

(Chapter 12)(Aldehydes Ketones and Carboxylic Acids)

XII

Intext Questions

Question 12.1:

Write the structures of the following compounds.

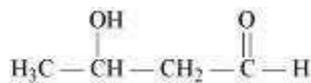
- (i) α -Methoxypropionaldehyde
- (ii) 3-Hydroxybutanal
- (iii) 2-Hydroxycyclopentane carbaldehyde
- (iv) 4-Oxopentanal
- (v) Di-sec-butyl ketone
- (vi) 4-Fluoroacetophenone

Answer

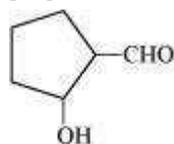
(i)



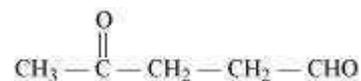
(ii)



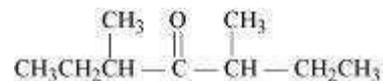
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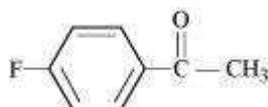
(iv)



(v)



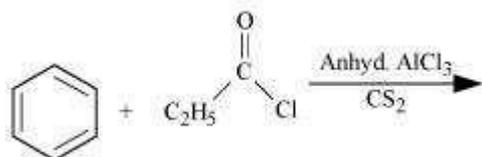
(vi)



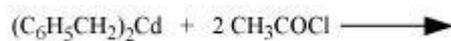
Question 12.2:

Write the structures of products of the following reactions;

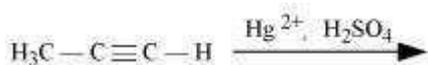
(i)



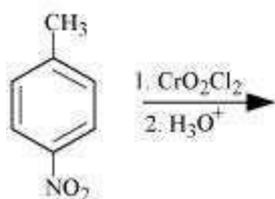
(ii)



(iii)

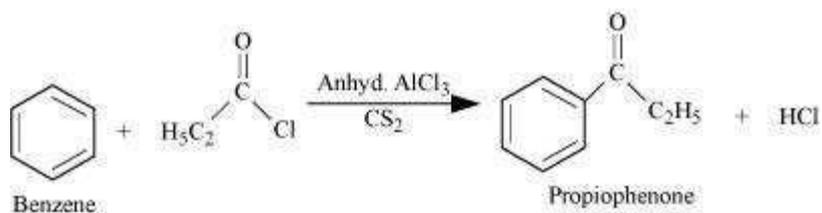


(iv)

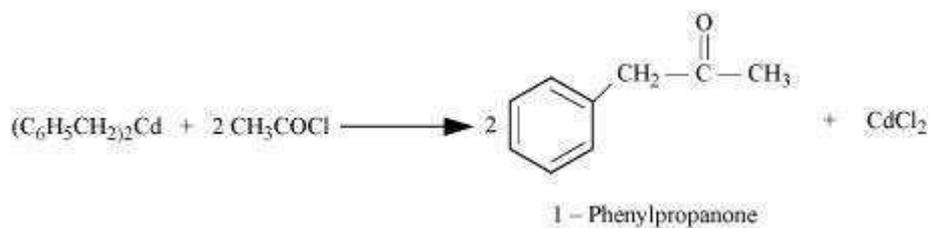


Answer

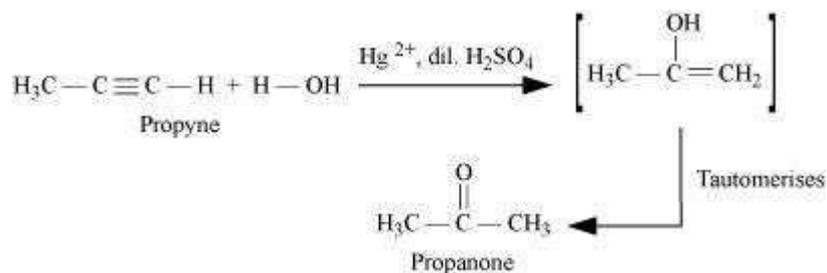
i.



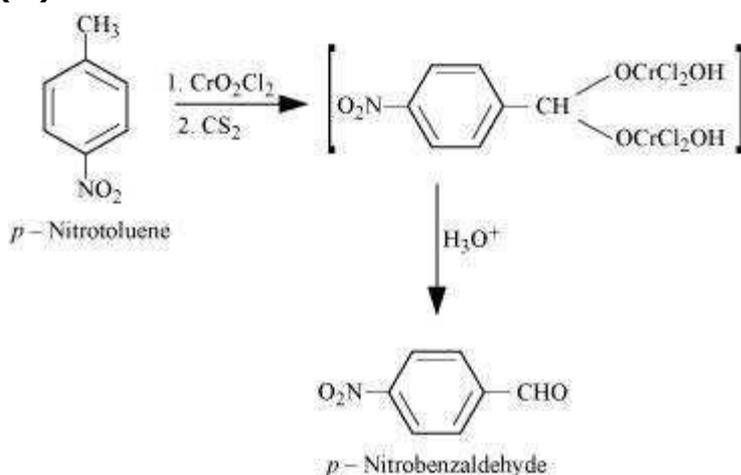
ii.



iii.



(iv)



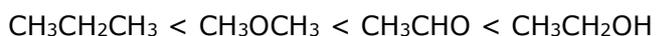
Question 12.3:

Arrange the following compounds in increasing order of their boiling points.



Answer

The molecular masses of the given compounds are in the range 44 to 46. $\text{CH}_3\text{CH}_2\text{OH}$ undergoes extensive intermolecular H-bonding, resulting in the association of molecules. Therefore, it has the highest boiling point. CH_3CHO is more polar than CH_3OCH_3 and so CH_3CHO has stronger intermolecular dipole – dipole attraction than CH_3OCH_3 . $\text{CH}_3\text{CH}_2\text{CH}_3$ has only weak van der Waals force. Thus, the arrangement of the given compounds in the increasing order of their boiling points is given by:



Question 12.4:

Arrange the following compounds in increasing order of their reactivity in nucleophilic addition reactions.

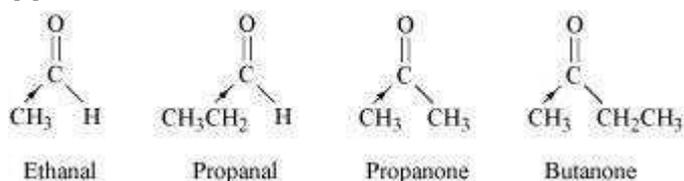
(i) Ethanal, Propanal, Propanone, Butanone.

(ii) Benzaldehyde, *p*-Tolualdehyde, *p*-Nitrobenzaldehyde, Acetophenone.

Hint: Consider steric effect and electronic effect.

Answer

(i)



The +I effect of the alkyl group increases in the order:

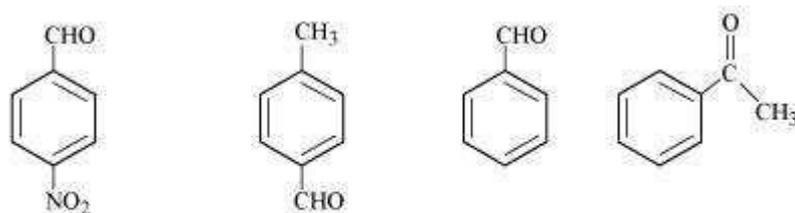
Ethanal < Propanal < Propanone < Butanone

The electron density at the carbonyl carbon increases with the increase in the +I effect.

As a result, the chances of attack by a nucleophile decrease. Hence, the increasing order of the reactivities of the given carbonyl compounds in nucleophilic addition reactions is:

Butanone < Propanone < Propanal < Ethanal

(ii)



p-Nitrobenzaldehyde

p-Tolualdehyde

Benzaldehyde

Acetophenone

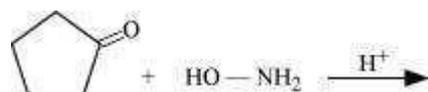
The +I effect is more in ketone than in aldehyde. Hence, acetophenone is the least reactive in nucleophilic addition reactions. Among aldehydes, the +I effect is the highest in *p*-tolualdehyde because of the presence of the electron-donating -CH₃ group and the lowest in *p*-nitrobenzaldehyde because of the presence of the electron-withdrawing -NO₂ group.

Hence, the increasing order of the reactivities of the given compounds is:

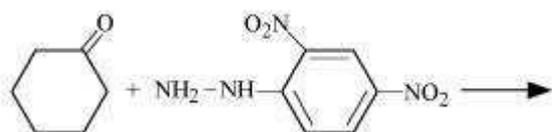
Acetophenone < *p*-tolualdehyde < Benzaldehyde < *p*-Nitrobenzaldehyde

Question 12.5:

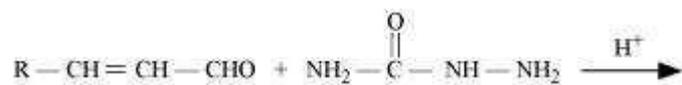
Predict the products of the following reactions: **(i)**



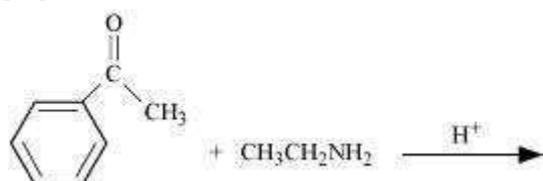
(ii)



(iii)



(iv)

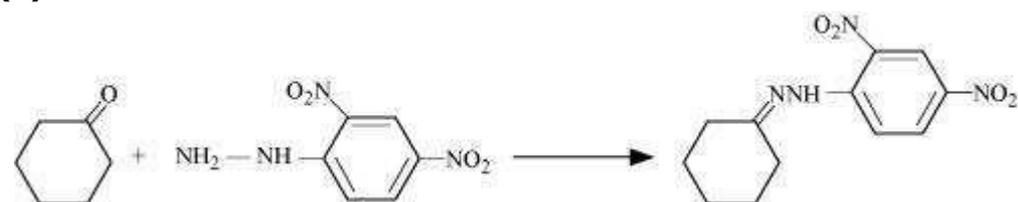


Answer

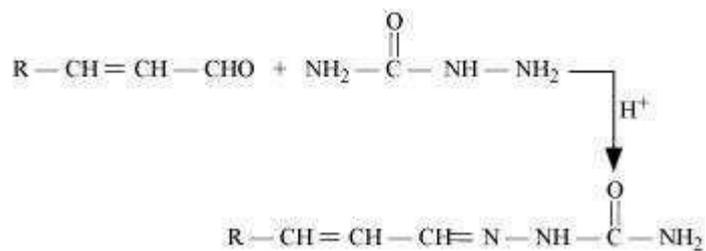
(i)



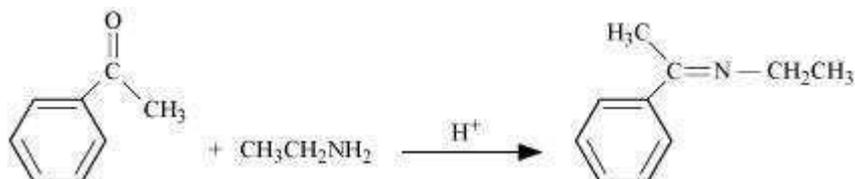
(ii)



(iii)



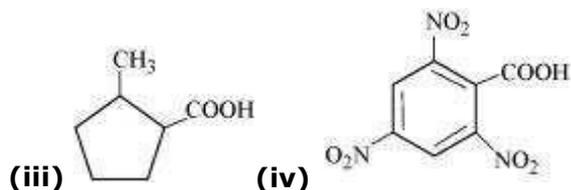
(iv)



Question 12.6:

Give the IUPAC names of the following compounds:

(i) $\text{PhCH}_2\text{CH}_2\text{COOH}$ (ii) $(\text{CH}_3)_2\text{C}=\text{CHCOOH}$



Answer

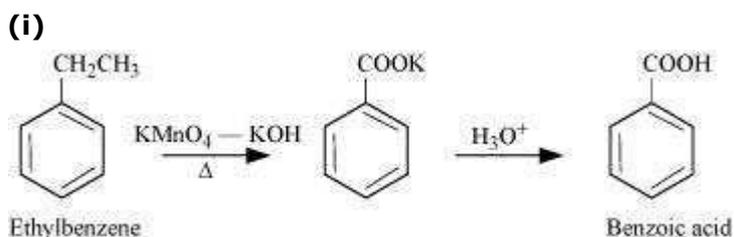
- (i) 3-Phenylpropanoic acid
(ii) 3-Methylbut-2-enoic acid
(iii) 2-Methylcyclopentanecarboxylic acid
(iv) 2,4,6-Trinitrobenzoic acid

Question 12.7:

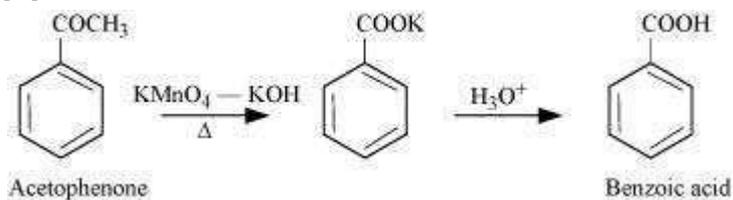
Show how each of the following compounds can be converted to benzoic acid.

(i) Ethylbenzene (ii) Acetophenone
(iii) Bromobenzene (iv) Phenylethene (Styrene)

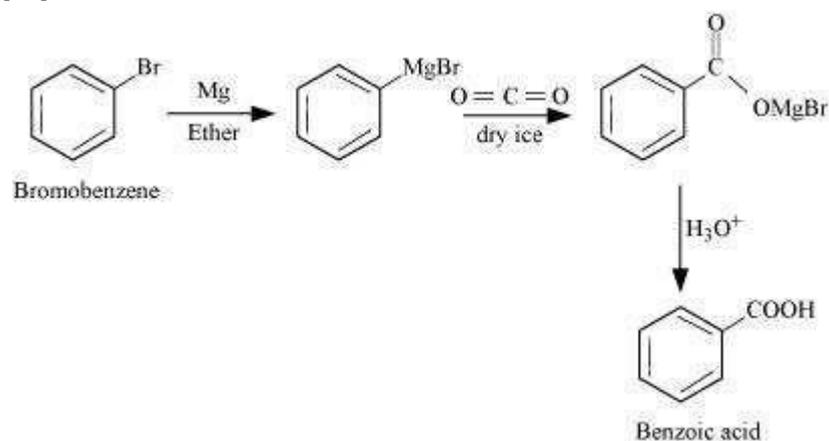
Answer



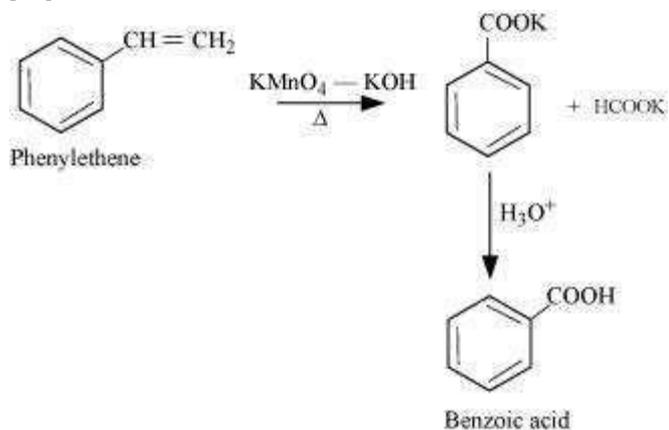
(ii)



(iii)



(iv)



Question 12.8:

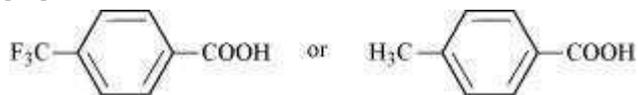
Which acid of each pair shown here would you expect to be stronger?

(i) $\text{CH}_3\text{CO}_2\text{H}$ or $\text{CH}_2\text{FCO}_2\text{H}$

(ii) $\text{CH}_2\text{FCO}_2\text{H}$ or $\text{CH}_2\text{ClCO}_2\text{H}$

(iii) $\text{CH}_2\text{FCH}_2\text{CH}_2\text{CO}_2\text{H}$ or $\text{CH}_3\text{CHFCH}_2\text{CO}_2\text{H}$

(iv)



Answer

(i)



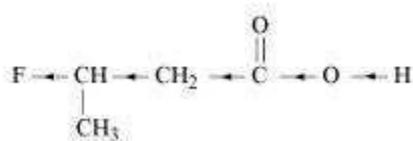
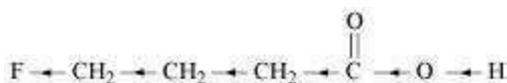
The +I effect of $-\text{CH}_3$ group increases the electron density on the O–H bond. Therefore, release of proton becomes difficult. On the other hand, the –I effect of F decreases the electron density on the O–H bond. Therefore, proton can be released easily. Hence, $\text{CH}_2\text{FCO}_2\text{H}$ is a stronger acid than $\text{CH}_3\text{CO}_2\text{H}$.

(ii)



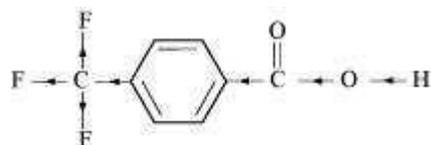
F has stronger –I effect than Cl. Therefore, $\text{CH}_2\text{FCO}_2\text{H}$ can release proton more easily than $\text{CH}_2\text{ClCO}_2\text{H}$. Hence, $\text{CH}_2\text{FCO}_2\text{H}$ is stronger acid than $\text{CH}_2\text{ClCO}_2\text{H}$.

(iii)

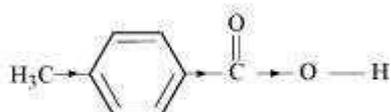


Inductive effect decreases with increase in distance. Hence, the +I effect of F in $\text{CH}_3\text{CHFCH}_2\text{CO}_2\text{H}$ is more than it is in $\text{CH}_2\text{FCH}_2\text{CH}_2\text{CO}_2\text{H}$. Hence, $\text{CH}_3\text{CHFCH}_2\text{CO}_2\text{H}$ is stronger acid than $\text{CH}_2\text{FCH}_2\text{CH}_2\text{CO}_2\text{H}$.

(iv)



(A)



(B)

Due to the $-I$ effect of F, it is easier to release proton in the case of compound (A). However, in the case of compound (B), release of proton is difficult due to the $+I$ effect of $-CH_3$ group. Hence, (A) is a stronger acid than (B).