefore, it does not lead to the pairing of unpaired <math>3d</math> electrons. (½ mark)</p> <p>Therefore, it undergoes <math>sp^3</math> hybridization.</p>  <p>(½ mark)</p> <p>Since there are 2 unpaired electrons in this case, it is paramagnetic in nature. (½ mark)</p>	
35.	<p>Case I</p> <p>Propanal + Propanal + dil. NaOH →  <math>\text{CH}_3\text{CH}_2\text{CH}=\text{C}(\text{CH}_3)\text{CHO}</math> (2-Methylpent-2-en-1-al)            (½ mark + ½ mark)</p> <p>Case II</p> <p>Butanal + Butanal + dil. NaOH →  <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{C}(\text{C}_2\text{H}_5)\text{CHO}</math> (2-Ethylhex-2-en-1-al)            (½ mark + ½ mark)</p> <p>Case III</p> <p>Butanal + Propanal + dil. NaOH →  <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{C}(\text{CH}_3)\text{CHO}</math> (2-Methylhex-2-en-1-al)</p>	5

(½ mark + ½ mark)

Case IV

Propanal + Butanal + dil. NaOH →

 $\text{CH}_3\text{CH}_2\text{CH}=\text{C}(\text{C}_2\text{H}_5)\text{CHO}$  (2-Ethylpent-2-en-1-al)

(½ mark + ½ mark)

In case III butanal act as electrophile and propanal act as nucleophile

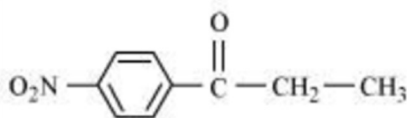
Or

In case IV propanal act as electrophile and butanal act as nucleophile

(any one, ½ mark + ½ mark)

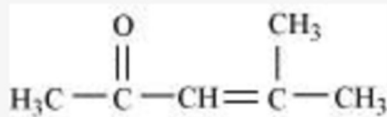
Or

i)



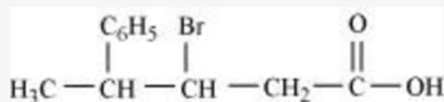
(1 mark)

ii)



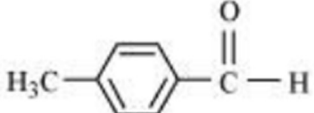
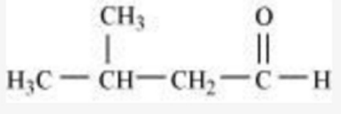
(1 mark)

iii)



(1 mark)

iv)

	<div data-bbox="300 197 678 353"> <chem>Cc1ccc(C=O)cc1</chem></div> <p data-bbox="1098 376 1252 421">(1 mark)</p> <p data-bbox="300 454 331 499">v)</p> <div data-bbox="300 510 689 654"> <chem>CC(C)CC=O</chem></div> <p data-bbox="1098 678 1252 723">(1 mark)</p>	
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