Blue Print (As per PU Board)

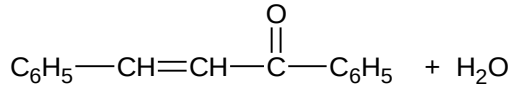
Topic	1 mark questions	2 marks questions	3 marks questions	5 marks questions	Total Marks
Aldehydes, Ketones & Carboxylic Acids	1	1	–	1	8

One mark questions

1. **What makes acetic acid a stronger acid than phenol?**
   Answer: Greater resonance stabilization of acetate ion over phenoxide ion.
2. **Mention the hybridized state of carbonyl carbon atom.**
   Answer: sp^2
3. **Write the IUPAC name of** $(CH_3)_2 CHCHO$
   Answer: 2-Methyl propanal.
4. **Complete the following reaction**

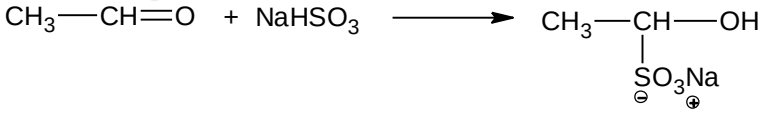
$$C_6H_5CHO + C_6H_5COCH_3 \xrightarrow[293K]{OH^-} ----$$

Answer:



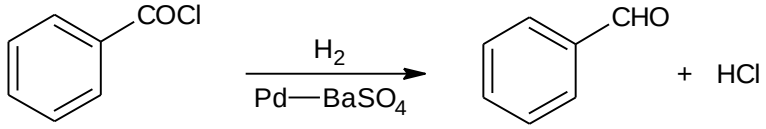
Two marks questions

5. **Explain with equation the addition reaction of acetaldehyde with sodium busulphite.**
   Answer: On shaking acetaldehyde with sodium bisulphite, an addition compound acetaldehyde sodium bisulphite is formed. (1 mark)



(1 mark)

6. **Mention two tests to distinguish aldehydes from ketones.**
   Answer: (i) Tollen's reagent test (1 mark)
   (ii) Fehlings test (1 mark)
7. **Explain Rosenmund's reduction of Benzoyl chloride.**
   Answer: Benzoyl chloride is hydrogenated over palladium catalyst on barium sulphate to get benzaldehyde. (1 mark)



Benzoyl chloride Benzaldehyde (1 mark)

8. **Explain the reaction of benzaldehyde with conc. solution of sodium hydroxide.**
   Answer: Benzaldehyde reacts with conc. $NaOH$ solution to give benzyl alcohol and sodium benzoate. This is known as cannizzaro's reaction. (1 mark)

$$2C_6H_5CHO + NaOH \longrightarrow C_6H_5CH_2OH + C_6H_5COONa$$ (1 mark)

Five marks questions

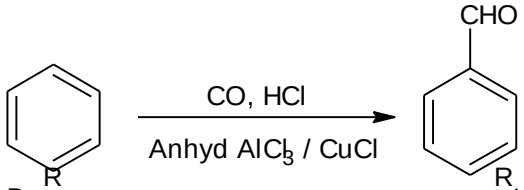
9. **(a) Write equations for:**
   (i) Gattermann – Koch reaction to convert benzene into benzaldehyde.
   (ii) The formation of oxime from carbonyl compounds.
   (iii) The reaction between carboxylic acid and PCl_5

(b) Give reasons:

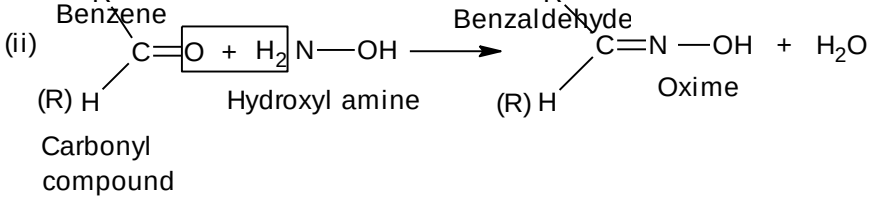
(i) $\alpha-$ hydrogen atoms of aldehydes and ketones are acidic.

(ii) An electron – donating group decreases the acidic strength of carboxylic acids.

Answer:

(a) (i) 

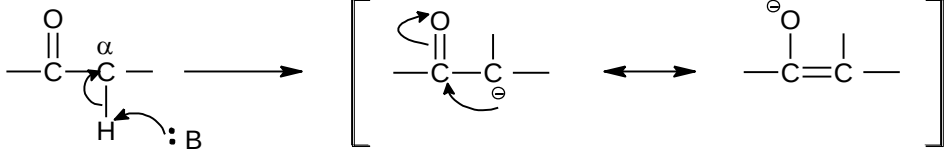
(1 mark)

(ii) 

(1 mark)

(iii) $R-\underset{\text{Acid}}{COOH}+PCl_5 \longrightarrow \underset{\text{Acid chloride}}{R-COCl}+POCl_3+HCl$ (1 mark)

(b) (i) $\alpha-H$ atoms of aldehydes and ketones are acidic due to strong electron with drawing effect of carbonyl group and resonance stabilisation of conjugate base. (1 mark)

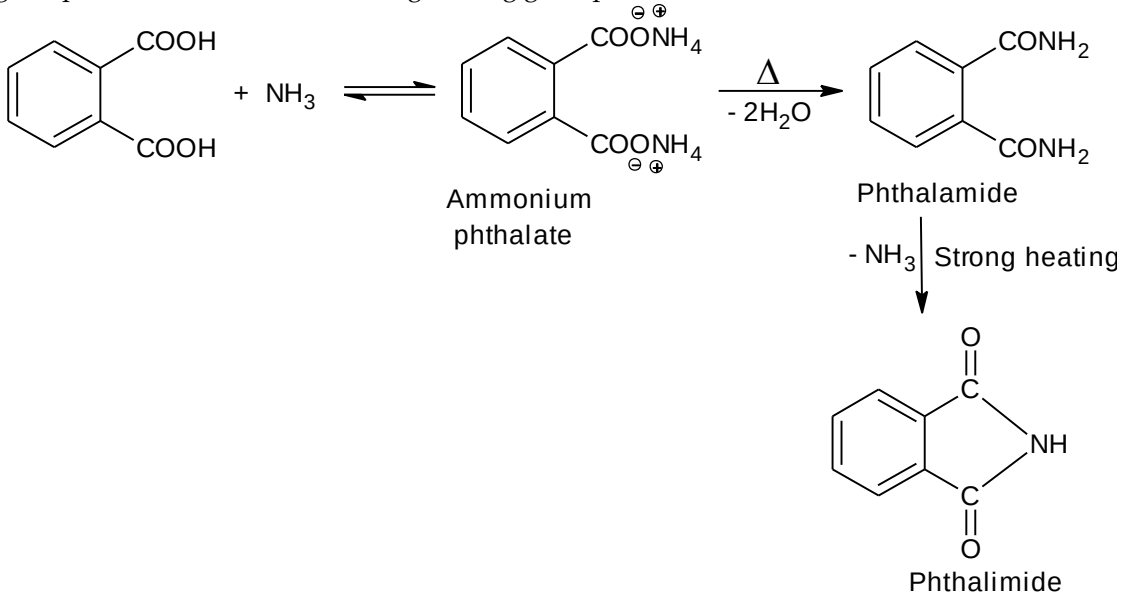


(ii) An electron donating group destabilizes the carboxylate anion or conjugate base.

10. **(a) Convert phthalic acid to phthalimide.**

(b) Explain tollen's test for acetaldehyde.

Answer: (a) Phthalic acid reacts with ammonia to give ammonium phthalate which on further heating gives phthalamide, Which on strong heating gives phthalimide.



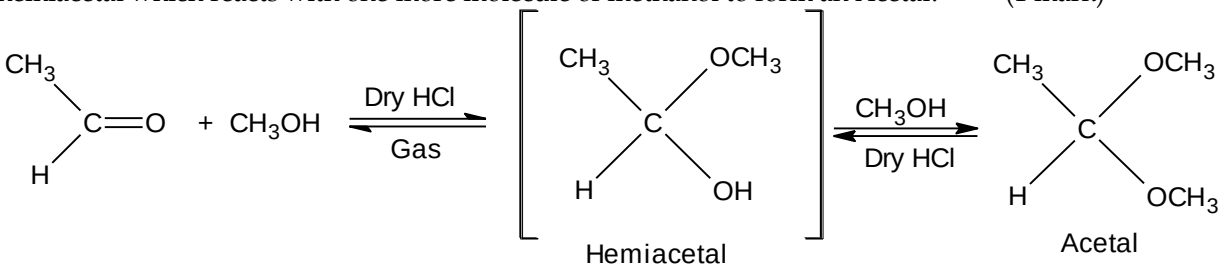
(2 marks)

(b) Ammoniacal silver nitrate solution is known as Tollen's reagent. When acetaldehyde is warmed with Tollen's reagent, a bright silver mirror is got. This is known as Tollens test. (1 mark)

$$CH_3-CHO+2\left[Ag\left(NH_3\right)_2\right]^{+}+3\bar{O}H \longrightarrow CH_3-COO^{-}+\underset{\text{Silver mirror}}{2Ag}+2H_2O+4NH_3$$ (1 mark)

11. **(a) Explain the formation of hemiacetal and acetals from acetaldehyde.**
(b) What is cross aldol condensation? Write the cross aldol condensation between ethanal and propanal.

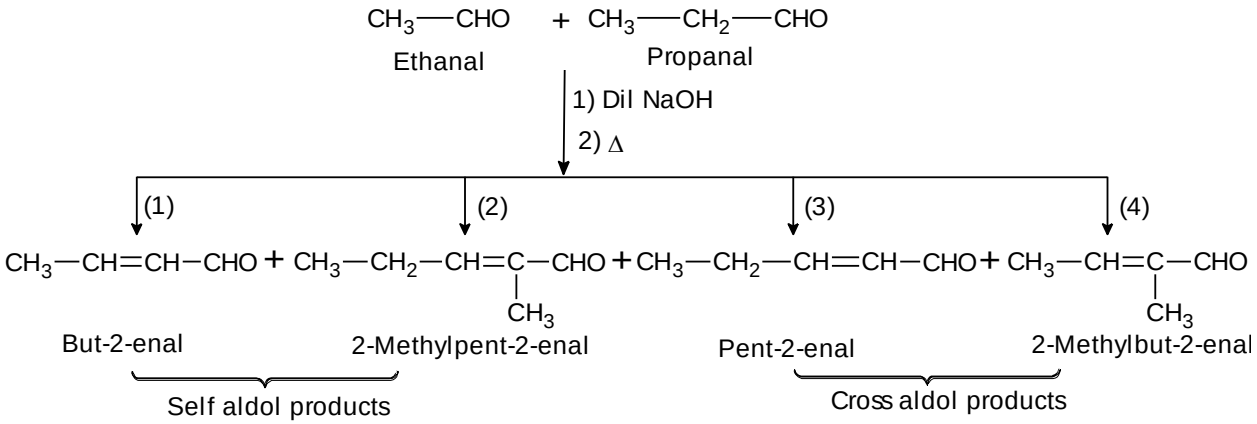
Answer: (a) Acetaldehyde reacts with one equivalent of methanol in presence of dry HCl to form a hemiacetal which reacts with one more molecule of methanol to form an Acetal. (1 mark)



(1 mark)

(b) When aldol condensation is carried out between two different aldehydes and / or ketones it is called cross aldol condensation.

Since both ethanal and propanal contains $\alpha - H$ atoms, a mixture of 4 products is got.



(2 marks)

12. **(a) (i) Write down functional isomers of a carbonyl compound with molecular formula C_3H_6O.**
(ii) Which isomer will react faster with HCN and why?
(iii) Will the reaction lead to completion?
(iv) If a strong acid is added to the reaction mixture, what will be the effect on the concentration of the product and why?
(b) Carboxylic acids contain carbonyl group but do not show nucleophilic addition reactions like aldehydes or ketones. Why?

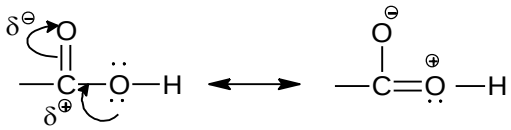
Answer: (a) (i) $\underset{(I)}{CH_3-CH_2-CHO}$ and $\underset{(II)}{CH_3-CO-CH_3}$ (1 mark)

(ii) Compound (I) will react faster with HCN due to less steric hinderance and electronic effects than (1 mark)

(iii) No, It is a reversible reaction, hence equilibrium is established and hence does not lead to completion. (1 mark)

(iv) Addition of an acid inhibits the reaction because the formation of CN^- ions is prevented. (1 mark)

(b) Due to resonance, carbon of carbonyl group gets less partial positive charge, hence a nucleophile cannot attack.



(1 mark)