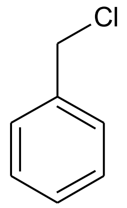
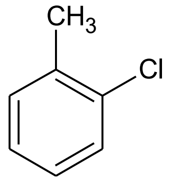
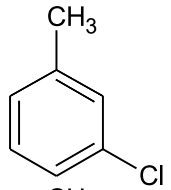
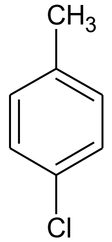
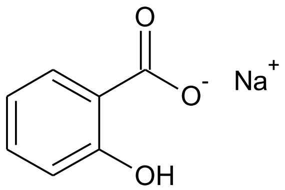
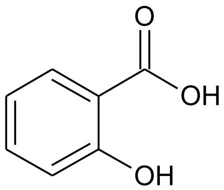
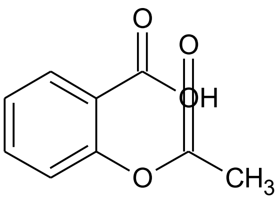
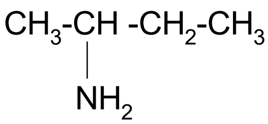
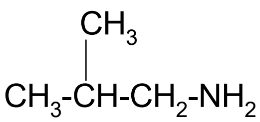
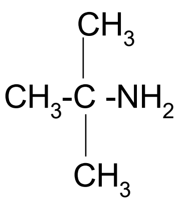
MARKING SCHEME CHEMISTRY [CODE NO 151]

Time allowed :3 hours. **Maximum marks :70**

1.	C. Substitution reaction	1
2.	B. Higher boiling point than both liquids	1
3.	D. 51%meta, 47%ortho, 2%para.	1
4.	D. Primary aliphatic amines	1
5.	C. 2-Methylpropan-2-ol	1
6.	A. 6	1
7.	A. Cu^{+}	1
8.	B. O_2 gas	1
9.	C. Molecularity of the reaction.	1
10.	B. Kolbe's reaction.	1
11.	D. 0	1
12.	B Secondary structure of protein.	
13.	A	1
14.	A	1
15.	C	1
16.	A	1
17.	(i) $\Delta G^\circ = -nFE^\circ_{\text{cell}}$ $$\Delta G^\circ = -RT\ln\ K$$ Combining both equations: $$nFE^\circ_{\text{cell}} = \text{RTln}\,K$$ $$E^\circ_{\text{cell}} = \frac{RT}{nF}\ln\ K$$ (ii) It completes the electrical circuit between the two half-cells. It maintains electrical neutrality of the solutions by allowing migration of ions. It prevents direct mixing of the two electrolytic solutions. (Any two reasons) OR A metal can liberate hydrogen gas from dilute sulfuric acid if its standard electrode potential is less than 0 V, because such metals are more reactive than hydrogen. Since metal **B** has a negative standard electrode potential, it can displace hydrogen from dilute sulfuric acid.	1 1 1 1
18.	ρ=R×A/l $$\rho = 500 \times \frac{1}{10}$$ $$\rho = 50\ \Omega\ \text{cm}$$	½ ½

	$$\kappa = \frac{1}{\rho}$$ $$\kappa = \frac{1}{50} = 0.02\ \Omega^{-1}\text{cm}^{-1}$$ $$\Lambda_m = \kappa \times \frac{1000}{C}$$ $$\Lambda_m = 0.02 \times \frac{1000}{0.05}$$ $$= 0.02 \times 20000$$ $$= 400\ \Omega^{-1}\text{cm}^2\text{mol}^{-1}$$	½ ½
19.	Hybridization: $$\boxed{sp^3d^2}$$ Shape: Octahedral The complex is an outer orbital octahedral complex.	1 1
20.	(i) $$CH_3CH_2OH \overset{conc.\ H_2SO_4}{\underset{443\ K}{\rightarrow}} CH_2 = CH_2$$ $$CH_2 = CH_2 \overset{Br_2/CCl_4}{\rightarrow} BrCH_2CH_2Br$$ $$BrCH_2CH_2Br \overset{alc.\ KOH}{\rightarrow} HC \equiv CH$$ $$HC \equiv CH \overset{NaNH_2}{\rightarrow} NaC \equiv CH$$ $$NaC \equiv CH + CH_3CH_2Br \rightarrow HC \equiv CCH_2CH_3$$ (ii) $$CH_3CH_2CH_2Br \overset{alc.\ KOH}{\rightarrow} CH_3CH = CH_2$$ $$CH_3CH = CH_2 \overset{HBr}{\rightarrow} CH_3CHBrCH_3$$	1 1
21.	(i) 2, 3-Dimethylbutane –2, 3-diol. (ii) 2-Methoxypropane.	1 1

22.	Four Possible structures are:     Out of them, benzyl chloride has the weakest C-Cl bond because of resonance possible in rest of the structures.	½ ½ ½ ½ 1
23.	(i) Iodoform test. (ii) Tollen's test or iodoform test. (iii) Sodium bicarbonate test or neutral $FeCl_3$ test.	1 1 1
24.	(i) $k = \frac{2.303}{t} \log \frac{[A]_0}{[A]}$ At 300 s, $k_1 = \frac{2.303}{300} \log \left(\frac{1.6 \times 10^{-2}}{0.8 \times 10^{-2}} \right)$ $= 2.31 \times 10^{-3}\ \mathrm{s}^{-1}$ Similarly, at 600 s, $k_2 = \frac{2.303}{600} \log \left(\frac{1.6 \times 10^{-2}}{0.4 \times 10^{-2}} \right)$ $= 2.31 \times 10^{-3}\ \mathrm{s}^{-1}$ Since $k$is constant, it follows first order reaction. (ii) $t_{1/2} = \frac{0.693}{k}$ $= \frac{0.693}{2.3 \times 10^{-3}}$ $= 301.3\ \mathrm{s}$	1 ½ ½ ½ ½

25.	A= $CH_3CH(OH)CH_3$. B=CH_3COCH_3. C=CHI_3. **OR**    	1 1 1 1 1 1
26.	Isomers: CH_3-CH_2-CH_2-CH_2-NH_2    Optically active isomer:	½ ½ ½ ½

<table>
<tr><td></td><td>CH_3-CH -CH_2-CH_3
|
NH_2
IUPAC name: Butan-2-amine</td><td>½
½</td></tr>
<tr><td>27.</td><td>(i) Cis isomer
Trans isomer
(ii) t2g3eg1</td><td>1
1
1</td></tr>
<tr><td>28.</td><td>Lowering temperature decreases the rate of spoilage because at lower temperature the kinetic energy of molecules decreases. As a result, the number of effective collisions between reacting molecules decreases, thereby slowing down the rate of chemical reactions responsible for decomposition.

The equation that relates rate constant with temperature is the Arrhenius equation.

Mathematical relation:
$k = Ae^{-E_a/RT}$</td><td>1

1

1</td></tr>
<tr><td>29.</td><td>(i)
Tollen’s reagent test is used to distinguish aldehydes from ketones.

(ii)
Carbon dioxide (CO_2)gas is evolved.

(iii)
Aldehydes are more reactive than ketones towards nucleophilic addition because: (any two)
• Aldehydes have only one alkyl group, while ketones have two alkyl groups.
• Alkyl groups donate electrons and decrease the positive charge on carbonyl carbon.
• Ketones also experience greater steric hindrance, making nucleophilic attack more difficult. (Any Two Reasons)

OR

(iii)
(a) Reaction of ethanoic acid with sodium bicarbonate:
$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

(b) Tollen’s test with ethanal:
$CH_3CHO + 2[Ag(NH_3)_2]^+ + 3OH^- \rightarrow CH_3COO^- + 2Ag + 4NH_3 + 2H_2O$

Silver metal is deposited as a silver mirror.</td><td>1
1
1
1
1
1</td></tr>
<tr><td>30.</td><td>(i)
Chromium gets deposited on the cathode (iron object).

(ii)
Electroplating is done to prevent corrosion and to improve the appearance of iron objects.</td><td>1
1</td></tr>
</table>

	(iii) According to Faraday's first law of electrolysis, the mass of substance deposited is directly proportional to the quantity of electricity passed through the electrolyte. Therefore, when more current passes for a given time, more chromium gets deposited. **OR** **(iii)** $I = 2A$ $t = 30 \text{ minutes} = 1800 \text{ s}$ Using: $Q = I \times t$ $Q = 2 \times 1800 = 3600\, C$ Therefore, the quantity of electricity passed is: $Q = 3600\, C$	1 1 1 1
31. B	(i) (a)Anomers are isomers of monosaccharides that differ in configuration at the hemiacetal or hemiketal carbon atom (anomeric carbon). (b)The linkage formed between two monosaccharide units through an oxygen atom by the elimination of a water molecule is called a glycosidic linkage. (c) An equimolar mixture of glucose and fructose formed by the hydrolysis of sucrose is called invert sugar. It is called so because the plane of polarised light gets inverted from right to left. (ii) (a) Acidic and basic amino acids: • Acidic amino acids contain an extra carboxyl group • Basic amino acids contain an extra amino group (b) Nucleotide and nucleoside: • A nucleoside consists of a nitrogenous base and a sugar. • A nucleotide consists of a nitrogenous base, a sugar and a phosphate group. **OR** (i) (a) Pentaacetate of glucose does not contain a free aldehyde group because all the hydroxyl groups, including the hemiacetal hydroxyl group, are acetylated. Hence, it cannot open into the free aldehydic form and therefore does not react with hydroxylamine. (b) Fructose is a reducing sugar because it can reduce Fehling's solution or Tollen's reagent. (c) non-essential amino acids are important because they are required for growth, repair of tissues and synthesis of proteins and enzymes, even though the body can synthesize them. (ii) **DNA** / **RNA** DNA contains deoxyribose sugar. / RNA contains ribose sugar. DNA has thymine as one of the bases. / RNA has uracil instead of thymine.	1 1 1 1 1 1 1 1 1 1

32.	(i) (a) Actinoids show a wide range of oxidation states because the energies of 5f, 6d and 7s electrons are very close to each other. (b) because it readily gains an electron and gets reduced to the more stable Ce^{3+} state. The Ce^{4+}/Ce^{3+} reduction has a high positive electrode potential, so Ce^{4+} easily accepts electrons and acts as a strong oxidising agent. (c) because Mn^{2+} has an extra stable half-filled $3d^5$ electronic configuration, whereas Cr^{3+} has the stable $3d^3$ configuration. (ii) $2MnO_2+4KOH+O_2 \rightarrow 2K_2MnO_4+2H_2O$ $3MnO_4^{2-}+2H_2O \rightarrow 2MnO_4^{-}+MnO_2+4OH^{-}$	1 1 1 1 1
	OR	
B	(i) (a) because their atomic sizes are very similar. Atoms of one transition metal can easily replace atoms of another metal in the crystal lattice without disturbing the structure. Hence, they readily mix with one another to form alloys. (b) because they possess a large number of unpaired electrons in their $(n-1)d$orbitals as well as valence s-orbitals. (c) because they can exhibit variable oxidation states and form intermediate compounds with reactants. They also provide a large surface area for adsorption of reactants, which increases the rate of reaction. (ii) **Similarity:** Both lanthanoids and actinoids show variable oxidation states and form coloured ions. **Difference:** Lanthanoids mainly show +3 oxidation state, whereas actinoids show a much wider range of oxidation states such as +3, +4, +5, +6 and +7.	1 1 1 1 1
33.	An ideal solution is a solution that obeys **Raoult's law** over the entire range of concentration and in which the intermolecular forces between unlike molecules are nearly equal to those between like molecules. For an ideal solution: $\Delta H_{\text{mix}} = 0$(no heat is absorbed or evolved) $\Delta V_{\text{mix}} = 0$(no change in volume on mixing) (ii) Aquatic species are more comfortable in cold water because the solubility of oxygen in water increases at lower temperatures. Therefore, cold water contains more dissolved oxygen, which is essential for the respiration and survival of aquatic organisms. (iii) For complete dissociation of $CaCl_2$: $$CaCl_2 \rightarrow Ca^{2+} + 2Cl^-$$ So, Van't Hoff factor: $$i = 3$$	1 1 1

	Using: $$\Delta T_f = iK_f m$$ $$m = \frac{\Delta T_f}{iK_f}$$ $$m = \frac{2}{3 \times 1.86}$$ $$m = \frac{2}{5.58}$$	½ ½
	Moles of solute required: $$n = m \times \text{mass of solvent in kg}$$ $$n = \frac{2}{5.58} \times 0.558$$ $$n = 0.2 \text{ mol}$$	½
	Mass of $CaCl_2$: $$\text{Mass} = n \times M$$ $$= 0.2 \times 111$$ $$= 22.2\ g$$ $$\boxed{22.2 \text{ g}}$$	½
	OR	
	(i) Reverse osmosis is the process in which pressure greater than the osmotic pressure is applied to a solution to force the solvent molecules through a semipermeable membrane from the solution side to the pure solvent side.	1
	(ii) Less than one.	1
	(iii) Moles of glucose: $$n_{\text{glucose}} = \frac{1.8}{180} = 0.01$$	½
	Moles of water: $$n_{\text{water}} = \frac{90}{18} = 5$$	½
	Mole fraction of water: $$X_{\text{water}} = \frac{5}{5 + 0.01} = \frac{5}{5.01} \approx 0.998$$	1
	Therefore, $$P = 0.998 \times 36$$ $$P \approx 35.93\ mm\ Hg$$	1/2for correct answer ½ for unit