
MARKING SCHEME (2021-22)

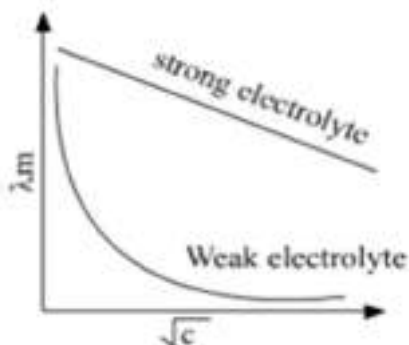
TERM – II

CHEMISTRY THEORY (043)

MM:35

Time: 2 Hours

1. (a) Picric acid < salicylic acid < benzoic acid < phenol 1
- (b) Methyl tert – butyl ketone < acetone < Acetaldehyde 1
- (c) ethanol < ethanoic acid < benzoic acid (boiling point of carboxylic acids is higher than alcohols due to extensive hydrogen bonding, boiling point increases with increase in molar mass) 1
2. B is a strong electrolyte. The molar conductivity increases slowly with dilution as there is no increase in number of ions on dilution as strong electrolytes are completely dissociated. $\frac{1}{2} + \frac{1}{2}$

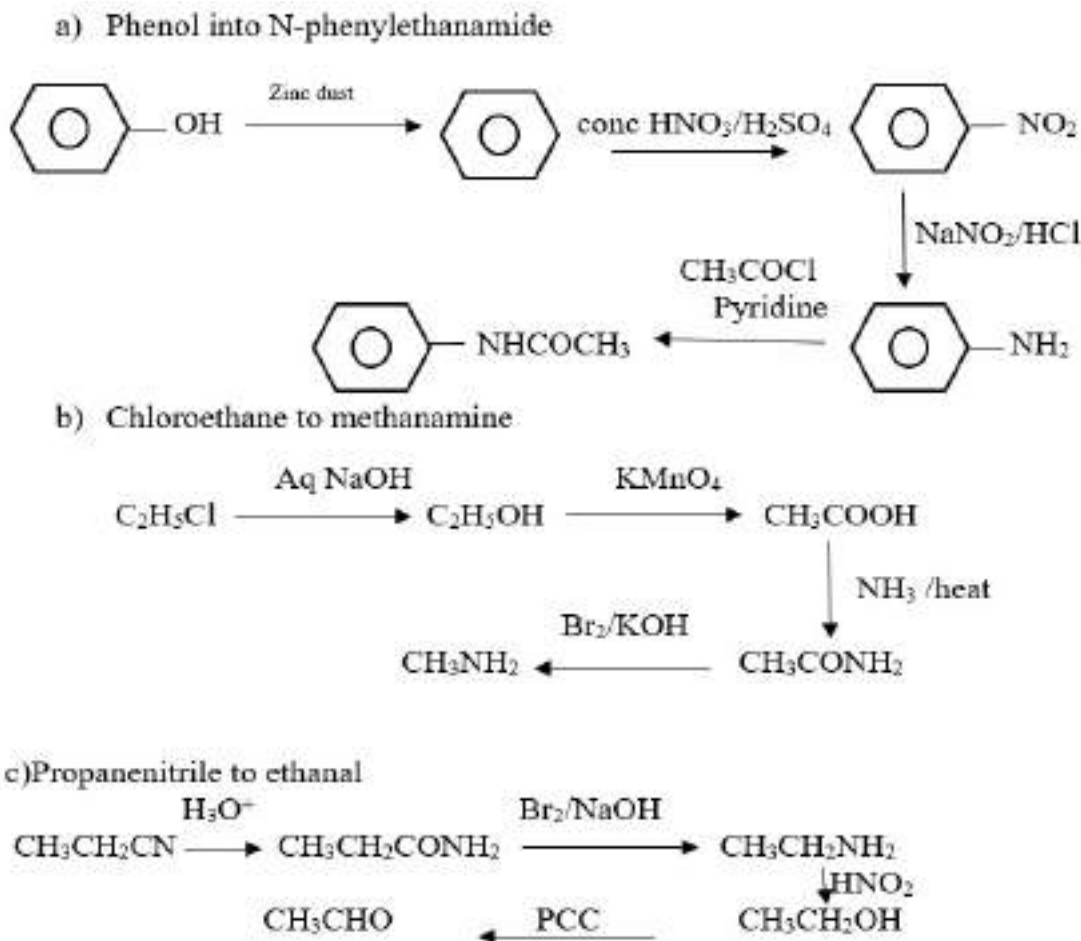


3. (a) The alpha hydrogen atoms are acidic in nature due to presence of electron withdrawing carbonyl group. These can be easily removed by a base and the carbanion formed is resonance stabilized. 1
- (b) Tollen's reagent is a weak oxidizing agent not capable of breaking the C-C bond in ketones. Thus ketones cannot be oxidized using Tollen's reagent itself gets reduced to Ag. 1
4. a) In case of chlorobenzene, the C—Cl bond is quite difficult to break as it acquires a partial double bond character due to conjugation. 1
So Under the normal conditions, ammonolysis of chlorobenzene does not yield aniline.
- b) Primary and secondary amines are engaged in intermolecular association due to hydrogen bonding between nitrogen of one and hydrogen of another molecule. Due to the presence of three hydrogen atoms, the intermolecular association is more in 1

primary amines than in secondary amines as there are two hydrogen atoms available for hydrogen bond formation in it.

c) During the acylation of aniline, stronger base pyridine is added. This done in order to remove the HCl so formed during the reaction and to shift the equilibrium to the right hand side.

OR



5 (a) The colour of coordination compound depends upon the type of ligand and d-d transition taking place .

H_2O is weak field ligand , which causes small splitting , leading to the d-d transition corresponding green colour , however due to the presence of (en) which ia strong field ligand , the splitting is increased . Due to the change in t_{2g} - e_g splitting the colouration of the compound changes from green to blue.

(b)Formula of the compound is $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3]_2(\text{SO}_4)_3$

The hybridisation of the compound is: d^2sp^3

OR

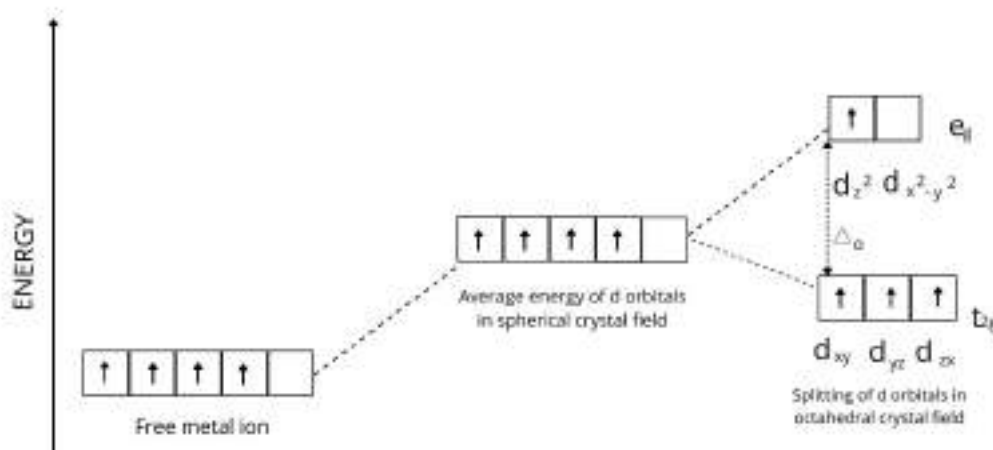
1

a) As the fourth electron enters one of the e_g orbitals giving the configuration $t_{2g}^3 e_g^1$, which indicates $\Delta_o < P$ hence forms high spin complex.

1

b)

2



6 (a) Ti is having electronic configuration $[Ar] 3d^2 4s^2$. Ti (IV) is more stable as Ti^{4+} acquires nearest noble gas configuration on loss of 4 e-. 1

(b) In case of transition elements, ions of the same charge in a given series show progressive decrease in radius with increasing atomic number. 1

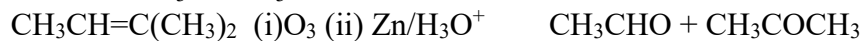
As the new electron enters a d orbital each time the nuclear charge increases by unity. The shielding effect of a d electron is not that effective, hence the net electrostatic attraction between the nuclear charge and the outermost electron increases and the ionic radius decreases.

(c) Iron and Chromium are having high enthalpy of atomization due to the presence of unpaired electrons, which accounts for their hardness. However, Zinc has low enthalpy of atomization as it has no unpaired electron. Hence zinc is comparatively a soft metal. 1

7 Compound A is an alkene, on ozonolysis it will give carbonyl compounds. As both B and C have $>C=O$ group, B gives positive Fehling's test so it is an aldehyde and it gives iodoform test so it is so it has $CH_3C=O$ group. This means the aldehyde is acetaldehyde C does not give Fehling's test, so it is a ketone. It gives positive iodoform test so it is a methyl ketone means it has $CH_3C=O$ group

Compound A (C_5H_{10}) on ozonolysis gives B (CH_3CHO) + C (CH_3COR)

So "C" is CH_3COCH_3



1/2

- $\text{CH}_3\text{CHO} + 2\text{Cu}^{2+} + 5\text{OH}^- \longrightarrow \text{CH}_3\text{COO}^- + \text{Cu}_2\text{O (red ppt)} + 3\text{H}_2\text{O}$
 $\text{CH}_3\text{COCH}_3 + 2\text{Cu}^{2+} + 5\text{OH}^- \longrightarrow \text{No reaction}$ 1/2
- $\text{CH}_3\text{CHO} + 3\text{I}_2 + 3\text{NaOH} \longrightarrow \text{CHI}_3 \text{ (yellow ppt)} + 3\text{HI} + \text{HCOONa}$
 $\text{CH}_3\text{COCH}_3 + 3\text{I}_2 + 3\text{NaOH} \longrightarrow \text{CHI}_3 \text{ (yellow ppt)} + 3\text{HI} + \text{CH}_3\text{COONa}$ 1/2
- A = $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$ 1/2
 B = CH_3CHO 1/2
 C = CH_3COCH_3 1/2
- 8 (a)electrodialysis 1
 (b)purification of colloidal solution 1
 (c)Yes. Dialysis is a very slow process to increase its speed electric field is applied 1/2+1/2
- 9 (a)When N-ethylethanamine reacts with benzenesulphonyl chloride , 1
 N,N-diethylbenzenesulphonamide is formed.
 b)When benzylchloride is treated with ammonia , Benzylamine is formed which on reation with Chloromethane yields a secondary amine , 1/2+1/2
 N-methylbenzylamine .
 c)When aniline reacts with chloroform in the presence of alcoholic potassium hydroxide , 1
phenyl isocyanides or phenyl isonitrile is formed .
 OR
- (i) 1
 N-Ethyl-N-methylbenzenamine or N-Ethyl-N-ethylaniline
- (ii) 1/2 each
- The reaction scheme shows the following steps:
 1. Nitrobenzene (benzene ring with NO₂) reacts with Sn/HCl to form Aniline (A, benzene ring with NH₂).
 2. Aniline (A) reacts with Br₂/H₂O to form 2,4-dibromoaniline (B, benzene ring with NH₂ at position 1 and Br at positions 2 and 4).
 3. Compound B reacts with NaNO₂/HCl at 273-278K to form 2,4-dibromo-N-chloroaniline (C, benzene ring with NCl at position 1 and Br at positions 2 and 4).
 4. Compound C reacts with HBF₄ and heat (Δ) to form 2,4-dibromo-N-fluoroaniline (D, benzene ring with F at position 1 and Br at positions 2 and 4).
- 10 $\text{Al(s) / Cd}^{2+} \text{ (0.1M) // Al}^{3+} \text{ (0.01M) / Cd(s)}$ 1/2
 $2\text{Al(s)} + 3\text{Cd}^{2+} \text{ (0.1M)} \rightarrow 3\text{Cd (s)} + 2\text{Al}^{3+} \text{ (0.01M)}$
 $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.059}{n} \log \frac{[\text{Al}^{3+}]^2}{[\text{Cd}^{2+}]^3}$ 1/2
 $E_{\text{cell}} = 1.26 - \frac{0.059}{6} \log \frac{(0.01)^2}{(0.1)^3}$ 1/2

	$= 1.26 - \frac{0.059}{6}(-1)$	1
	$= 1.26 + 0.009$	$\frac{1}{2}$
	$= 1.269 \text{ V}$	ans unit
11	(a) The ability of fluorine to stabilize the highest oxidation state is attributed to the higher lattice energy or high bond enthalpy.	1
		1
	(b) Co^{2+} has three unpaired electrons so it would be paramagnetic in nature, hence Co^{2+} ion would be attracted to magnetic field.	
	(c) The transition elements of 5d series have intervening 4f orbitals. There is greater effective nuclear charge acting on outer valence electrons due to the weak shielding by 4f electrons. Hence first ionisation energy of 5 d series of transition elements are higher than that of 3d and 4d series.	1
	OR	1
	a) Manganese is having lower melting point as compared to chromium, as it has highest number of unpaired electrons, strong interatomic metal bonding, hence no delocalisation of electrons.	
	b) There is much more frequent metal – metal bonding in compounds of the heavy transition metals i.e 4d and 5d series, which accounts for lower melting point of 3d series.	1
	c) Tungsten	1
12	(a) Ratio of neutrons to protons is 2.3: 1 which is not the stable ratio of 1:1	1
	(b) Age of fossils can be estimated by C-14 decay. All living organisms have C-14 which decays without being replaced back once the organism dies.	1
	(c) carbon-14 atoms decay to stable nitrogen atoms and potassium-40 atoms decay to stable calcium	1
	(d) $t = 2.303 / k \log (\text{Co}/\text{Ct})$	$\frac{1}{2}$
	$\text{Co} = 20 \text{ g}$ $\text{Ct} = ?$	
	$t = 10320 \text{ years}$ $k = 0.693/6000$ (half-life given in passage)	
	substituting in equation:	
	$10320 = 2.303 / (0.693/6000) \log 20/ \text{Ct}$	$\frac{1}{2}$
	$0.517 = \log 20 / \text{Ct}$ $\text{antilog}(0.517) = 20/\text{Ct}$	
	$3.289 = 20/\text{Ct}$	$\frac{1}{2}$
	$\text{Ct} = 6.17 \text{ g}$	$\frac{1}{2}$
	OR	
	$t = 2.303 / k \log (\text{Co}/\text{Ct})$	$\frac{1}{2}$
	$\text{Co} = 32 \text{ g}$ $\text{Ct} = 12$	
	$t = ?$ $k = 0.693/6000$ (half life given in passage)	
	substituting in equation:	
	$t = 2.303 / (0.693/6000) \log 32/ 12$	$\frac{1}{2}$
	$t = 2.303 \times 60000 / 0.693 \log 2.667$	$\frac{1}{2}$
	$t = 2.303 \times 60000 \times 0.4260 / 0.693$	

= 8494 years

$\frac{1}{2}$