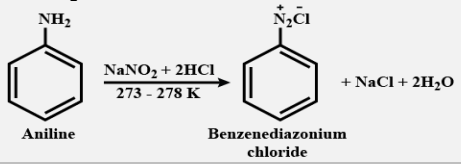
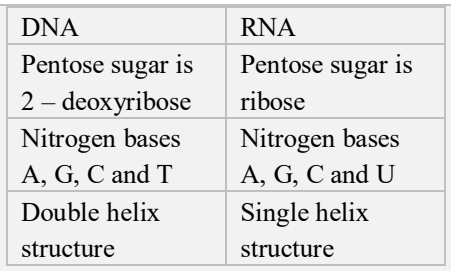
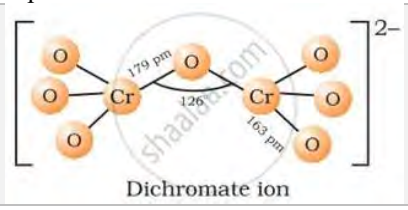
SECOND YEAR HSS MODEL EXAMINATION

FEBRUARY 2023

ANSWER KEY

Q No	Value point	Mark
	1 to 5, Any 4 (4 × 1 = 4 Marks)	
1	Zero	1
2	Lanthanoid contraction	1
3	EDTA	1
4	(d) Benzaldehyde	1
5	(a) Chloroform	1
	6 to 15, Any 8 (8 × 2 = 16 Marks)	
6 (i)	For a solution of volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution. or $p \alpha \chi$	1
(ii)	Mixture of ethanol and acetone.	1
7	Solutions having same osmotic pressure at a given temperature. or Solutions having same concentration at a given temperature. Eg. 0.9 % normal saline solution & blood	1 1
8	Anode reaction: $Zn(s) \xrightarrow{Oxi} Zn^{2+}(aq) + 2\,e^-$ Cathode reaction: $Cu^{2+}(aq) + 2\,e^- \xrightarrow{Red} Cu(s)$ Net cell reaction: $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$	½ ½ 1
9	$t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$ $t = \frac{2.303}{k} \log \frac{5}{3}$ s $= \frac{2.303}{1.15 \times 10^{-3}} \log 1.666$ s $= 2 \times 10^3 \times 0.2218$ s $= 4.44 \times 10^2$ s	½ ½ 1
10 (a)	Potassiumhexacyanoferrate (III)	1
(b)	Tetracarbonylnickel (0)	1
11	Chloroform is slowly oxidised by air in the presence of light to an extremely poisonous gas, carbonyl chloride, (phosgene).	1 1
12	Phenol is resonance stabilized, which gives positive charge on oxygen of O – H group, that enhances the release of H^+ ion. The phenoxide ion thus formed is also get more stabilized by resonance than phenol.	1 1
13	Conversion of aniline to benzene diazonium chloride by treating aniline with $NaNO_2$ and HCl under ice cold condition.  	1
14	It is due to the presence of incompletely filled (n -1) d orbitals with unpaired electrons and hence d – d transition.	1 1
15		1 1

DNA	RNA
Pentose sugar is 2 – deoxyribose	Pentose sugar is ribose
Nitrogen bases A, G, C and T	Nitrogen bases A, G, C and U
Double helix structure	Single helix structure

	16 to 26, Any 8 (8 × 3 = 24 Marks)	
16 (i)	(c) Lead storage battery	1
(ii)	Galvanic cells used to convert the energy of combustion of fuels directly into electrical energy. Eg. $H_2 – O_2$ fuel cell.	1 1
(iii)	$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$	
17(i)	$k = A\,e^{-Ea/RT}$ where k is rate constant, A is the frequency factor, E_a is activation energy, R is gas constant and T is the Kelvin temperature.	1
(ii)	The minimum amount of extra energy required by a reacting molecule to get converted into product.	1
(iii)	$k = \frac{[R]_0 - [R]}{t}$ K – Rate constant $[R]_0$ – Initial concentration of reactant [R] – Concentration of reactant after time 't'	1
18(i)	Bimolecular reaction that is made to behave like a first order reaction. Eg. Inversion of cane sugar	1
(ii)	3	1
(iii)	Order = 2 + ½ = 2 ½ = 5/2	1
19 (i)	The preparation involves 2 steps. 1. Conversion of pyrolusite, MnO_2 to potassium manganate by fusion with KOH in presence of air. $2\,MnO_2 + 4\,KOH + O_2 \rightarrow 2\,K_2MnO_4 + 2\,H_2O$ 2. Conversion of potassium manganate to potassium permanganate, by electrolytic oxidation in presence of KOH. $K_2MnO_4 \xrightarrow{\text{Electrolytic oxidation in KOH}} KMnO_4$ The resulting solution on heating purple-coloured crystals of $KMnO_4$ separates out.	1 1
(ii)	 	1

20 (i)

Double salt	Coordination compound
Dissociate into simple ions completely	Do not dissociate in to simple ions
Exists in solid state Eg. Carnallite	Exists in solid state as well as in solution Eg. $K_4[Co(CN)_6]$

2

(ii) 1

4

21(i)

$2\ R-O-H + 2Na \rightarrow 2\ R-O-Na + H_2$ — 1

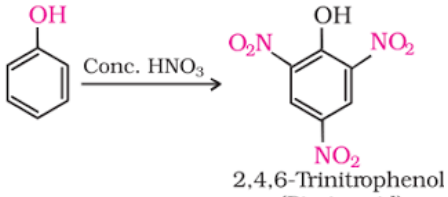
Sodium alkoxide

$6\ R_3-O-H + 2Al \rightarrow 2(R_3-O)_3\ Al + 3H_2$ — 1

Aluminium tert-alkoxide

(ii) 1

(For highly activating group, HNO_3 is enough for nitration)



2,4,6-Trinitrophenol (Picric acid)

22 3

$CH_3-CH=CH_2 + (BH_3)_2 \longrightarrow CH_3-CH_2-CH_2BH_2$

Propene

$CH_3-CH=CH_2 \longrightarrow (CH_3-CH_2-CH_2)_2BH$

$\downarrow\ CH_3-CH=CH_2$

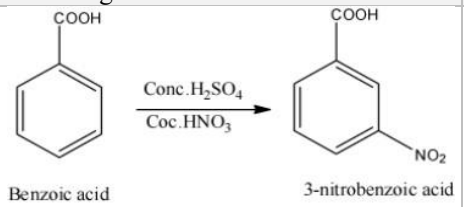
$(CH_3-CH_2-CH_2)_3B$

$CH_3CH_2CH_2OH + B(OH)_3 \xleftarrow{H_2O_2/OH^-}$

Propan-1-ol Boric acid

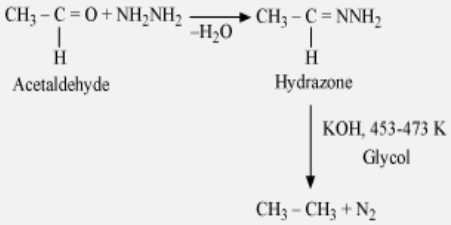
It is similar to addition of water according to anti - Markonikov's rule.

23 (i) 1



Benzoic acid 3-nitrobenzoic acid

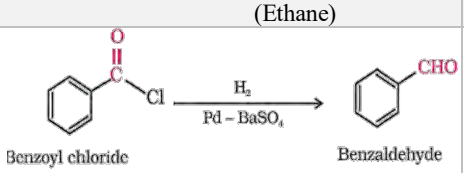
(ii) 1



Y

(Ethane)

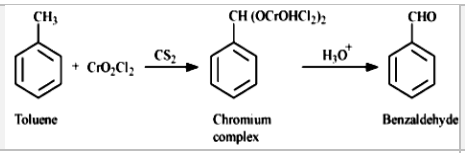
(iii) 1



Benzoyl chloride Benzaldehyde

Z + HCl

24 (i) 1½



(ii)

$CH_3COOH + C_2H_5OH \xleftrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$ — 1

Ethyl ethanoate (Ester)

Esterification reaction. — ½

25

(i) Benzenesulphonyl chloride, $C_6H_5 - SO_2Cl$ — 1

(ii) Test to distinguish primary, secondary and tertiary amines. — ½

Primary amine reacts with Hinsberg reagent to form N - alkylbenzene sulphonamide, which is soluble in alkali, since it is acidic. — ½

$C_6H_5-SO_2Cl + R-NH_2 \rightarrow C_6H_5-SO_2-NH-R$

Secondary amine reacts with Hinsberg reagent to form N, N -dialkylbenzene sulphonamide, which is insoluble in alkali, since it is not acidic. — ½

$C_6H_5-SO_2Cl + R_2-NH \rightarrow C_6H_5-SO_2-N-R_2$

Tertiary amine does not react with Hinsberg reagent, since there is no H atom on tertiary amine. — ½

26

(i) A — 1

Xerophthalmia — 1

(ii) Invertase — 1

27 to 31, Any 4 (4 × 4 = 16 Marks)

27(i) Dissociation or association of solute in solution. — 1

(ii) By multiplying van't Hoff factor (i) to the right-hand side of the equations for the colligative properties. — 1

For dissociation, $i > 1$ — ½

For 100 % dissociation, $i = n$

Eg. For NaCl, $i = 2$

For association, $i < 1$ — ½

For 100 % association, $i = 1/n$

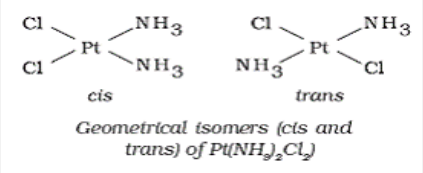
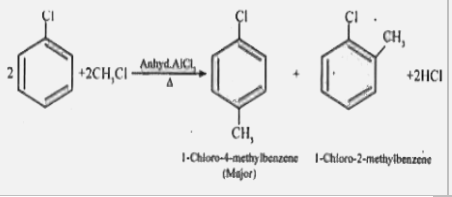
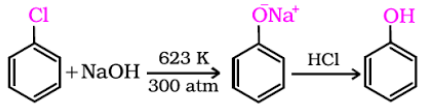
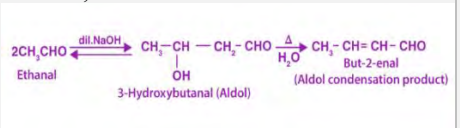
Eg. For dimerization, $i = 1/2$

(iii) Water purification (Desalination of water) — 1

28(i) The cell which converts the chemical energy of a spontaneous redox reaction into electrical energy. — 1

(ii) It is an electrochemical phenomenon. At any one spot iron losses electron and that spot act as anode. Electrons released at the anodic spot move through the metal and reduce oxygen at another spot in presence of H^+ ion and that spot act as cathode. — 1

Anode reaction: $2\ Fe \xrightarrow{Oxi} 2\ Fe^{2+} + 4\ e^-$ — 1

	Cathode reaction: $O_2 + 4H^+ + 4\,e^- \xrightarrow{Red} 2\,H_2O$ Overall reaction: $2\,Fe + O_2 + 4H^+ \xrightarrow{Redox} 2\,Fe^{2+} + 2\,H_2O$ The ferrous ions are further oxidised to Fe^{3+} which comes out as rust in the form of hydrated ferric oxide, $Fe_2O_3.x\,H_2O$.	
(iii)	1. Coating the surface of metal with paint, oil etc. 2. Coating a reactive metal on the surface of metal.	½ ½
29(i)	 *cis* *trans* *Geometrical isomers (cis and trans) of $Pt(NH_3)_2Cl_2$)*	1 1
	Homoleptic complexes: Complexes in which a metal is bound to only one kind of ligands. Eg. $[Co(NH_3)_6]^{3+}$ **Heteroleptic complexes:** Complexes in which a metal is bound to more than one kind of ligands. Eg. $[Co(NH_3)_4Cl_2]^+$	1 1
30 (i)	 1-Chloro-4-methylbenzene (Major) 1-Chloro-2-methylbenzene	2
(ii)	 Phenol (X)	1
(iii)	$CH_3– Cl + NaI \xrightarrow{\text{acetone, Heat}} ?$ $CH_3– I + NaCl$ Iodomethane (Y)	1
31(i)	Aldehydes which do not have an α - H atom undergo self-oxidation and reduction to form acid salt and alcohol, on treatment with concentrated alkali. $HCHO \xrightarrow{Conc.NaOH} HCOONa + CH_3OH$ Methanal Sod. Methanoate Methanol Or $C_6H_5CHO \xrightarrow{Conc.NaOH} C_6H_5COONa + C_6H_5CH_2OH$	1½
(ii)	Aldehydes or ketones with α – H atom undergo condensation to form β – hydroxy aldehyde or β – hydroxy ketones, on treatment with dilute alkali.  Ethanal 3-Hydroxybutanal (Aldol) But-2-enal (Aldol condensation product)	1½
(iii)	$CH_2ClCOOH$	1

– I effect of Cl or electron withdrawing group stabilises the carboxylate anion and increases the acidity.

SUJITH

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