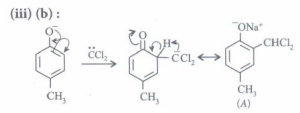
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Answers Key:

Case Study Questions

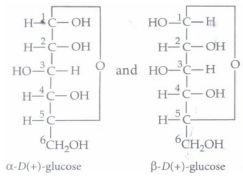
1. **(i) (b):** It is an electrophilic substitution reaction.
   (ii) (c)



   (iv) (b): It is known as Reimer-Tiemann reaction.



2. **(i) (d):** α-D-(+)-glucose and β -D-(+)-glucose differ in configuration at C1 (U., anomeric or glycosidic carbon) and hence are called anomers.

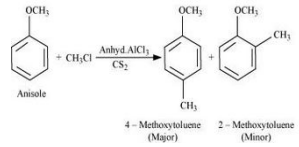


   (ii) (b): This structure is an example of pyranose and aldohexose. Here, the carbohydrate's structure is of the β -pyranose form.
   (iii) (a) : C-1 is the anomeric carbon.
   (iv) (d): Anomers are cyclic monosaccharides or glycosides that are epimers, differing from each other in the configuration at C-1, if they are aldoses or in the configuration at C- 2 if they are ketoses.
3. (a) It is for CH_3COOH.
   (b) It is equal $\Lambda°$ (limiting molar conductivity).
   (c) $\Lambda_m = \Lambda_m^\circ - A\sqrt{C}$
   (d) Slope = -A
   (e) Λm for weak electrolyte increases sharply on dilution because both number of ions as well as mobility of ions increases.

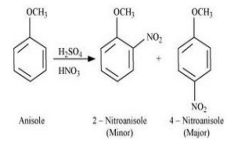
Assertion and reason

5 Marks

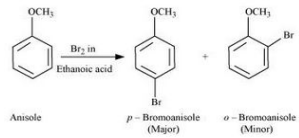
4. (i)



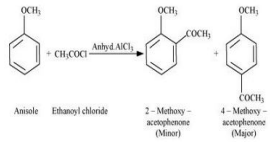
   (ii)



   (iii)



   (iv)



5. (i) Since compound (A) on treatment with CHCI3 and KOH (i.e., Reimer-Tiemann reaction), gives two products Band C, therefore, A must be phenol and Band C must be o-hydroxybenzaldehyde and P: hydroxybenzaldehyde respectively or vice-versa.

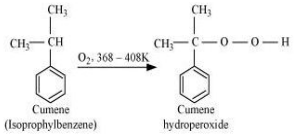
(ii) Since both Band C on distillation with Zn dust give the same compound (D), therefore, D must be benzaldehyde.
(iii) Since oxidation of D gives E with M.F. C7R602, therefore, E must be benzoic acid.
(iv) Since sodium salt of E, i.e.benzoic acid upon heating with soda-lime gives compound (F), therefore.
(F) must be benzene. Zn dust distillation of A would also give benzene (F).

6. Evidences on the basis of which glucose was assigned the given structure are as follows
(i) Glucose on reaction with HI produces n-hexane which indicates presence of six carbon atoms linked in a straight chain.
$C_6H_{12}O_6 \xrightarrow{HI} n\text{-hexane}$
(ii) Glucose on reaction with acetic anhydride produces glucose pentaacetate which indicates presence of five -OH groups.
$C_6H_{12}O_6 \xrightarrow{Ac_2O}$ Glucose pentaacetate
(iii) Glucose on oxidation with bromine water produces gluconic acid indicates presence of -CHO group.
Glucose $\xrightarrow{Br_2/H_2O}$ Gluconic acid
iv) Glucose on reaction with HNO_3 produces saccharic acid, which indicates the presence of one primary -OH group.

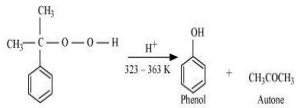
3 Marks

7. $E^{\circ}_{cell} = 0.236V$
$\Delta_r G^{\circ} = -nE^{\circ}F = -2 \times 0.236V \times 96500$
$\Delta_r G^{\circ} = -0.472 \times 96500 = -45548 Jmol^{-1} = -45.54 kJmol^{-1}$
$nE^{\circ}F = 2.303 \quad RTlogK$
$log \quad K_c = \frac{nE^{\circ}F}{2.303RT} = \frac{nE^{\circ}}{0.0591} = \frac{2\times0.236}{0.0591} = \frac{0.472}{0.0591} = 7.99$
$\Rightarrow \quad K_c = Anitlog\ 7.99$
$\Delta_r G^{\ominus}$ = -45.54 kJ Mol^{-1}
$K_c = 9.62 \times 10^7$

8. To prepare phenol, cumene is first oxidized in the presence of air of cumene hydro-peroxide.



Then, cumene hydroxide is treated with dilute acid to prepare phenol and acetone as by-products.

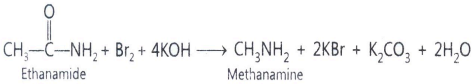


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9.

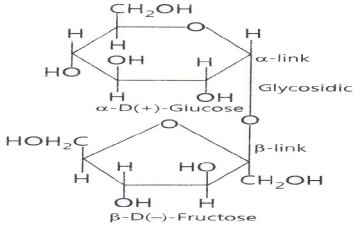
α-Glucose	β-Glucose
(i) It has optical rotation +111^0	(i) It has optical rotation 19.2^0
(ii) It has melting point 419 K	(ii) It has melting point 423 K

The six memberd cyclic structure og glucose is called pyranous structure.

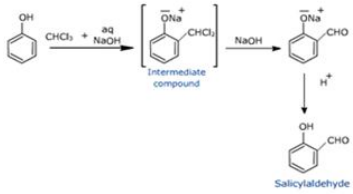


10. Each strand consist of 4 bases which are Adenine, Guanine, Thymine and Cytosine.
These complementary bases are the following:
Adenine (A) ⇔ Thymine (T)
Cytosine (C) ⇔ Guanine (G)
⇔ This symbol represents that both the left and right hand side bases are complementary to each other.
The two strands are internally connected by hydrogen bonding between complementary bases. The two strands of DNA are not identical because their sequence of bases has to be complementary to each other. Ex- If one sequence is ATCG the other has to be TAGC.

11. (i)The ion whose one end is positively charged and other end is negatively charged is called Zwitter ion, e.g.,
$H_2N - CH_2 - COOH \rightleftharpoons H_3^{\oplus}N - CH_2 - COO^-$
(ii) Glycosidic Linkage: The oxide linkage between monosachharide units in oligo and polysachharide is called glycosidic linkage, e.g.



12. (i) Reimer-Tiemann reaction



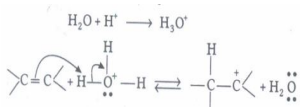
(ii) Williamson syntheses:

$$\underset{\text{Alkylhalide}}{R-X} + \underset{\text{Sodium alkoxide}}{\overset{+}{N}a-\bar{O}-R'} \longrightarrow R-O-R' + NaX$$

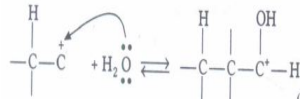
$$\underset{\text{Alkyl halide}}{CH_3-CH_2-Br} + \underset{\text{Sodium alkoxide}}{\overset{+}{N}a-\bar{O}-CH_2-CH_3} \longrightarrow \underset{\text{Diethyl ether}}{CH_3-CH_2-O-CH_2-CH_3} + NaBr$$

13. (i) $CH_3-O-CH_3 + HI \longrightarrow CH_3-OH + CH_3-I$

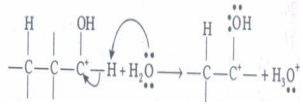
(ii) (a) Protonation of alkene to form carbocation by elecrophilic attack of H_3O^+.



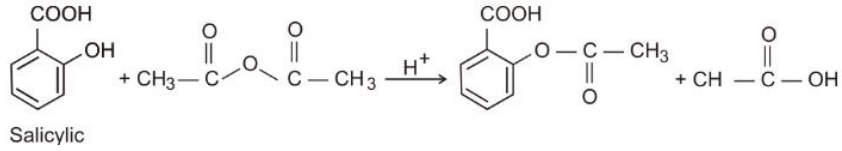
(b) Nucleophilic attack of water on carbocation.



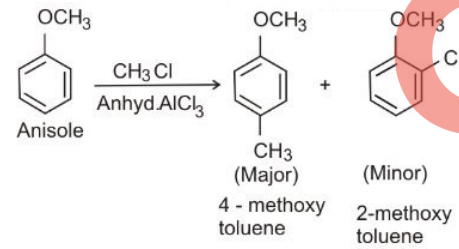
(c) Deprotonation to form an alcohol.



14. (i)



(ii)



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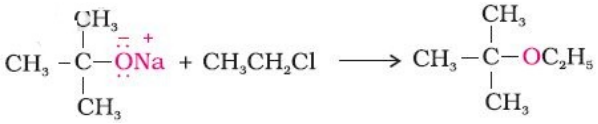
2 Marks

15. (i) $H_2O \rightarrow 2H^+ + \frac{1}{2}O_2 + 2e^- i.e.\ 2\ Faradays = 2 \times 96500C = 193000C$

(ii) $Fe^{2+} \rightarrow Fe^{3+} + e^- i.e.\ 1\ Faraday = 96500C$

16. (i) The major product of the given reaction is 2-methylprop-1-ene. It is because sodium ethoxide is a strong nucleophile as well as a strong base. Thus elimination reaction predominates over substitution.

(ii)



17. There are 3 main types of RNA
    1. mRNA - Messenger RNA
    2. tRNA - Transfer RNA
    3. rRNA - Ribosomal RNA

18. **Monosaccharides** Ribose, 2-deoxyribose, galactose and fructose.
    Disaccharides Maltose and lactose.

19. $\Lambda^o_{m(HAc)} = \lambda^0_{H^+} + \lambda^0_{Ac^-} = \lambda^0_{H^+} + \lambda^0_{Cl^-} + \lambda^0_{Ac^-} + \lambda^0_{Na^+} - \lambda^0_{Cl^-} - \lambda^o_{Na^+}$
    $= \Lambda^0_{m(HCl} + A^0_{m(NaAc)} - \Lambda^o_{m(NaCl}$
    = (425.9 + 91.0 – 126.4) S cm^2 mol^{-1}
    = 390.5 S cm^2 mol^{-1}.

20. o-Nitrophenol is steam-volatile due to chelation (intramolecular H-bonding) and hence can be separated by steam distillation from p-nitrophenol which is not steam volatile because of intermolecular H-bonding.

Multiple Choice Question

21. (a) sodium
22. (c) $3^\circ > 2^\circ > 1^\circ$
23. (c) 2-butanol
24. (a) five

25. (b) Proteins
26. (c) vitamins
27. (a) heating sodium ethoxide with ethyl bromide
28. (a) Uracil
29. (d) Glycogen
30. (c) (ii) < (iii) < (i)
31. The inert electrode does not participate in the cell reactions and provides surface for the conduction of electrons. It provides a surface for either Oxidation or reduction reactions, but not for redox reactions.
32. (c) 2
33. Conductivity is higher for strong electrolyte, conductivity decreases with dilution.
34. In the electrolysis of aqueous sodium chloride solution, the oxidation reactions that occur at the anode are as follows:
    $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$; E^o_{cell} = 1.23 V
    $Cl^-_{(aq)} \rightarrow \frac{1}{2}Cl_{2(g)} + e^-$; E^o_{cell} = 1.36 V
    The reaction with a lower value of E° is preferred at the anode. In that case, water should get oxidised in preference to Cl^-. Due to overpotential of oxygen, the oxidation of water does not take place. Instead, the oxidation of Cl^- takes place at anode.

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