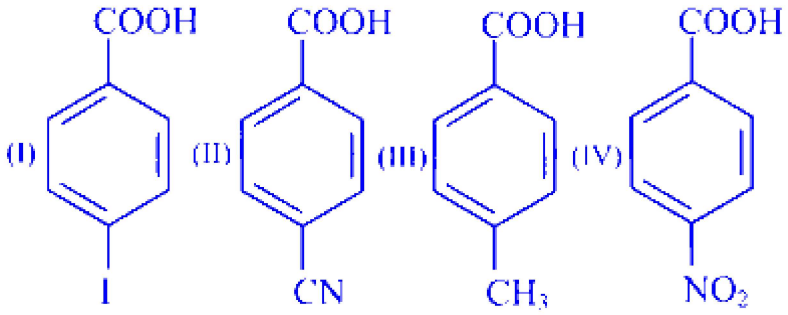
Carboxylic Acids and Its Derivatives

Question1

The carboxylic acid with highest pK_a and lowest pK_a values of the following respectively are



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Options:

A.

I, II

B.

I, IV

C.

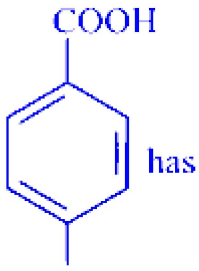
III, II

D.

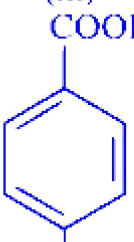
III, IV

Answer: D

Solution:

Among the give options  has

(III)

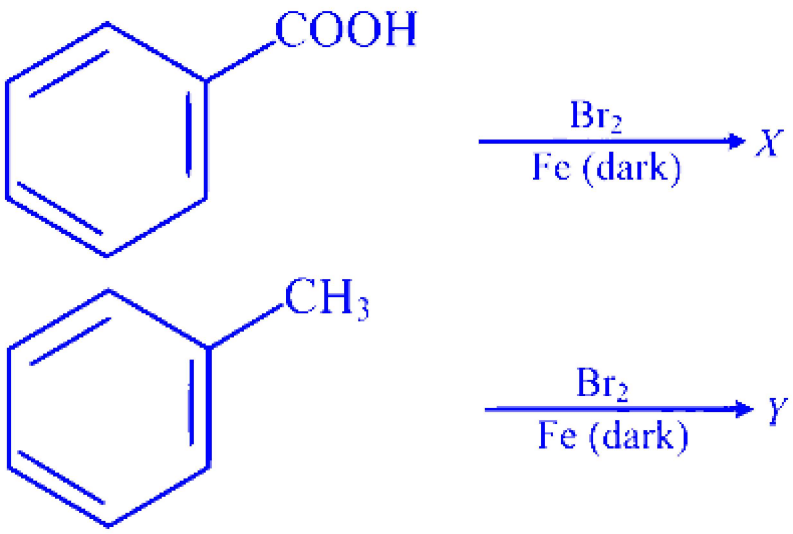


Highest pKα value while Has lowest pKα

has lowest pK_a

Question2

What are the major products X and Y respectively in the following set of reactions?



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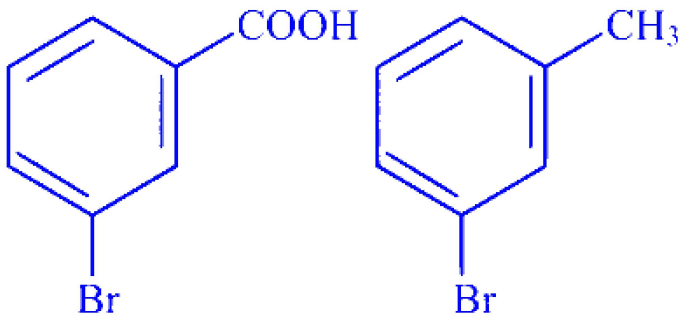
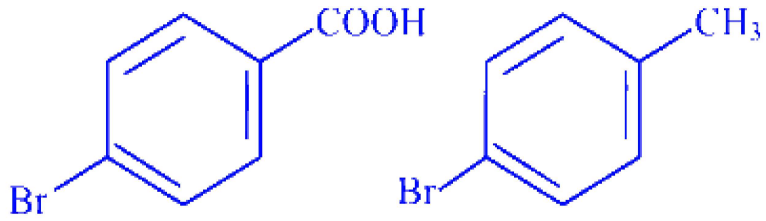
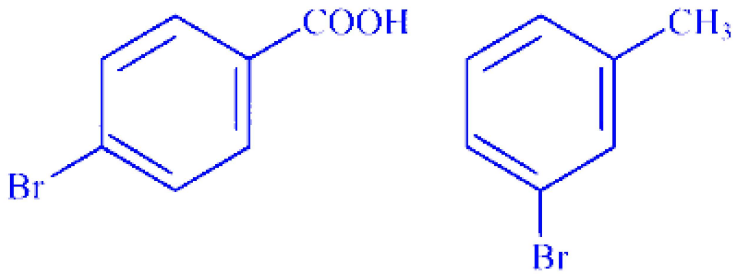
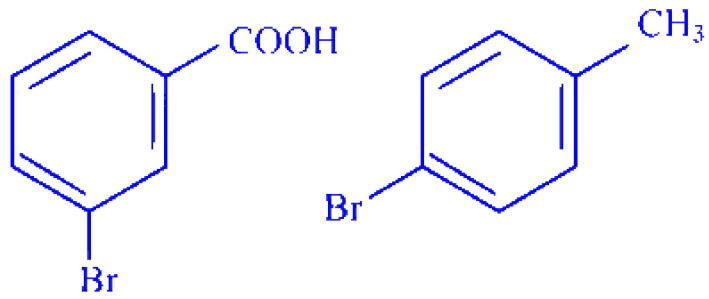
Options:

A. 

B. 

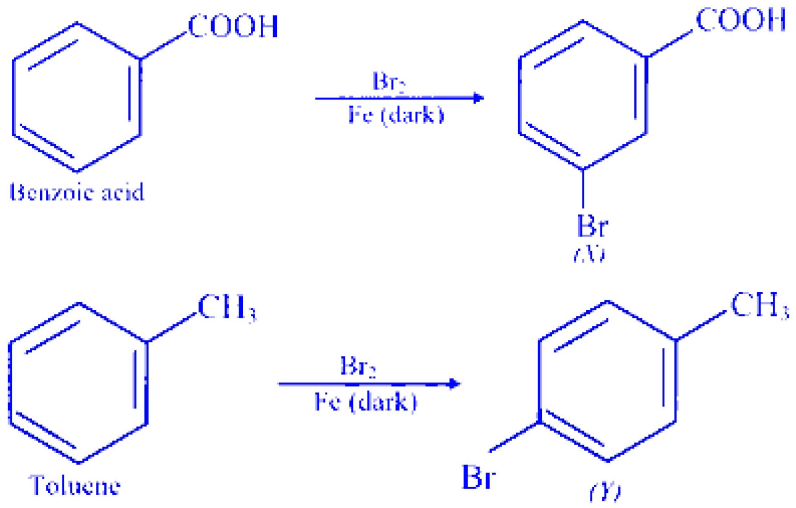
C. 

D. 

Answer: D

Solution:

The complete reaction involved is



Question3

The structures of succinic acid (x) and malonic acid (y) respectively are

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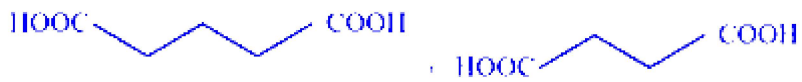
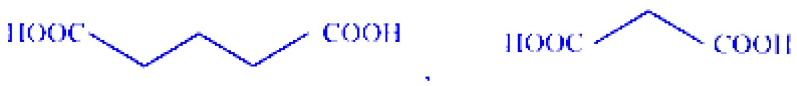
Options:

A. 

B. 

C. 

D. 

Answer: D

Solution:

The correct structures of succinic acid (x) and malonic acid (y) respectively are

Question4

The final product (C) in the given reaction sequence is

$$C_6H_5COOH \xrightarrow{SOCl_2} (A) \xrightarrow[\text{anhy } \cdot AlCl_3]{C_6H_6} (B) \xrightarrow[\text{(ii) } KOH_4/(CH_2OH)_2]{\text{(i) } NH_2-NH_2} (C)$$

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Options:

A.

benzophenone

B.

diphenyl methane

C.

diphenylmethanol

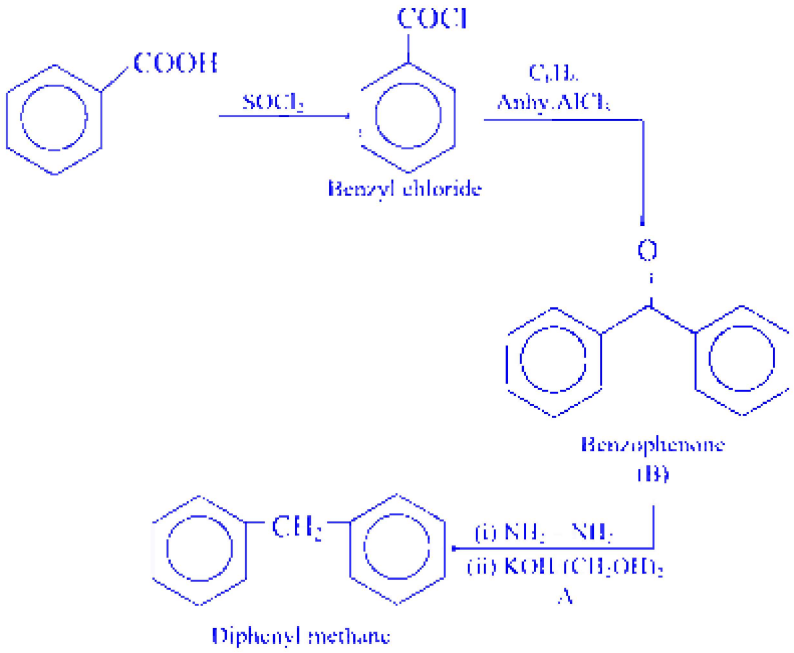
D.

benzoic acid

Answer: B

Solution:

The complete reaction sequence is as follows



Question5

An alkyl bromide X $(C_5H_{11}Br)$ undergoes hydrolysis in a two step mechanism X is converted to Grignard reagent and then reacted with CO_2 in dry ether followed by acidification gave Y. What is Y ?

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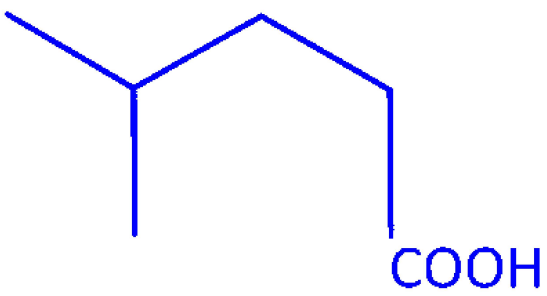
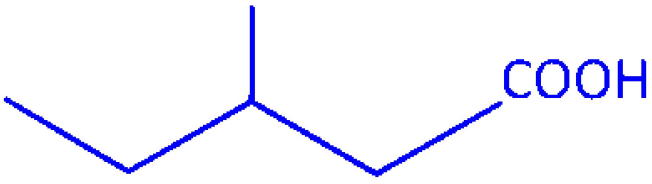
Options:

A.

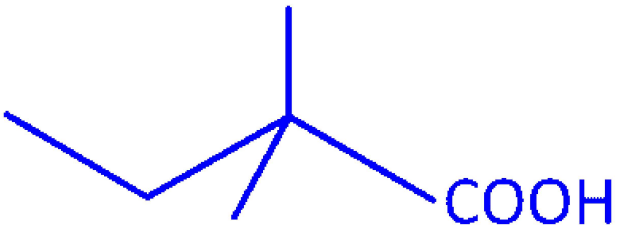


B.

C.



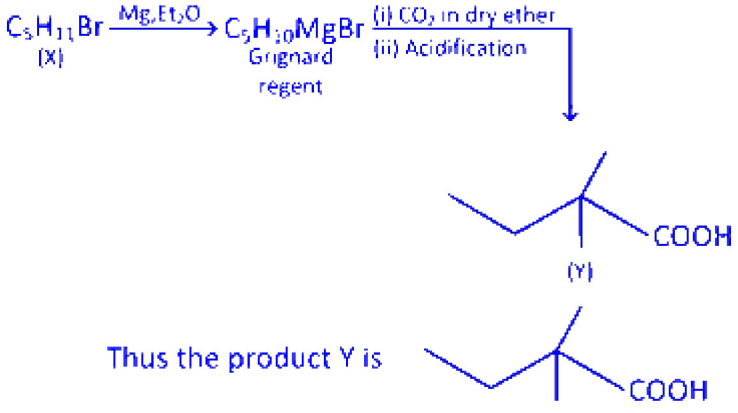
D.



Answer: D

Solution:

The complete reaction sequence is as follows



Question6

Consider the following sequence of reactions

$$C_6H_5COONa \xrightarrow[\Delta]{NaOH/CaO} X \xrightarrow[Anhy\ \cdot AlCl_3]{CO+\ HCl} Y \xrightarrow[NaOH]{Conc.} A + B$$

If A is the reduction product of Y, what is B ?

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Options:

A.

Sodium formate

B.

Sodium phenoxide

C.

Sodium salt of benzoic acid

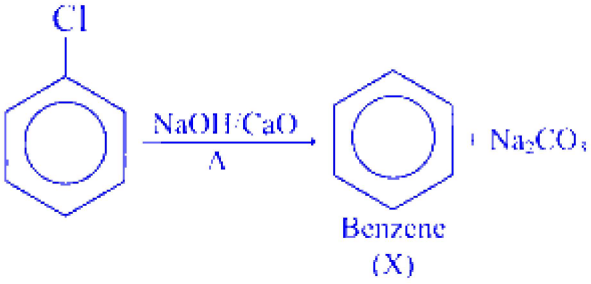
D.

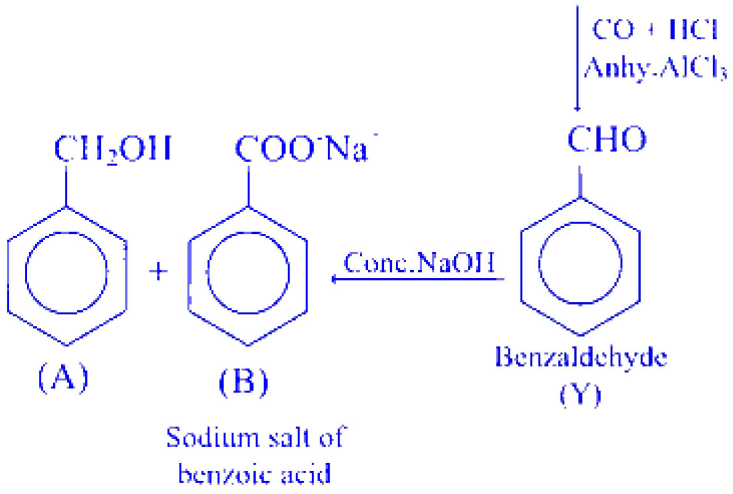
Sodium salt of salicylic acid

Answer: C

Solution:

The complete reaction sequence is as follows





Question7

What are X, Y, Z in the following reaction sequence?

But-2-ene $\xrightarrow{X}$ **Ethanoic acid** $\xrightarrow{Y}$ **Ethanoyl chloride** $\xrightarrow[\text{Anhy.}]{\text{Benzene}}{}_{\text{AlCl}_3} Z$

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Options:

A.

$KMnO_4/H^+; SOCl_2$; Acetophenone

B.

$KMnO_4/H^+; Cl_2$; Propiophenone

C.

Cold $KMnO_4; SOCl_2$; Propiophenone

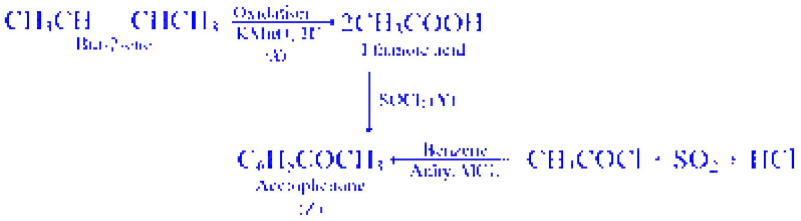
D.

Cold$KMnO_4; Cl_2$; Acetophenone

Answer: A

Solution:

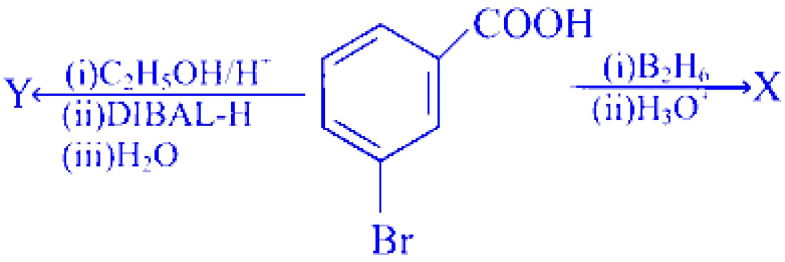
The complete reaction is as follows,



$X = \mathrm{KMnO_4/H^+}, Y = \mathrm{SOCl_2}$
$Z =$ Acetophenone

Question8

What are X and Y respectively in the following set of reactions?



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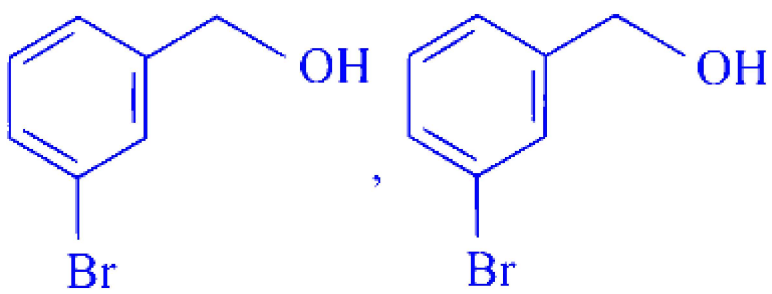
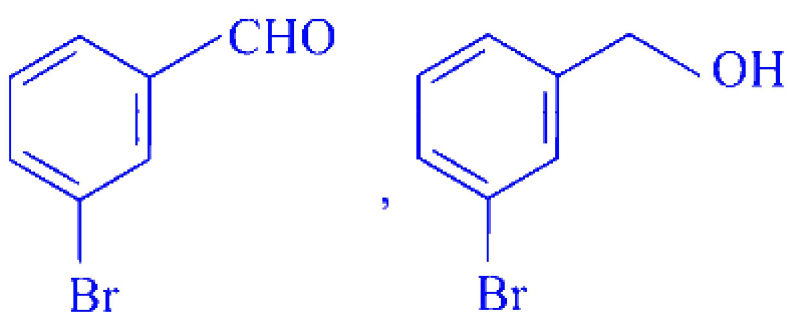
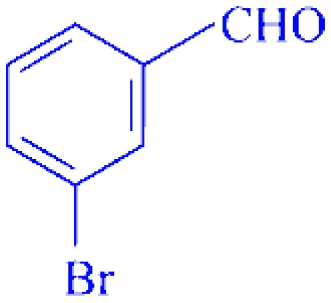
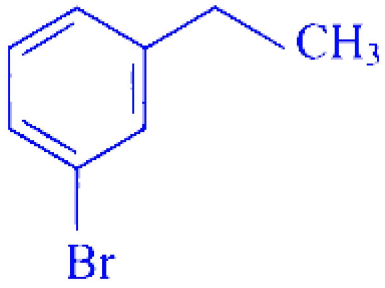
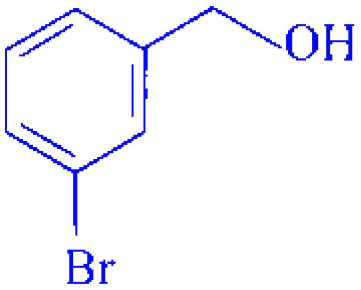
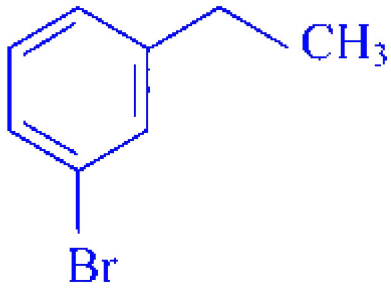
Options:

A. 

B. 

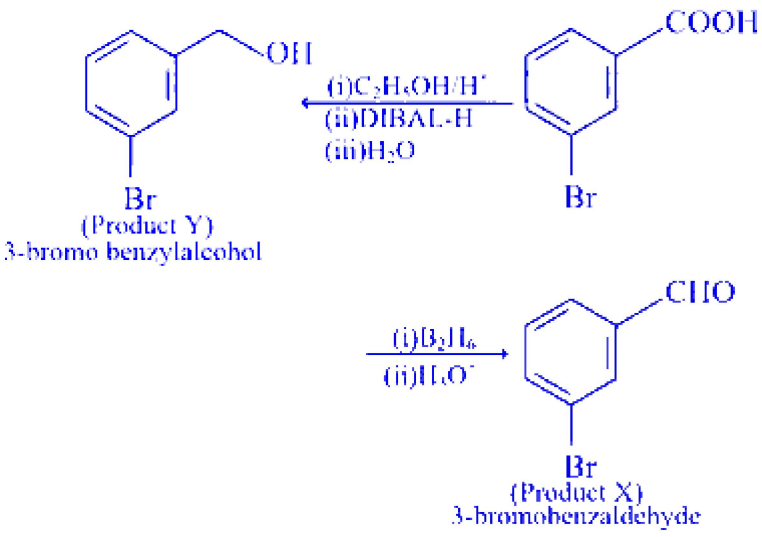
C.  , 

D.  , 

Answer: B

Solution:

The complete reaction is as follows,



Question9

The most acidic carboxylic acid is

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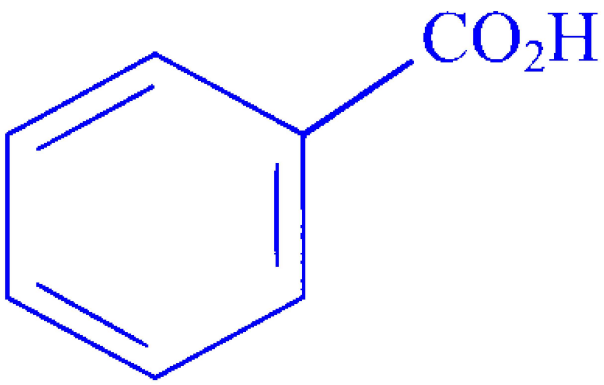
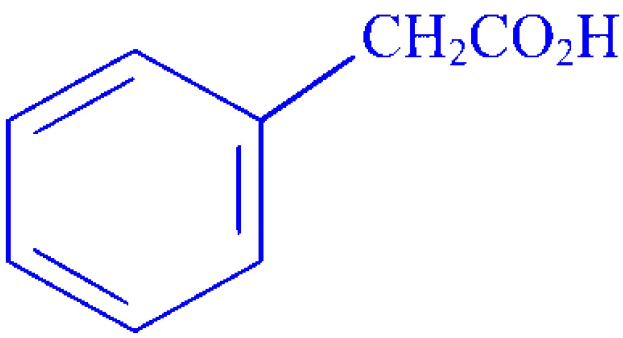
Options:

A. 

B. 

C.

HCOOH

D.

CH_3COOH

Answer: C

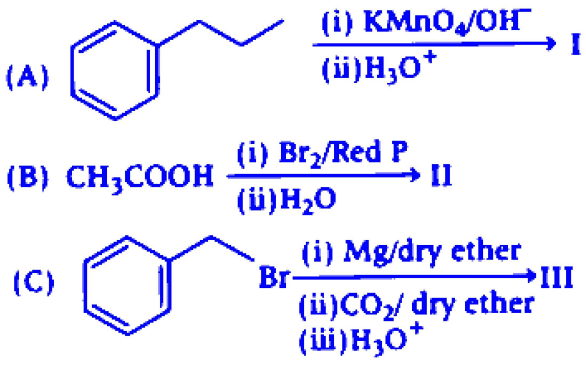
Solution:

Among the given options, most acidic carboxylic acid is HCOOH .

This is due to the sability of its conjugate base, the formate ion $\left[HCOO^{-}\right)$.

Question10

Arrange the products I, II, III from the following reactions in decreasing order of their acid strength.



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Options:

A.

III > II > I

B.

III > I > II

C.

II > I > III

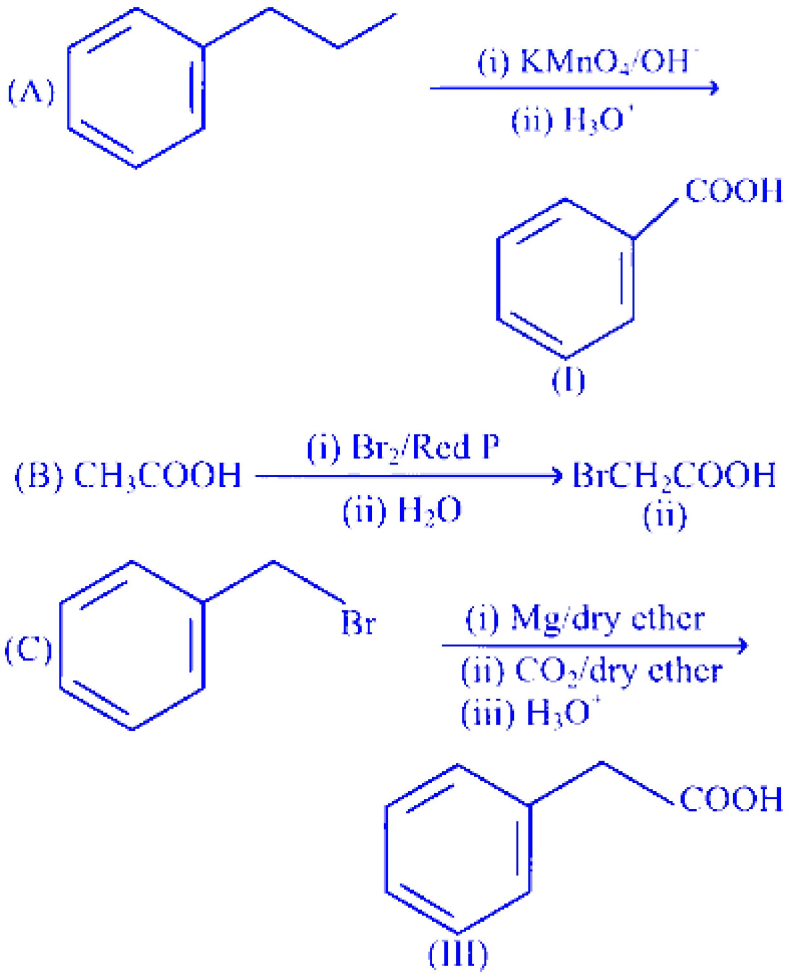
D.

I > II > III

Answer: C

Solution:

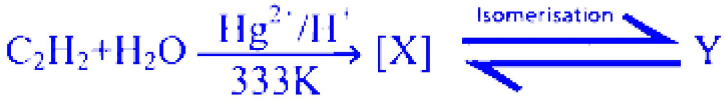
The complete reaction sequence is as follows



Thus, the correct decreasing order of their acid strength is II > I > III.

Question11

Consider the following reactions



Y can not be obtained from which of the following reaction?

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Options:

A.

$CH_3COCl + H_2 \xrightarrow[BaSO_4]{Pd/}$

B.

$CH_3CH_2OH \xrightarrow{Cu/573\ K}$

C.

$CH_3CN + SnCl_2 + HCl \longrightarrow X \xrightarrow{H_3O^+}$

D.

$CH_3COOH \xrightarrow[(i)\ \ H/H_2O]{O\ \ LiAl_2}$

Answer: D

Solution:

The reaction provided in option (d) results in the formation of a primary alcohol.

The specific reaction is as follows:

$CH_3COOH \xrightarrow[(ii)\ \ H_2O]{(i)\ \ LiAlH_4\ /ether} CH_2CH_2OH$

This procedure leads to the production of ethanol (a primary alcohol), not acetaldehyde.

Compound Y, which is the desired product, is acetaldehyde (CH_3CHO). Therefore, the reaction outlined in option (d) cannot be used to produce compound Y.

Question12

Assertion (A) : Carboxylic acids are more acidic than phenols

Reason (R) : Resonance structures of carboxylate ion are equivalent, while resonance structures of phenoxide ion are not equivalent.

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Options:

A. Both (A) and (R) are correct and (R) is the correct explanation of (A).

B. Both (A) and (R) are correct But (R) is not the corred explanation of (A).

C. (A) is correct but (R) is incorrect.

D. (A) is incorrect but (R) is correct.

Answer: A

Solution:

Both A and R are correct and R is the correct explanation of A.

Question13

In the reaction sequence Y is

$$CH_3CO_2H \xrightarrow[(2)\Delta]{(1)NH_3} P \xrightarrow{Br/NaOH} Y$$

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Options:

A. a primary amine with same number of carbons as in P.

B. a primary amine with one carbon less than in P.

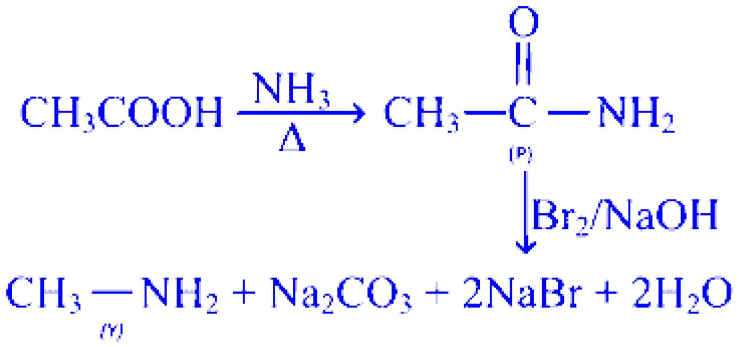
C. a secondary amine with same number of carbons as in P

D. a secondary amine with one carbon less than in P.

Answer: B

Solution:

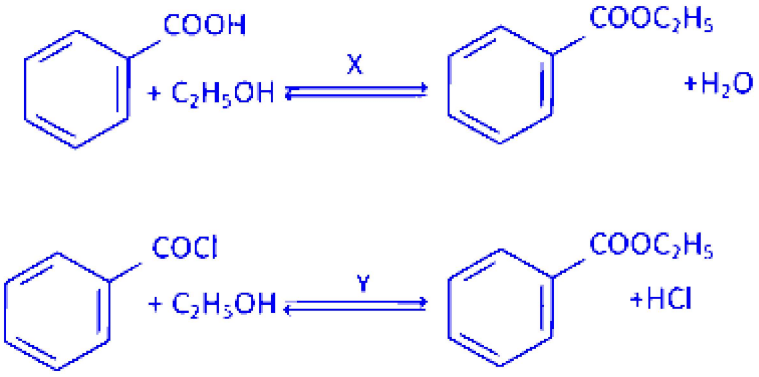
The complete reaction sequence is as follows.



Then, the compound Y is a primary amine with one carbom less than in P.

Question14

What are X and Y respectively in the following reactions?



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Options:

A. H^-, H^+

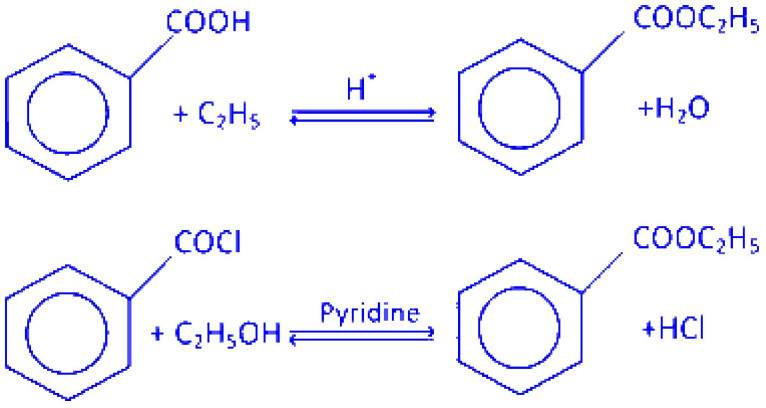
B. H^+, Pyridine

C. Pyridine, H^+

D. Pyridine, Pyridine

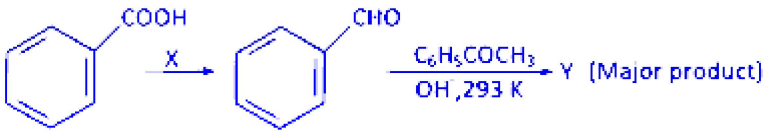
Answer: B

Solution:



Question15

What are X and Y respectively in the following reactions?



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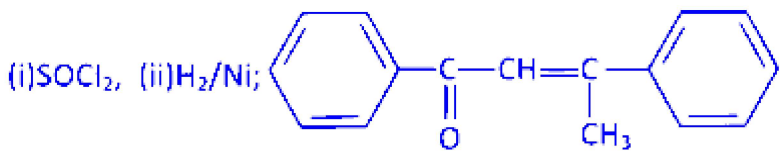
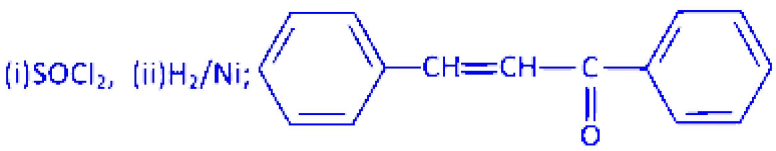
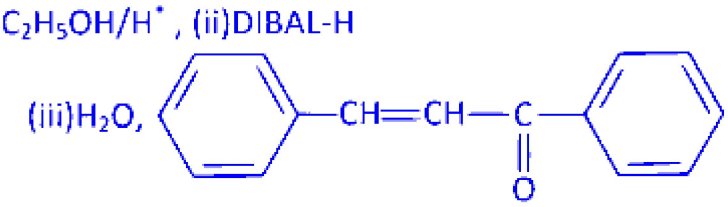
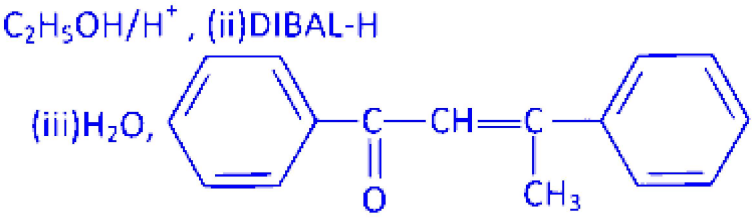
Options:

A. 

B. 

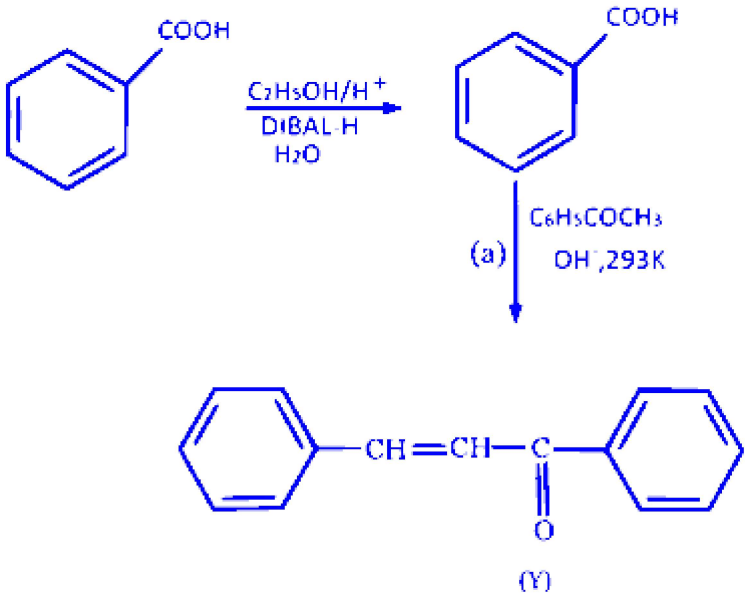
C. 

D. 

Answer: C

Solution:

The reaction involved is as follows.



Question16

What is X in the following reaction?

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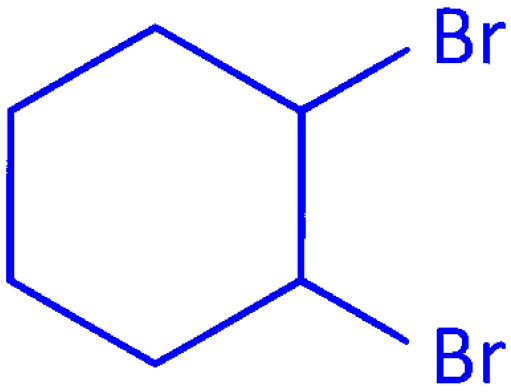
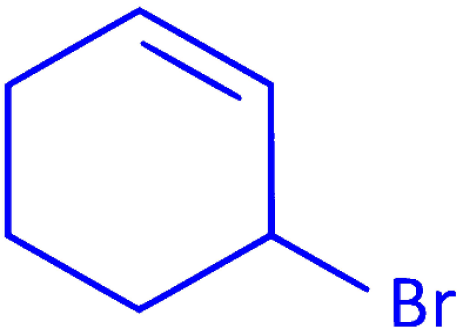
Options:

A. $H_3C - CH_2 - C \equiv C - CH_2 - CH_2Br$

B. $H_3C - CH_2 - C \equiv C - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3$

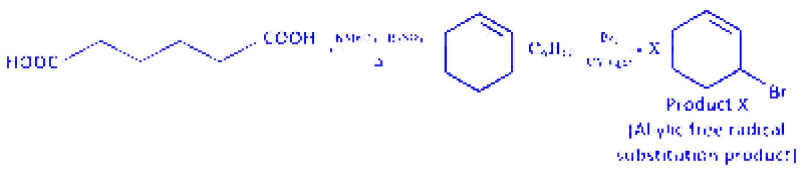
C. 

D. 

Answer: D

Solution:

The complete reaction is as follows,



Question17

What are A and B in the following reaction sequence ?

$$CH_3COOH \xrightarrow{A} X \xrightarrow[H^+]{Y} B \text{ (Analgesic drug)}$$

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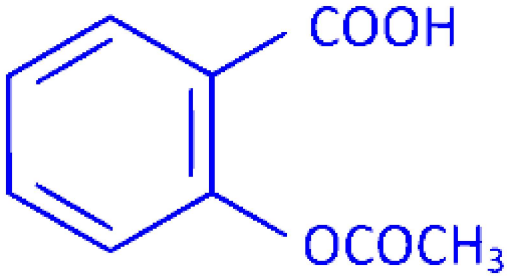
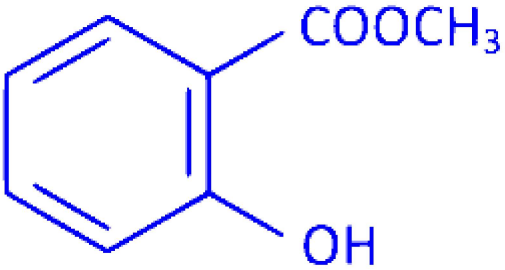
Options:

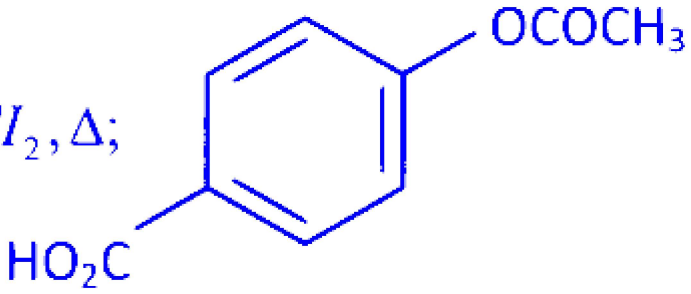
A. $P_2O_5, \Delta;$



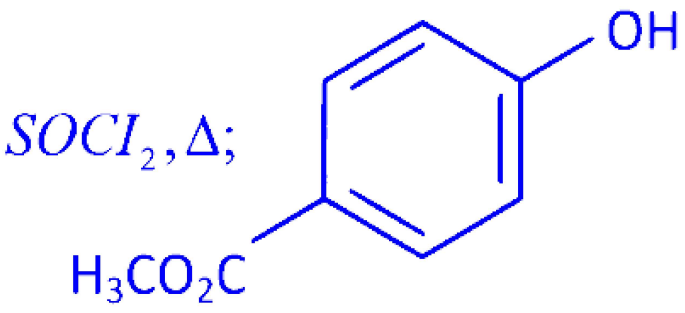
B. $P_2O_5, \Delta;$



C. $SOCl_2, \Delta;$



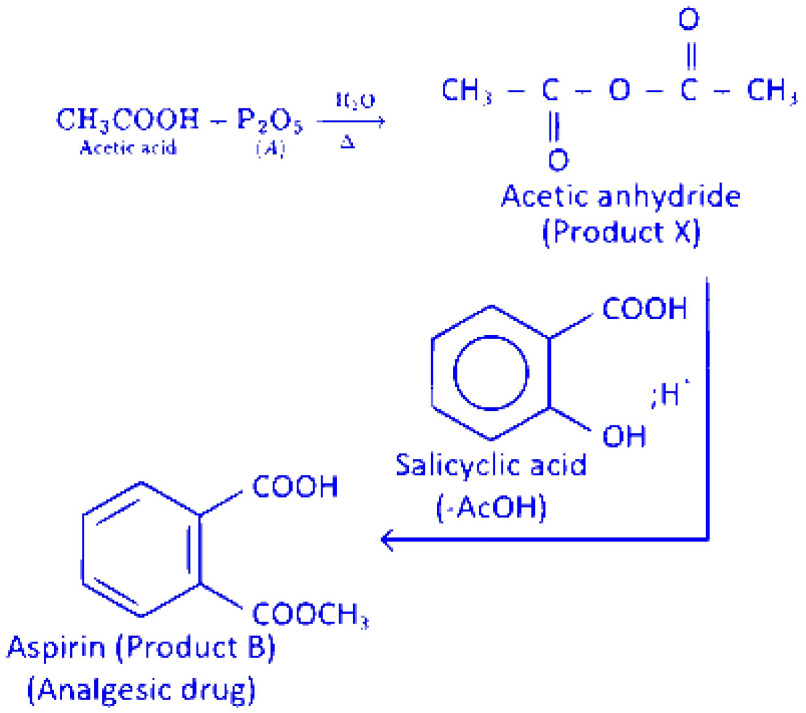
D.



Answer: A

Solution:

The complete reaction is as follows,



Question18

When glucose is oxidised with nitric acid the compound formed is

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Options:

A. Gluconic acid

B. n-hexanoic acid

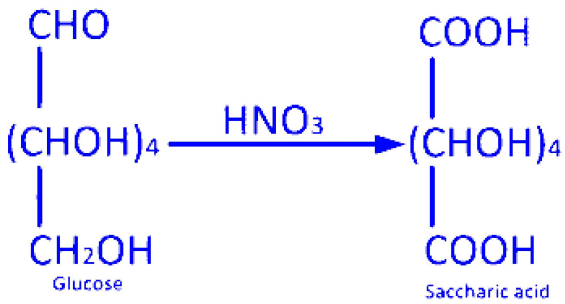
C. Sacharic acid

D. Cyanohydrin

Answer: C

Solution:

When glucose is oxidised with nitric acid, saccharic acid is formed.



Question19

$$\text{Benzamide} \xrightarrow{Br_2/NaOH} X \xrightarrow[\text{Alc. KOH}]{CHCl_3} Y$$

The conversion of X to Y is

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Options:

A. Hoffmann reaction

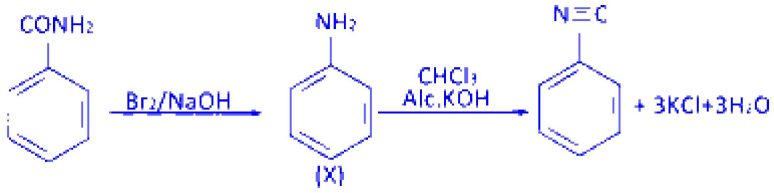
B. Etard reaction

C. Stephen reaction

D. Carbyl amine reaction

Answer: D

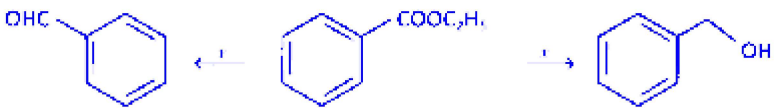
Solution:



The conversion of X to Y is called as carbylamine reaction.

Question20

What are X and Y in the following set of reactions?



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Options:

A. $X =$ (i) DIBAL $-H$ (ii) $H_2O Y =$ (i) DIBAL -H (ii) H_2O

B. $X = H_2 /$ Catalyst $Y = H_2$ / Catalyst

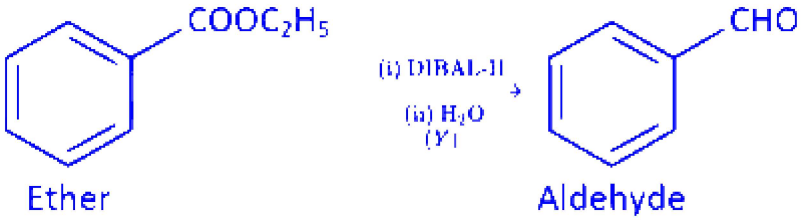
C. $X = H_2$ / Catalyst $Y =$ (i) DIBAL -H (ii) H_2O

D. X = (i) DIBAL - H (ii) H_2O, Y = $H_2 /$ Catalyst

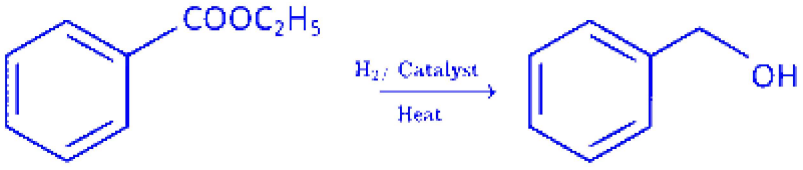
Answer: C

Solution:

When ether is reduced with DIBAL-H, aldehyde is formed



When ether is reacted with excess H_2, then alcohol is formed.



Hence, $X = H_2/$ catalyst, $Y =$ DIBAL-H (ii) H_2O.

Question21

An aryl carboxylic acid on treatment with sodium hydrogen carbonate liberates a gaseous molecule. Identify the gas molecule liberated.

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Options:

A. H_2

B. CO_2

C. CO

D. O_2

Answer: B

Solution:

Carboxylic acid can be tested by treating with sodium hydrogen carbonate. The brisk effervescences of CO_2 will confirm the test. Further by passing it through lime water, the milky solution too confirms the test.

$$Ar - COOH + NaHCO_3 \longrightarrow ArCOO^{\ominus}Na^{\oplus} + CO_2 \uparrow + H_2O$$

Question22

In the presence of peroxide, styrene reacts with HBr to give X. When X is reacted with magnesium in dry ether followed by CO_2 and hydrolysis gave Y. Treatment of Y with PCl_5 and then next with H_2. $Pd - BaSO_4$ gave Z . What is Z ?

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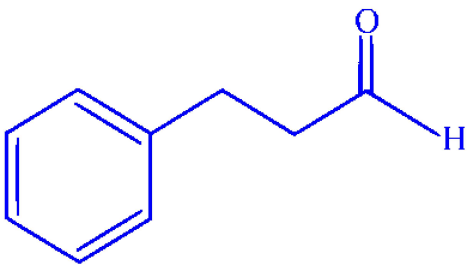
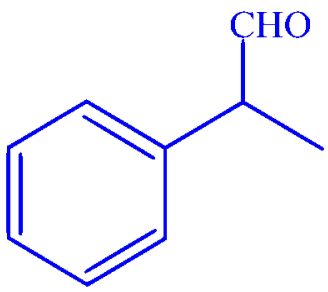
Options:

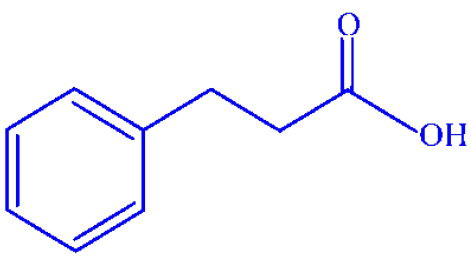
A.



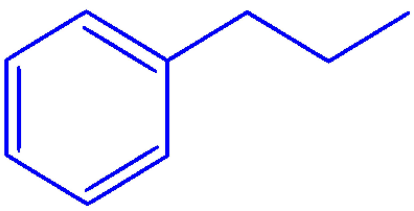
B.



C.



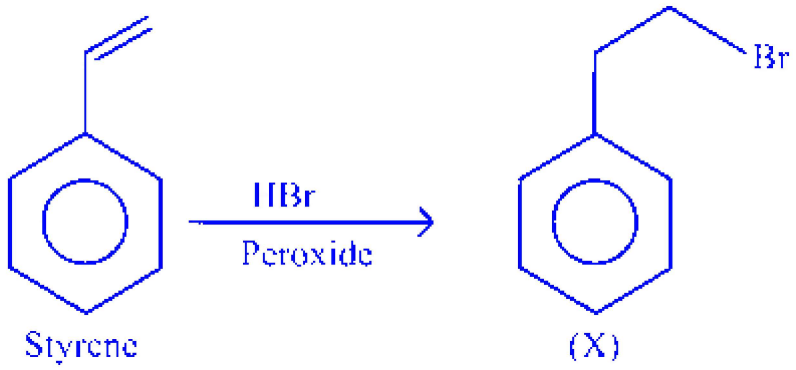
D.



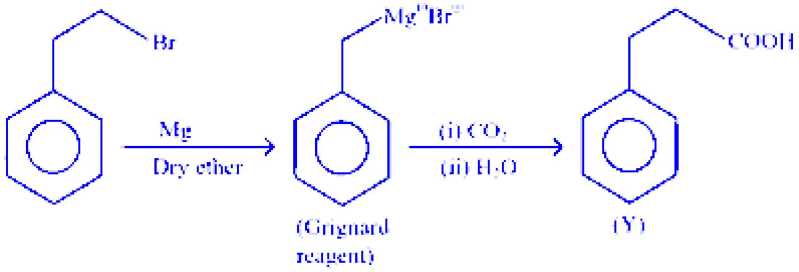
Answer: A

Solution:

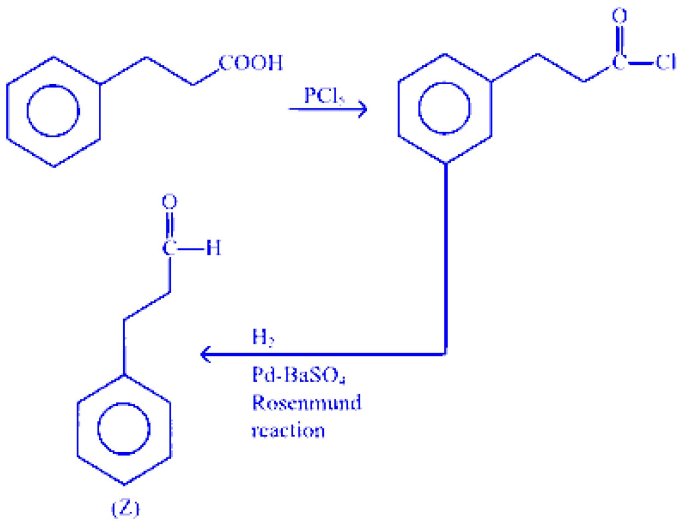
Styrene reacts with HBr in presence of peroxide to add Br at less substituted carbon. This reaction follows anti-Markownikoff rule.



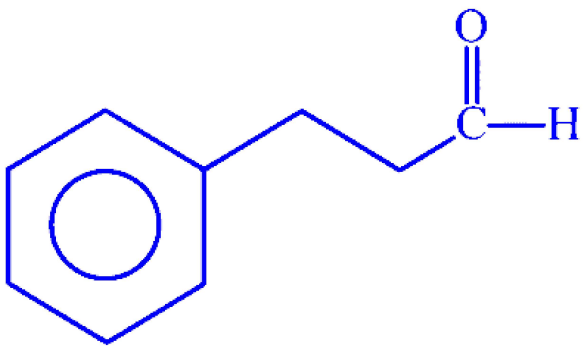
Product (X) reacts with Mg in dry ether to form Grignard reagent which on treatment with CO_2 followed by hydrolysis gives carboxylic acid.



Y on treatment with PCl_5 form acyl chloride. This acyl chloride on reduction with H_2; $Pd - BaSO_4$ gives aldehyde and this reaction is known as "Rosenmund reaction."



Hence, Z is



Question23

The correct order of acidic strength among the following is

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Options:

A. $FCH_2CO_2H > C_6H_5CO_2H > CH_3CH_2CHClCO_2H > CH_3CO_2H$

B. $C_6H_5CO_2H > CH_3CO_2H > CH_3CH_2CHClCO_2H > FCH_2CO_2H$

C. $CH_3CH_2CHClCO_2H > FCH_2CO_2H > CH_3CO_2H > C_6H_5CO_2H$

D. $FCH_2CO_2H > CH_3CH_2CHClCO_2H > C_6H_5CO_2H > CH_3CO_2H$

Answer: D

Solution:

Carboxylic acids are the most acidic compounds among the organic compounds. Due to presence of electron withdrawing group i.e. chlorine and fluorine, FCH_2COOH and $CH_3CH_2CHClCOOH$ are more acidic, than C_6H_5COOH and CH_3COOH. Fluorine is more electron withdrawing group than chlorine.

Therefore, $\underset{\text{Fluoro ethanoic acid}}{FCH_2COOH} > \underset{\text{2-chlorobutanoic acid}}{CH_3CH_2CHClCOOH} > \underset{\text{Benzoic acid}}{C_6H_5COOH} > \underset{\text{Acetic acid}}{CH_3COOH}$
