Alcohol, Phenols and Ethers

Question1

Ethyl alcohol is heated with concentrated sulphuric acid at 413 K . The major product

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Options:

A. $C_2H_5 - O - C_2H_5$

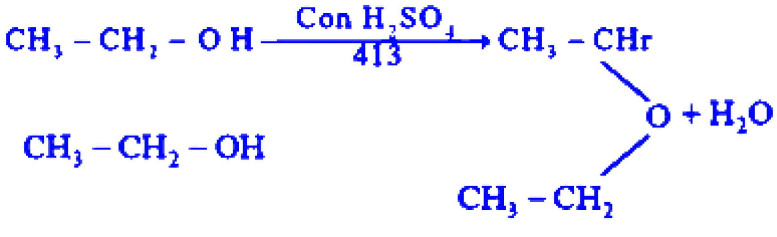
B. $CH_3 - O - C_3H_7$

C. $CH_2 = CH_2$

D. $CH_3COOC_2H_5$

Answer: A

Solution:



Question2

Phenol can be distinguished from propanol by using the reagent

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Options:

A. Bromine water

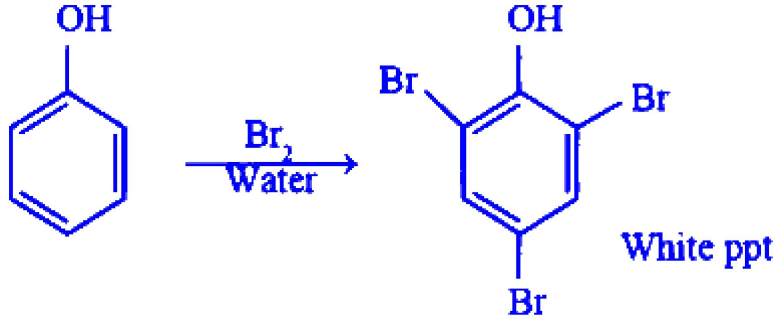
B. Iron metal

C. Iodine in alcohol

D. Sodium metal

Answer: A

Solution:



Where as propand Cannot form white ppt with Br_2 water

Question3

Match the following with their pKa values

Acid	pKa
(I) Phenol	(a) 16
(II) p-Nitrophenol	(b) 0.78
(III) Ethyl alcohol	(c) 10
(IV) Picric acid	(d) 7.1

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Options:

A. I - c, II - d, III - a, IV - b

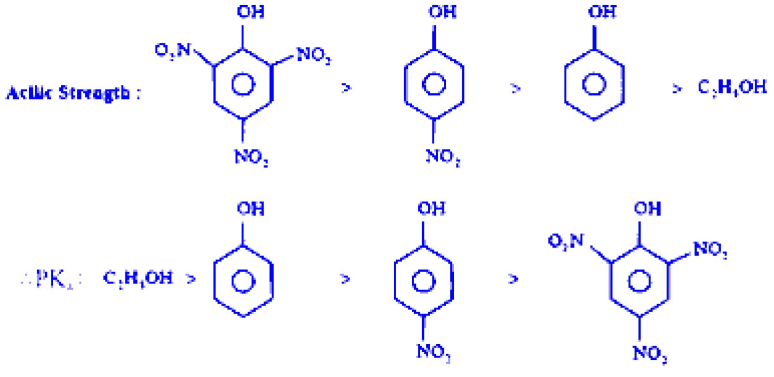
B. I - a, II - d, III - c, IV - b

C. I - a, II - b, III - c, IV - d

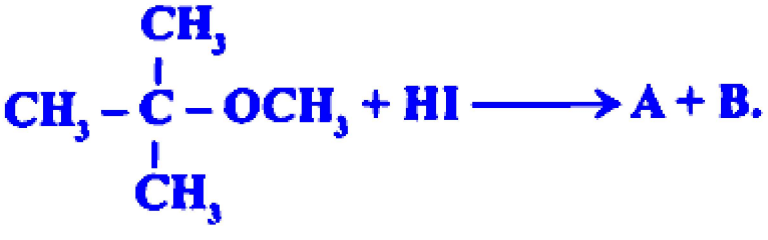
D. I - b, II - a, III - d, IV - c

Answer: A

Solution:



Question4



A and *B* respectively are

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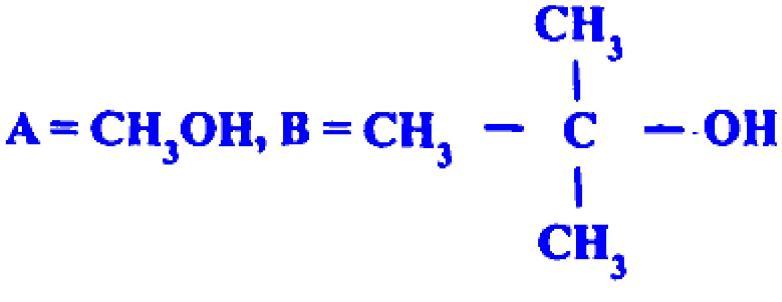
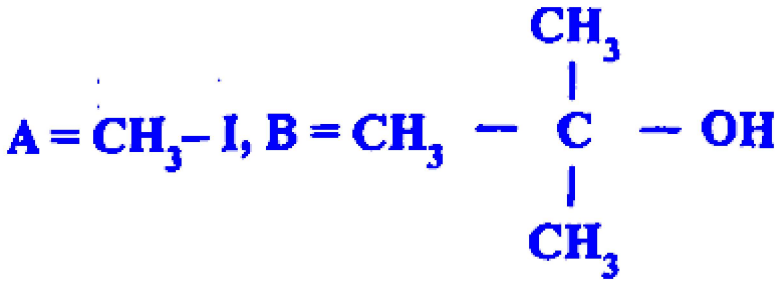
Options:

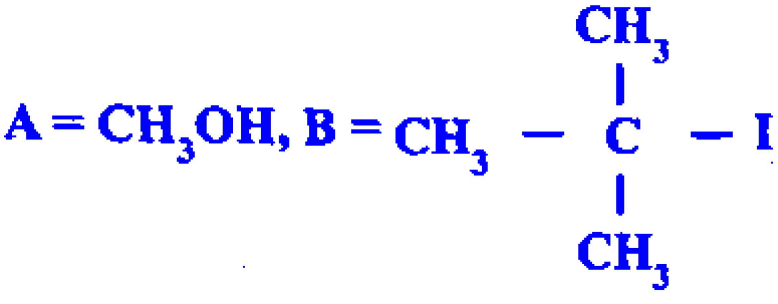
A.



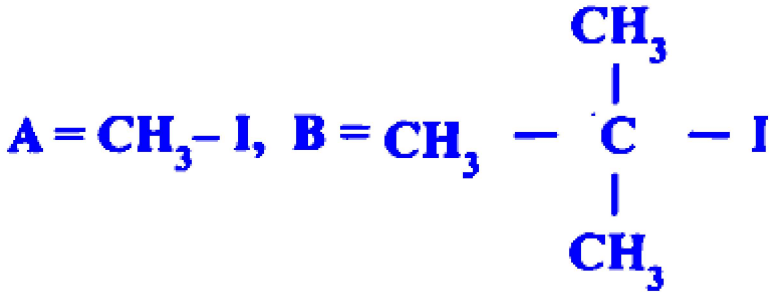
B.



C.

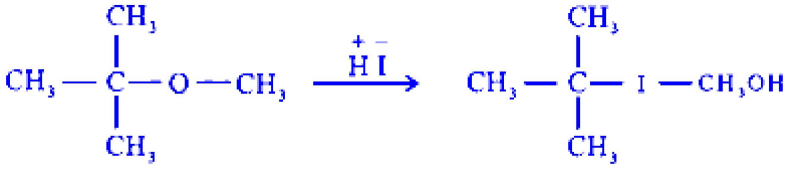


D.



Answer: C

Solution:



Question5

8.8 g of monohydric alcohol added to ethyl magnesium iodide in ether liberates 2240 cm^3 of ethane at STP. This monohydric alcohol when oxidised using pyridinium-chloro-chromate, forms a carbonyl

compound that answers silver mirror test (Tollen's test). The monohydric alcohol is

KCET 2024

Options:

A. butan-2-ol

B. 2,2-dimethyl propan-1-ol

C. pentan-2-ol

D. 2, 2-dimethyl ethan-1-ol

Answer: B

Solution:

Given that, 8.8 g of monohydric alcohol liberates 2240 cm^3 of ethane.So, 88 g of monohydric alcohol will liberate 22400 cm^3 (STP)Now, the carbonyl compound that can oxidise Tollens reagent is aldehyde and it is the oxidising product of 1° alcohol. So, among the given options 2, 2-dimethyl propan-1-ol (molecular mass $= 88$) is the required monohydric alcohol.

Question6

When a tertiary alcohol ' A' $(C_4H_{10}O)$ reacts with $20\%H_3PO_4$ at 358 K , it gives a compound ' B' (C_4H_8) as a major product. The IUPAC name of the compound ' B ' is

KCET 2024

Options:

A. but-1-ene

B. but-2-ene

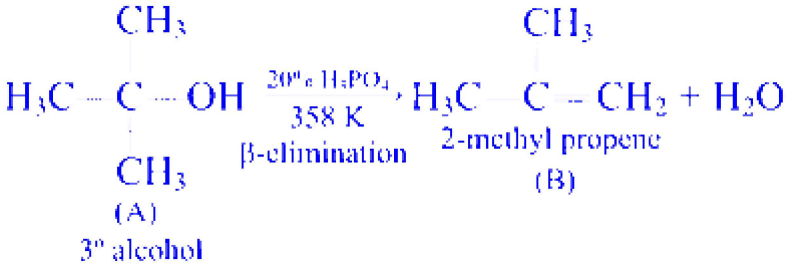
C. cyclobutane

D. 2-methylpropene

Answer: D

Solution:

The complete reaction sequence involved is as follows



Thus, the IUPAC name of the product B is 2-methyl propene.

Question7

PCC is

KCET 2024

Options:

A. $K_2Cr_2O_7$ + Pyridine

B. $CrO_3 + CHCl_3$

C. $CrO_3 + H_2SO_4$

D. A complex of chromium trioxide with pyridine +HCl

Answer: D

Solution:

PCC is pyridinium chlorochromate. It is a complex of chromium trioxide with pyridine +HCl , i.e. $[C_5H_5NH]^+[CrO_3Cl]^-$.

It is a reagent in organic synthesis used primarily for oxidation of alcohols to form carbonyl.

Question8

$$CH_3 - CH = CH - CH_2OH \xrightarrow{PCC}$$

$$CH_3 - CH = CH - CHO$$

Hybridisation change involved at C-1 in the above reaction.

KCET 2023

Options:

A. sp^3 to sp

B. sp^2 to sp^3

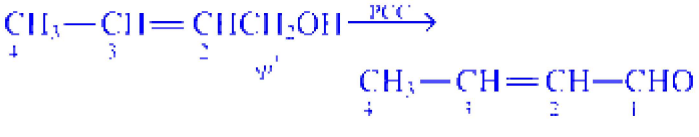
C. sp^3 to sp^2

D. sp to sp^2

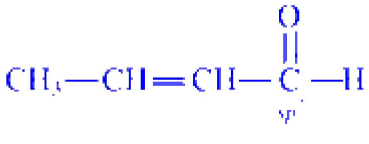
Answer: C

Solution:

For the given reaction hybridisation change is as follows



or



Thus, hybridisation of C-1 changes from sp^3 to sp^2.

Question9

A better reagent to oxidise primary alcohols into aldehyde is

KCET 2023

Options:

A. PCC

B. Alkaline $KMnO_4$

C. Acidified $K_2Cr_2O_7$

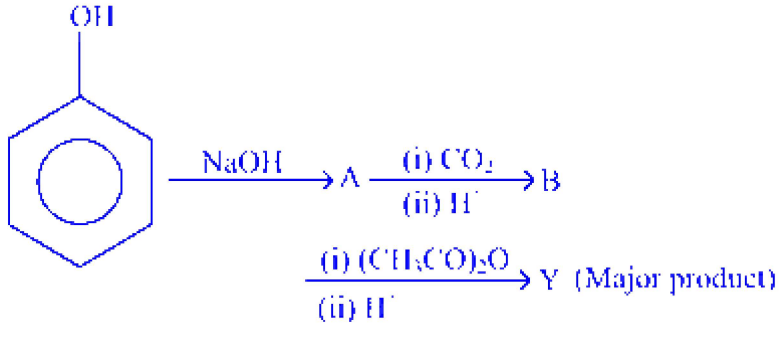
D. CrO_3

Answer: A

Solution:

PCC (pyridinium chlorochromate) is a commonly used reagent for the oxidation of primary alcohols to aldehyde. It is favoured due to its selectivity, mild reaction conditions, compatibility with functional groups and ease of handling.

Question10



Y in the above reaction is

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Options:

A. salicylaldehyde

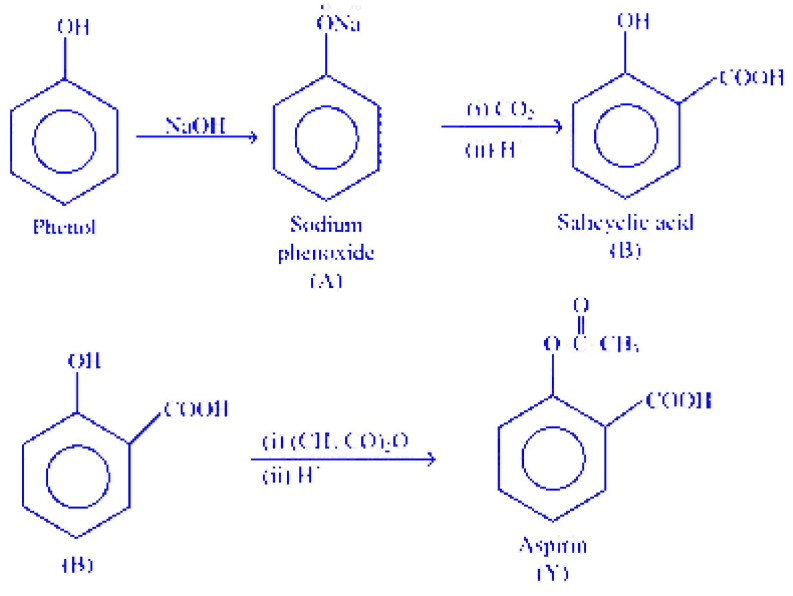
B. aspirin

C. cumene

D. picric acid

Answer: B

Solution:



Thus, the compound Y in above reaction is aspirin.

Question11

An organic compound with molecular formula C_7H_8O dissolves in $NaOH$ and gives a characteristic colour with $FeCl_3$. On treatment with bromine, it gives a tribromo derivative $C_7H_5OBr_3$. The compound is

KCET 2022

Options:

A. o-cresol

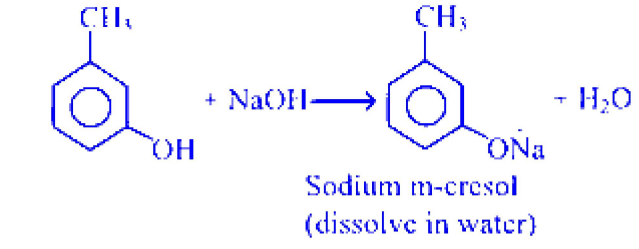
B. *m*-cresol

C. p-cresol

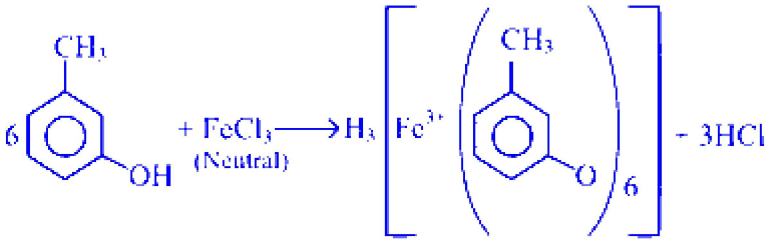
D. benzyl alcohol

Answer: B

Solution:

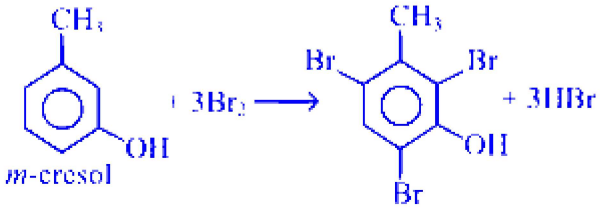


Sodium m-cresol
(dissolve in water)



Violet complex

According to given information the compound is *m*-cresol.



Question12

In Kolbe's reaction the reacting substances are

KCET 2022

Options:

A. phenol and CCl_4

B. sodium phenolate and CCl_4

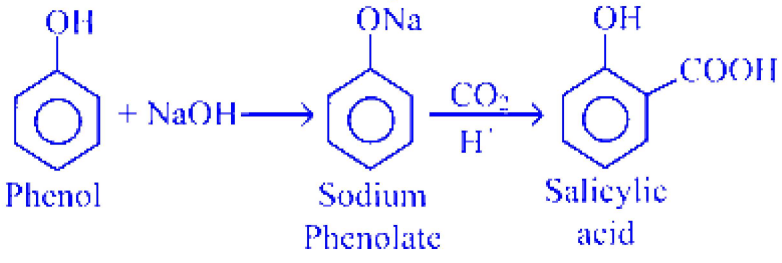
C. phenol and $CHCl_3$

D. sodium phenolate and CO_2

Answer: D

Solution:

In the Kolbes reaction the reacting substances are sodium phenolate and CO_2. The reaction involve are as follows



Question13

The major product obtained when ethanol is heated with excess of conc. H_2SO_4 at 443 K is

KCET 2022

Options:

A. ethyne

B. ethane

C. methane

D. ethene

Answer: D

Solution:

The major product obtained when ethanol is heated with excess of conc. H_2SO_4 at 443 K is ethene. The reaction involve is as follows

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\ K]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$$

Question14

Among the following, the products formed by the reaction of anisole with HI are

KCET 2022

Options:

A. sodium phenate + methanol

B. benzene + methanol

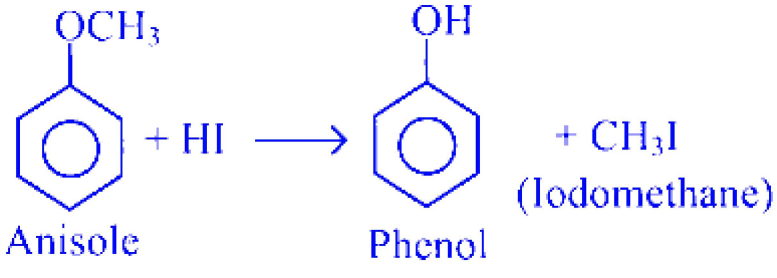
C. phenol + methane

D. phenol + iodomethane

Answer: D

Solution:

Phenol and iodomethane are formed by the reaction of anisole with HI.



Question15

Which is most VISCOUS?

KCET 2022

Options:

A. Ethanol

B. Ethylene glycol

C. Glycerol

D. Methanol

Answer: C

Solution:

We know that, higher is the extent of H-bonding higher will be the viscosity.

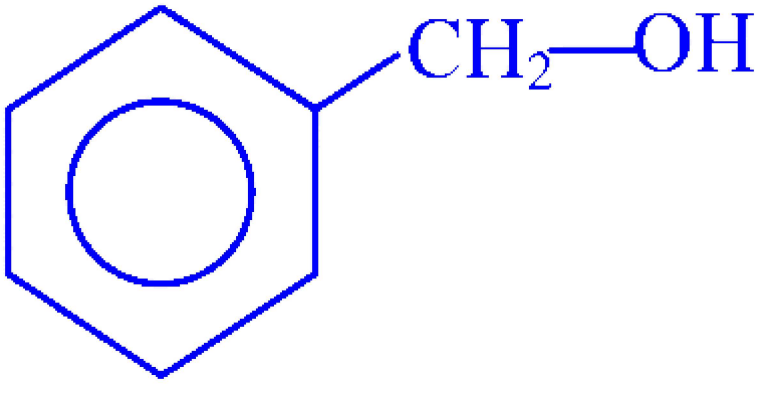
Among the given option glycerol has the highest viscosity as in this case 3-OH groups are involved in hydrogen bonding which is greater than other ethylene glycol has two and both ethanol and methanol has one $-OH$ group.

Question16

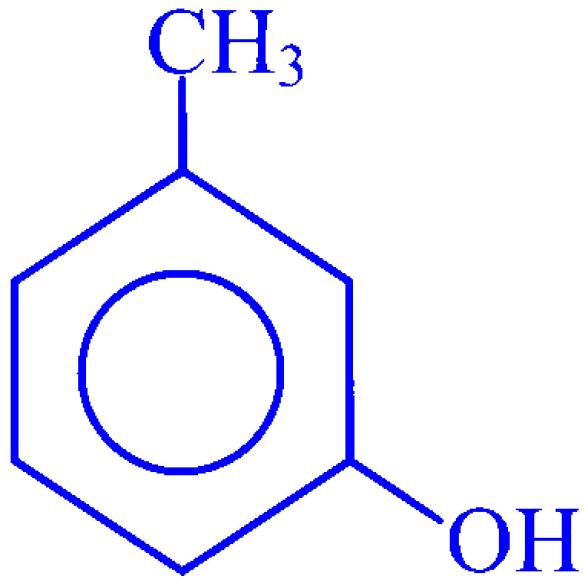
A compound $'A'$ (C_7H_8O) is insoluble in $NaHCO_3$ solution but dissolve in $NaOH$ and give a characteristic colour with neutral $FeCl_3$ solution. When treated with bromine water compound $'A'$ forms the compound B with the formula $C_7H_5OBr_3$. $'A'$ is

KCET 2021

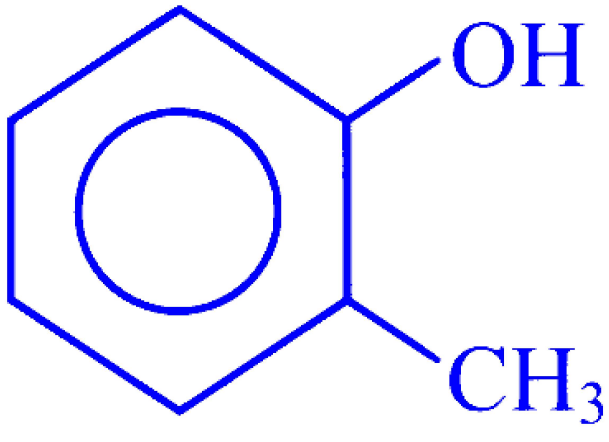
Options:

A. 

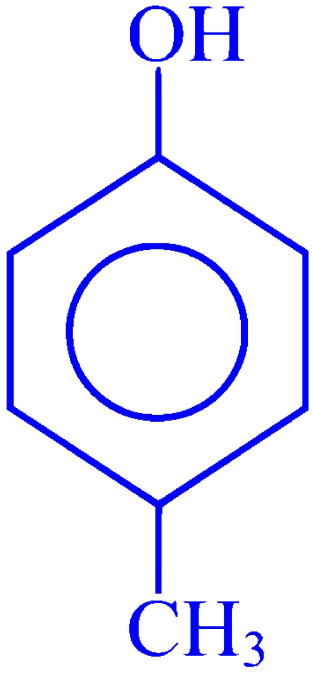
B.



C.



D.



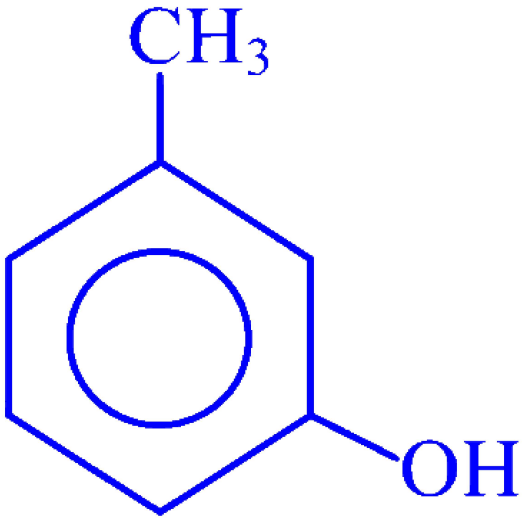
Answer: B

Solution:

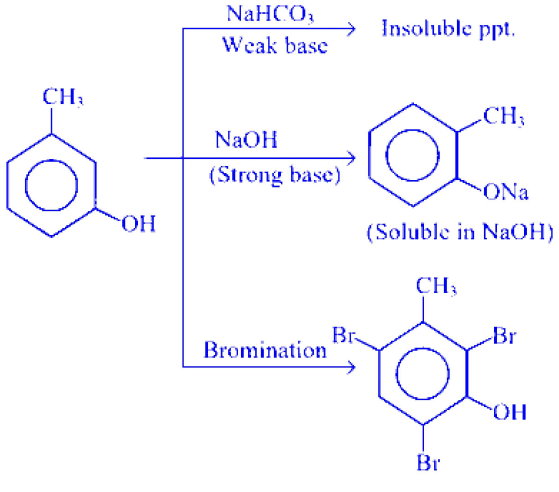
It is given in the question that, compound A gives a characteristic colour with neutral $FeCl_3$ solution and soluble in NaOH solution that means it contains a phenolic group.

Since compound 'A' when treated with Br_2 forms compound 'B' with molecular formula $C_7H_5OBr_3$ (ppt.).

Considering the given information the given compound is most likely to be m-cresol. i.e.



Thus, the overall reactions are as follows.



Question17

The major product of the following reaction is

$$CH_2 = CH - CH_2 - OH \xrightarrow[\text{Excess}]{HBr} \text{Product}$$

KCET 2021

Options:

A. $CH_3 - CHBr - CH_2Br$

B. $CH_2 = CH - CH_2Br$

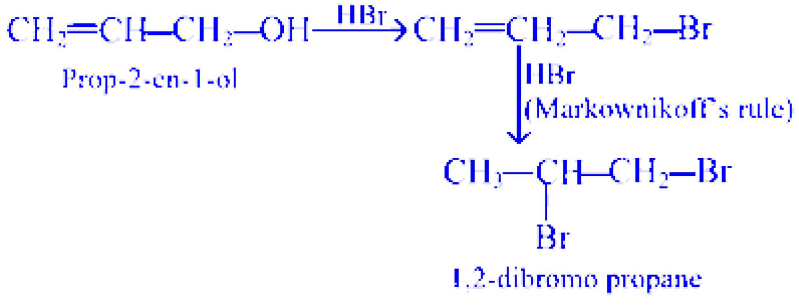
C. $CH_3 - CHBr - CH_2 - OH$

D. $CH_3 - CHOH - CH_2OH$

Answer: A

Solution:

The given reaction take place in following way



Question18

Which of the following on heating gives an ether as major products?

(P) $C_6H_5CH_2Br + CH_3ONa$

(Q) $C_6H_5ONa + CH_3Br$

(R) $(CH_3)_3C - Cl + CH_3ONa$

(S) $C_6H_5CH = CHCl + CH_3ONa$

KCET 2020

Options:

A. Both (R) and (S)

B. Both (P) and (R)

C. Both (Q) and (S)

D. Both (P) and (Q)

Answer: D

Solution:

Here, P and Q both on heating will produce ether as major product.

$$\underset{\substack{\text{(1 halide)}\\\text{Benzyl bromide}}}{C_6H_5CH_2Br} + \underset{\substack{\text{Sodium}\\\text{methoxide}}}{CH_3ONa} \longrightarrow CH_3OCH_2C_6H_5 + NaBr$$

$$\underset{\substack{\text{Sodium}\\\text{phenoxide}}}{C_6H_5ONa} + \underset{\text{(1 halide)}}{CH_3Br} \longrightarrow \underset{\substack{\text{Methoxy benzene}\\\text{(Anisole)}}}{C_6H_5OCH_3} + NaBr$$

Here, aryl halide and sodium alkanide cannot be used for preparing phenolic ethers because of very less reactivity of aryl halides.

Question19

The steps involved in the conversion of propan -2-ol to propan -1-ol are in the order

KCET 2020

Options:

A. dehydration, addition of HBr, heating with aq. KOH

B. heating with PCl_5, heating with alc. KOH, acid catalysed addition of water

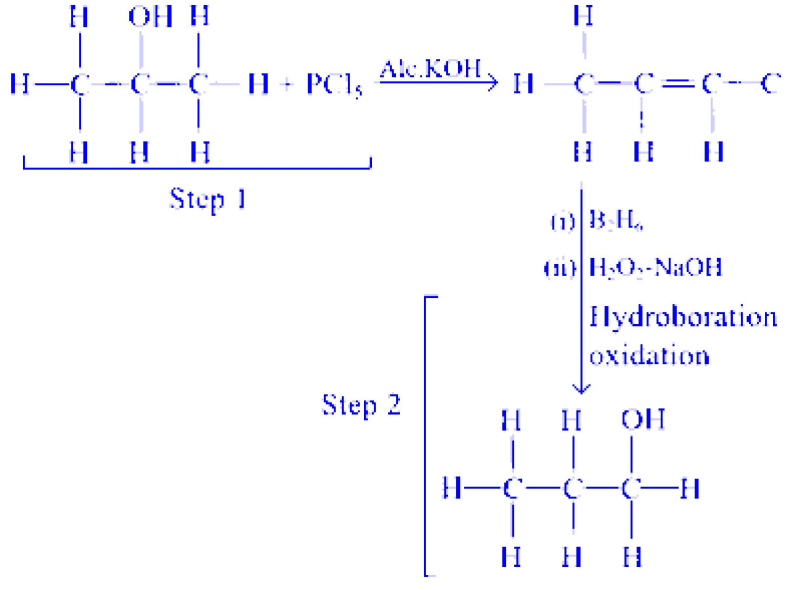
C. heating with PCl_5, heating with alc. KOH, hydroboration oxidation

D. dehydration, addition of HBr in presence of peroxide, heating with alc. KOH

Answer: C

Solution:

The conversion of propan-2-ol and propan-1-ol shall take place as



Question20

Match the following acids with their pKa values :

	Acid		pKa
A.	Phenol	i.	16
B.	*p*-Nitrophenol	ii.	0.78
C.	Ethanol	iii.	10
D.	Picric acid	iv.	7.1

KCET 2019

Options:

A. A - iii, B - iv, C - i, D - ii

B. A - ii, B - i, C - ii, D - iv

C. A - iii, B - i, C - iv, D - ii

D. A - iv, B - ii, C - iii, D - i

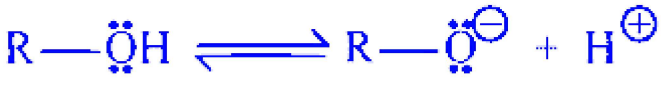
Answer: A

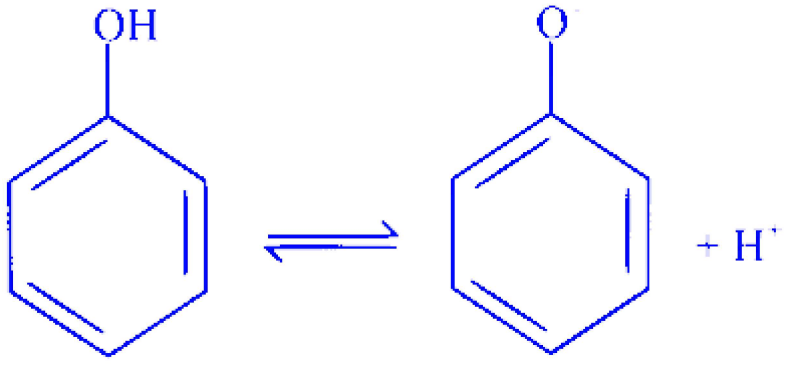
Solution:

Key Idea Acidic strength is inversely proportional to the $p\,K_a$ value. The correct match is

$a \rightarrow iii, b \rightarrow iv, c \rightarrow i, d \rightarrow ii$

Phenols are stronger acids than alcohols. The ionisation of an alcohol and a phenol takes place as follows





In alkoxide ion, the negative charge is localised on oxygen while in phenoxide ion, the charge is delocalised. The delocalisation of negative charge makes phenoxide ion more stable and favours the ionisation of phenol. In substituted phenols, the presence of electron withdrawing groups such as nitro group enhances the acidic strength of phenol. The stronger the acid, the lower the pK_a value.

Question21

Which of the following can be used to test the acidic nature of ethanol?

KCET 2019

Options:

A. Blue litmus

B. Na_2CO_3

C. $NaHCO_3$

D. Na metal

Answer: D

Solution:

The reactions of ethanol with metals (e.g., sodium) indicate its acidic nature. It reacts with active metals such as sodium to yield corresponding alkoxide and hydrogen

$$2R-OH+2Na \rightarrow \underset{\text{Sodium alkoxide}}{2R-\overset{-}{O}-\overset{+}{Na}}+H_2$$

The acidic character of alcohols is due to the polar nature of $O-H$ bond. These are weaker acids than water.

Question22

Phenol can be distinguished from ethanol by the reagent

KCET 2018

Options:

A. bromine water

B. sodium metal

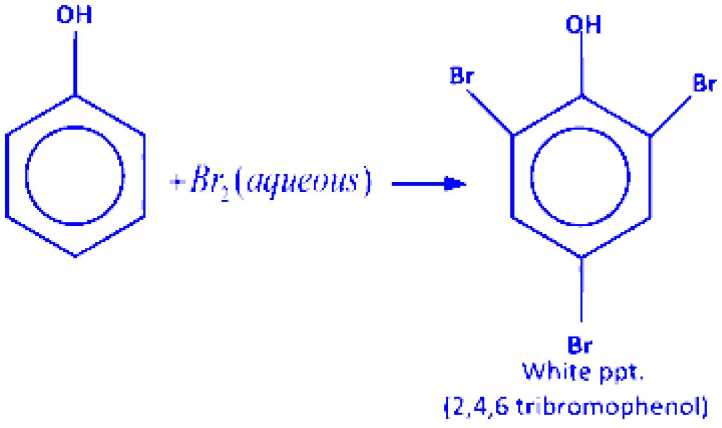
C. iron metal

D. chlorine water

Answer: A

Solution:

(a) Bromine water is used to distinguish phenol from ethanol, as phenol give white ppt. of 2, 4, 6 tribromophenol with Br_2 (aqueous).



While, ethanol will not give any such reaction.

Question23

What is the increasing order of acidic strength among the following?

(i) p-methoxy phenol

(ii) *p*-methyl phenol

(iii) *p*-nitro phenol

KCET 2018

Options:

A. ii < iii < i

B. iii < ii < i

C. i < ii < iii

D. i

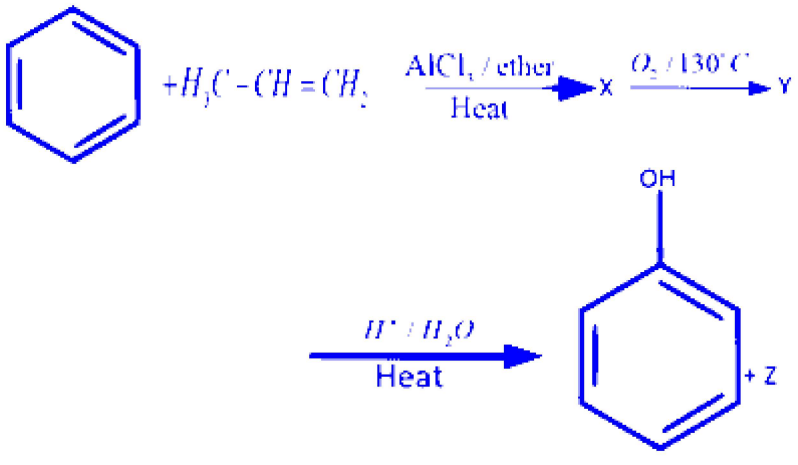
Answer: C

Solution:

In substituted phenol, presence of electron withdrawing group. Such as $-NO_2$ group increases the acidic strength of phenol but presence of electron releasing group such as alkyl and alkoxy group decreases the acidic strength of phenol $-OCH_3$ group is more electron releasing group then CH_3 so, *p*-methoxy phenol is less acidic than *p*-methyl phenol.

Question24

The products X and Z in the following raction sequence are



KCET 2018

Options:

A. isopropyibenzene and acetone

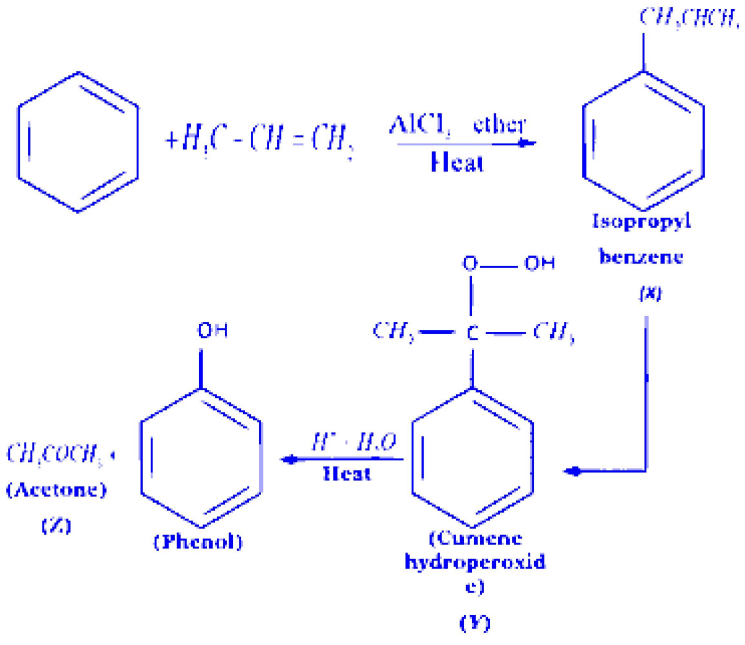
B. cumene peroxide and acetone

C. isopropylbenzene and isopropyl alochol

D. phenol and acetone

Answer: A

Solution:



$\therefore X =$ isopropyl benzene

$Z =$ acetone

Hence, (a) is the correct option.

Question25

Which of the following reagent cannot be used to oxidise primary alcohols to aldehydes?

KCET 2017

Options:

A. Pyridinium chlorochromate

B. $KMnO_4$ in acidic medium

C. CrO_3 in anhydrous medium

D. Heating in presence of Cu at 573 K

Answer: B

Solution:

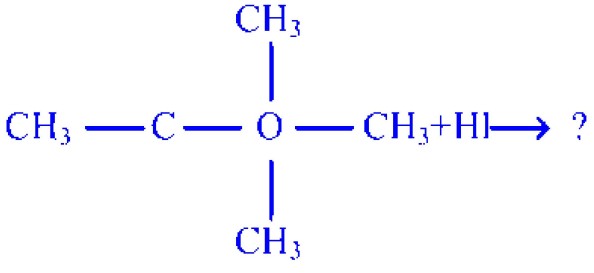
$KMnO_4$ in acidic medium cannot be used to oxidise primary alcohols to aldehydes because it convert primary alcohols into carboxylic acid the direct oxidation of primary alcohols to carboxylic acids can be

carried out using $KMnO_4$.

$$CH_3CH_2OH \xrightarrow[H^+]{KMnO_4} CH_3COOH$$

Question26

The product formed during the following reaction are



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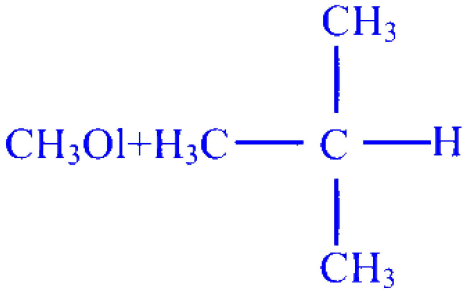
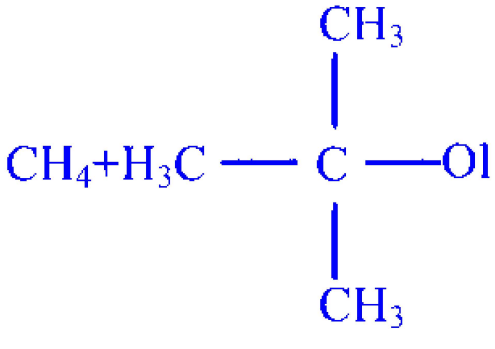
Options:

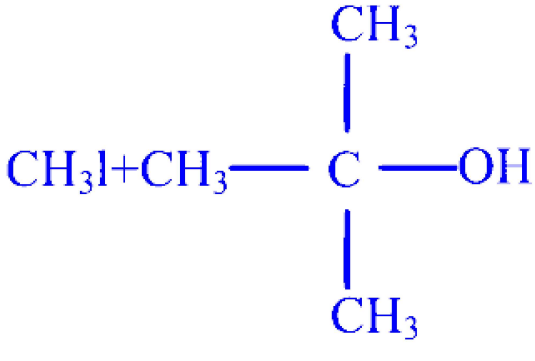
A.



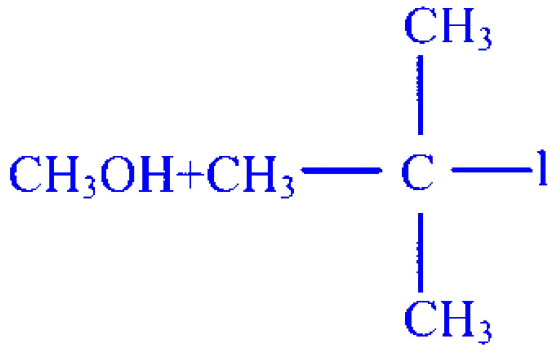
B.



C.

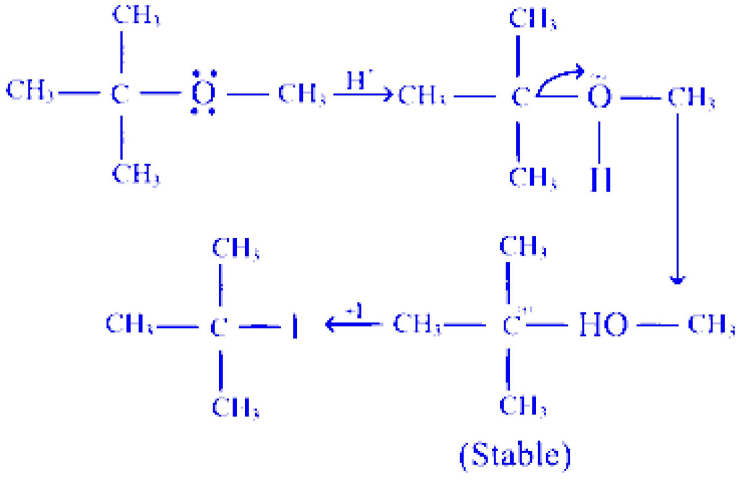


D.



Answer: D

Solution:



Question27

Which of the following order is true regarding the acidic nature of phenol?

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Options:

A. Phenol

B. Phenol > 0-cresol > 0-nitrophenol

C. Phenol o-nitrophenol

D. o-cresol < phenol < o-nitrophenol

Answer: D

Solution:

Presence of electron releasing group like CH_3 over benzene nucleus destabilises the phenoxide ion, thus decreases the acidity of phenol where as presence of electron withdrawing group like NO_2 stabilises the phonoxide ion and thus increases the acidity of phenol, hence order of acidity will be O-cresol < phenol < O - nitrophenol

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Question28

In the following sequence of reactions

$$CH_3Br \xrightarrow{KCN} A \xrightarrow{H_3O^-} B \xrightarrow{LiAl/H_4}$$

The end product C is

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Options:

A. acetone

B. ethyl alcohol

C. methane

D. acetaldehyde

Answer: B

Solution: