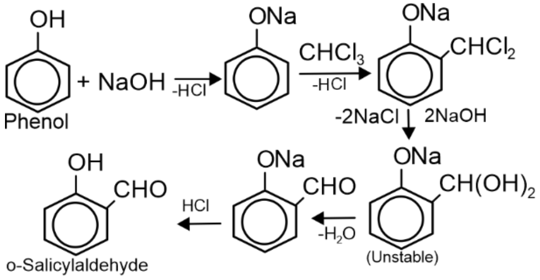
Marking Scheme of Model Question Paper Chemistry Class 12

Session 2024-25

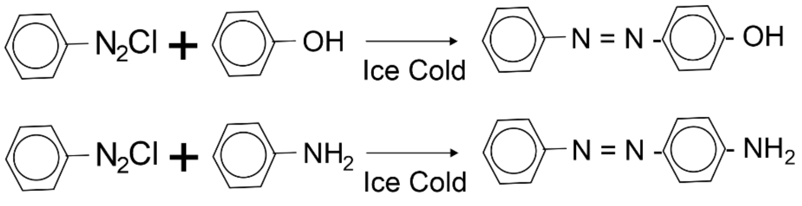
Note:

a. MCQ will be awarded 1 mark for each right answer
b. For numerical problems ½ mark will be deducted for wrong/no unit

Section A(MCQ)		
Q. No.	Solution	Marks awarded
1	b	1 No partial credit
2	a	1 No partial credit
3	c	1 No partial credit
4	a	1 No partial credit
5	c	1 No partial credit
6	c	1 No partial credit
7	d	1 No partial credit
8	a	1 No partial credit
9	b	1 No partial credit
10	a	1 No partial credit
11	a	1 No partial credit
12	a	1 No partial credit
Section B (Very Short answer Questions)		
13	$E_{cell`} = E^o{}_{cell} - \frac{0.591}{2}\log\frac{[Mg^{2+}]}{[Cu^{2+}]}$ $= 2.7 - \frac{0.591}{2}\log 10$ $= 2.7 - 0.029$ $= 2.67V$	½ ½ ½ ½
14	Consider a first order reaction A → Products According to rate Law Rate of reaction = k[A] $-\frac{d[A]}{dt} = k[A]$ $-\frac{d[A]}{[A]} = kdt$ Integrating Both sides $-\int \frac{d[A]}{[A]} = \int kdt$ $-ln[A] = kt + C$ To find C When t=0, [A] = $[A_o]$	½ ½

	$-ln[A_o] = k \times 0 + C$ $C = -ln[A_o]$ $-ln[A] = kt - ln[A_o]$ $k = \frac{1}{t} ln \frac{[A_o]}{[A]}$ $k = \frac{2.303}{t} \log \frac{[A_o]}{[A]}$	½ ½
15	The chelate effect refers to the enhanced stability of a coordination compound containing a polydentate ligand compared to similar compounds with monodentate ligands. This is because polydentate ligands form ring-like structures with the metal ion, leading to greater stability. For example, $[Ni(en)_3]^{2+}$ is more stable than $[Ni(NH_3)_6]^{2+}$, where "en" is ethylenediamine, a bidentate ligand.	1 ½ ½
16	Ethers are relatively unreactive compared to alcohols because the oxygen atom in ethers is bonded to two alkyl or aryl groups, making the C-O bonds in ethers less polar. Additionally, there is no hydrogen atom attached directly to the oxygen (as in alcohols), so ethers cannot participate in hydrogen bonding or undergo reactions typical of hydroxyl groups, such as dehydration or oxidation.	1 1
17	Aldehydes are generally more reactive than ketones in nucleophilic addition reactions due to the following reasons: **Electronic Effects:** In aldehydes, the carbonyl carbon is attached to one alkyl group (or hydrogen) and a hydrogen atom. In contrast, ketones have two alkyl groups attached to the carbonyl carbon. Alkyl groups are electron-donating via inductive effect (+I effect), which reduces the partial positive charge on the carbonyl carbon, making it less electrophilic. Since aldehydes have fewer electron-donating groups, the carbonyl carbon in aldehydes is more positively charged and, therefore, more susceptible to nucleophilic attack than in ketones. **Steric Effects:** In ketones, the presence of two bulky alkyl groups around the carbonyl carbon creates steric hindrance, making it harder for nucleophiles to approach and attack the carbonyl carbon. Aldehydes, having only one alkyl group (and a smaller hydrogen atom), experience less steric hindrance, allowing nucleophiles easier access to the carbonyl carbon.	½ ½ ½ ½
18	Theoretical description of reaction  Name of the final product formed (Full credit may be awarded for any reaction i.e. with $CHCl_3$ or CCl_4)	½ ½ ½ ½
19	**Secondary structure of proteins:** The secondary structure of a protein refers to the shape in which a long polypeptide chain can exist. The secondary structures of proteins exist in two forms: α-Helix β-sheets α-**Helix:** "α-Helix is one of the most common ways in which a polypeptide chain forms all	½

	possible hydrogen bonds by twisting into a right-handed screw (helix) with the –NH group of each amino acid residue hydrogen-bonded to the C=O of an adjacent turn of the helix." β-**sheets:** "In β-pleated sheet structure, all peptide chains are stretched out to nearly maximum extension and then laid side by side which is held together by intermolecular hydrogen bonds."	½ 1
	Section C (Long Answer Type Questions)	
20	a) Potassium trioxalatoaluminate(III) b) In [**Co** (**NH3**)**6**]3+, **Co** is in +3 oxidation state with the configuration $3d^6$. In the presence of **NH$_3$** a strong ligand, the 3d electrons pair up leaving two d-orbitals empty. Hence, the **hybridization** is d^2sp^3 forming an inner orbital octahedral complex.	1 no partial credit ½ ½ ½ ½
21	**Definition:** A fuel cell can be defined as an electrochemical cell that generates electrical energy from fuel via an electrochemical reaction. **Construction:** **a) Diagram** **b) Theory** **Working:** The working of this fuel cell involved the passing of hydrogen and oxygen into a concentrated solution of sodium hydroxide via carbon electrodes. The cell reaction can be written as follows: Cathode Reaction: $\mathbf{O_2 + 2H_2O + 4e^- \rightarrow 4OH^-}$ Anode Reaction: $\mathbf{2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-}$ Net Cell Reaction: $\mathbf{2H_2 + O_2 \rightarrow 2H_2O}$ However, the reaction rate of this electrochemical reaction is quite low. This issue is overcome with the help of a catalyst such as platinum or palladium. In order to increase the effective surface area, the catalyst is finely divided before being incorporated into the electrodes.	1 ½ ½ ½ ½
22	$t = \frac{2.303}{k} log \frac{[A_0]}{[A]}$ t_{90} = 27 min $t_{90} = \frac{2.303}{k} log \frac{100}{10}$ $27 = \frac{2.303}{k} log \frac{100}{10}$ $27 = \frac{2.303}{k}$ ------------ (i) t_{99} = ? $t_{99} = \frac{2.303}{k} log \frac{100}{1}$	½ ½ ½ ½

	$t_{99} = 27 \times 2$ min $t_{99} = 54\,min$	½ ½
23	a. Phenol is more acidic than ethanol because, in phenol, the negative charge on the oxygen atom after deprotonation is delocalized over the aromatic ring through resonance. This stabilization of the phenoxide ion makes the release of a proton easier, increasing its acidity. In ethanol, the ethoxide ion formed after deprotonation has no such resonance stabilization, making ethanol less acidic than phenol. b. $CH_3CH(OH)CH_3 \xrightarrow{H_2SO_4/443K} CH_3CH{=}CH_2 + H_2O$	1 1 1
24	a. Four differences b. Calcipherol	½ mark for each correct difference 1 No Partial Credit
	Section D (Case study Questions)	
25	a. $CH_3Cl + NaOH\ (aq) \rightarrow CH_3OH + NaCl$ It is a Nucleophilic substitution reaction (S_N2 Mechanism) b. Chlorobenzene does not react with aqueous NaOH under normal conditions because the C-Cl bond in chlorobenzene is strengthened by resonance. The lone pair of electrons on chlorine is partially delocalized into the benzene ring, making the carbon less susceptible to nucleophilic attack. Additionally, the sp² hybridized carbon in chlorobenzene has more s-character, making the C-Cl bond shorter and stronger than in chloromethane. c. When chloromethane is treated with aqueous $AgNO_3$, the reaction is as follows: $CH_3Cl + AgNO_3\ (aq) \rightarrow CH_3NO_3 + AgCl\ (s)$ The white precipitate formed is insoluble silver chloride (AgCl).	1 1 ½ ½ 1 1 1
	Section E (Long Answer Type Questions)	
26	a. Theoretical Description of reaction  *p*-hydroxy azobenzene or *p*-amino azobenzene (Correct name of the product) (Full credit may be awarded for any reaction i.e. with phenol or aniline) b. $CH_3CH_2CONH_2 + Br_2 + 4\ KOH\ (alc.) \rightarrow CH_3CH_2NH_2 + 2KBr + 2\ K_2CO_3$ c. Step-I (Aniline to Diazonium salt – Diazotization reaction) Step-II (Diazonium salt to Phenol) Or a. **X**: Propanamide ($CH_3CH_2CONH_2$) **Y**: Propanoic acid (CH_3CH_2COOH) **Z**: Propanenitrile (CH_3CH_2CN) b. **Chemical Equations:** 1. Reaction of **X** with HNO_2:	½ mark 1 mark for reaction ½ 1 mark for each correct step 1 mark for each correct compound 1 mark for each correct reaction

	$CH_3CH_2CONH_2 + HNO_2 \rightarrow CH_3CH_2COOH + N_2 + H_2O$ 2. Dehydration of **X** to form **Z**: $CH_3CH_2CONH_2 \xrightarrow{P_2O_5} CH_3CH_2CN + H_2O$	
27	a. Moles of NaCl = mass/molar mass =5 g/58.5 g/mol =0.0855 mol Mass of solvent (water) = 100 g = 0.1 kg Molality = moles of solute/mass of solvent in kg =0.0855 mol/0.1 kg =0.855 mol/kg b. Four Differences	½ ½ ½ ½ ½ ½ ½ Mark for each correct difference.
28	a. d-d transition b. Lanthanide contraction is the steady decrease in atomic and ionic size of lanthanoids as their atomic number increases. Causes of Lanthanide contraction: In f-block elements, the positive charge on the nucleus rises by one unit, and one additional electron enters the same subshell, as the atomic number increases. c. Transition elements show a variable oxidation state because their valence electrons in two different sets of orbitals, that is (n − 1) d and ns. The energy difference between these orbitals is very less, so both the energy levels can be used for bond formation. Thus, transition elements have variable oxidation states. d. $2KMnO_4 + 8\,H_2SO_4 + 10\,FeSO_4 \rightarrow K_2SO_4 + 5\,Fe_2(SO_4)_3 + 2MnSO_4 + 8\,H_2O$	1 1 1 ½ ½ 1