Phenol was first isolated from?

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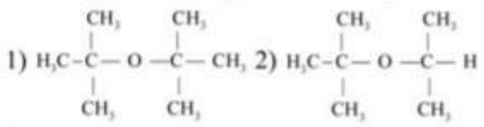
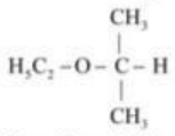
ETHERS

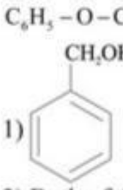
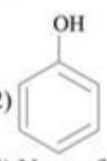
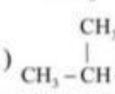
Continued from January 7th..

LEVEL II A

METHODS OF PREPARATION

1. **Which of the following pairs of reagents will not form ether**
   1) $C_2H_5Br + C_2H_5ONa$ 2) $C_2H_5Br + CH_3ONa$
   3) $CH_3Br + C_2H_5ONa$ 4) $C_2H_5Br + HCOONa$
2. **What is Y in the following reactions**
   $C_2H_5I + NaOC_2H_5 \rightarrow X + NaI$
   $X + 2HI \rightarrow 2Y + H_2O$
   1) C_2H_6 2) C_2H_5I 3) C_2H_4 4) $C_2H_5OC_2H_5$
3. **Which of the following cannot be prepared by using Williamson synthesis ?**
   1) Methoxybenzene 2) Benzyl-*p*-nitrophenol ether
   3) Methyl tert-butyl ether 4) Ditertiary butyl ether
4. **Methoxy benzene is called anisole.**
   
   How many more structures can be drawn for the same formula ?
   1) 5 2) 4 3) 3 4) 2
5. **Which of the following types of ethers cannot be synthesized by Williamson synthesis?**
   
   3) $C_6H_5-O-C_6H_5$ 4) None of these
6. **Which alkyl halide would be preferred for the synthesis of the following ether by Williamson synthesis ?**
   
   1) *n*-Propyl chloride 2) Isopropyl chloride
   3) Ethyl chloride 4) Methyl chloride

PROPERTIES AND USES OF ETHERS

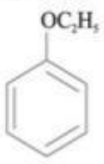
7. **Which of the following does not react with diethyl ether**
   1) C_2H_5ONa 2) $AlCl_3$ 3) BF_3 4) HCl
8. **$C-O-C$ bond in ethers can be cleaved by**
   1) $KMnO_4$ 2) $LiAlH_4$ 3) KOH 4) HI
9. $A + B \rightarrow CH_3-O-C(CH_3)_2 \xrightarrow{HI} X + Y$.
   Correct statement among the following is
   1) A and B are CH_3ONa and $(CH_3)_3CBr$
   2) X and Y are CH_3I and $(CH_3)_3COH$
   3) X and Y are CH_3OH and $(CH_3)_3CI$
   4) A and B are CH_3OH and $(CH_3)_3COH$
10. $P + Q \rightarrow Anisole \xrightarrow{HI} R + S$.
    Correct statement among the following is
    1) P and Q are C_6H_5ONa and C_2H_5Cl
    2) R and S are C_6H_5I and CH_3OH
    3) R and S are C_6H_5OH and CH_3I
    4) P and Q are C_6H_5Cl and CH_3ONa
11. $(CH_3)_3COCH_3 \xrightarrow{+HI} (CH_3)_3CI + CH_3OH$
    It follows which mechanism ?
    1) S_N1 2) S_N2 3) E_1 4) E_2
12. **Which of the following reagents can distinguish ethyl methyl ether from isopropyl alcohol ?**
    1) Br_2CCl_4 2) $AgNO_3 / NH_4^+OH^-$
    3) I_2 and NaOH 4) $CuCl / NH_4^+OH^-$
13. **Which of the following compounds is produced with this reaction takes place ?**
    $C_6H_5-O-CH_2C_6H_5 \xrightarrow[cold]{HI}$
    1)  2) 
    3) Both of these 4) None of these
14. **Which of the following compounds is produced when this reaction takes place ?**
    $CH_3-CH(CH_3)-OCH_3 \xrightarrow[cold]{HI}$
    1)  2) CH_3-OH
    3) Both of these 4) None of these

LEVEL II A - KEY

1) 4 2) 2 3) 4 4) 2 5) 4 6) 3 7) 1
8) 4 9) 3 10) 3 11) 1 12) 3 13) 2 14) 1

LEVEL II B

METHODS OF PREPARATION

1. **The reaction, sodium alkoxide + alkyl halide → ether is called**
   1) Wurtz reaction 2) Kolbe's reaction
   3) Williamson's synthesis 4) Perkin's reaction
2. **In which of the following reactions, the product is an ether?**
   1) $C_6H_6 + CH_3COCl$/anhydrous $AlCl_3$
   2) C_2H_5Cl + aq.KOH
   3) $C_6H_6 + C_6H_5COCl$/anhydrous $AlCl_3$
   4) $C_2H_5Cl + C_2H_5ONa$
3. **Williamson's synthesis is an example of**
   1) Nucleophillic addition
   2) Electrophillic addition
   3) Electrophillic substitution
   4) Nucleophillic substitution reaction
4. **Ethoxy benzene is called PHENETOLE.**
   
   How many more ethers can be drawn for the same formula ?
   1) 5 2) 4 3) 3 4) 2

PROPERTIES AND USES OF ETHERS

5. **Diethyl ether reacts with cold. HI to give**
   1) Ethyl iodide 2) Ethyl alcohol
   3) Both 1 and 2 4) Ethylene
6. **Hybridisation of oxygen in diethyl ether is**
   1) sp 2) sp^2 3) sp^3 4) sp^3d
7. **In the reaction**
   $(CH_3)_3C-O-CH_2CH_3 + HI_{(1\ mole)} \xrightarrow{heat}$ **the product(s) formed is (are)**
   1) $(CH_3)_3C-OH$ and CH_3CH_2I
   2) $(CH_3)_3C-I$ and CH_3CH_2OH
   3) $(CH_3)_3C-I$ and CH_3CH_2I
   4) $C(H_3C)_3-O^+(H)-CH_2CH_3I^-$
8. $CH_3-CH(CH_3)-OCH_3 \xrightarrow[excess,\Delta]{HI}$
   Which of the following is not formed in the above reaction ?
   1) Methyl iodide 2) Isopropyl iodide
   3) Isopropyl alcohol 4) All of these
9. $C_6H_5-O-CH_2CH_3 \xrightarrow{HI}$ **which of the following is not formed in this reaction ?**
   1) C_6H_5-I 2) C_6H_5-OH
   3) Both of these 4) None of these
10. **Ethyl phenyl ether on reaction with excess HI yields**
    1) Ethyl iodide and iodobenzene
    2) Ethyl iodide and phenol
    3) Ethyl alcohol and phenol
    4) Ethyl alcohol and iodobezene

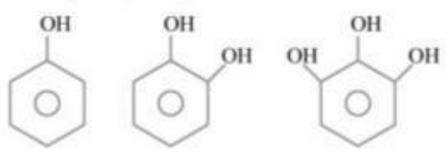
LEVEL II B KEY

1) 3 2) 4 3) 4 4) 2 5) 3 6) 3 7) 2
8) 3 9) 1 10) 2

PHENOLS

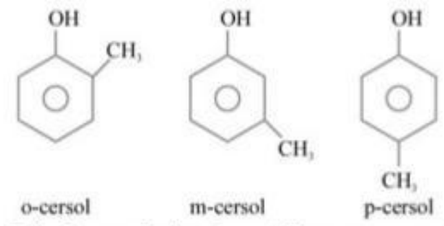
SYNOPSIS

- Aromatic hydroxy compounds in which -OH group is bonded to benzene ring directly are called phenols. Monohydroxy benzene is called phenol. Phenol is also known as **carbolic acid**.
- Phenols are classified as monohydroxy, dihydroxy and trihydroxy compounds



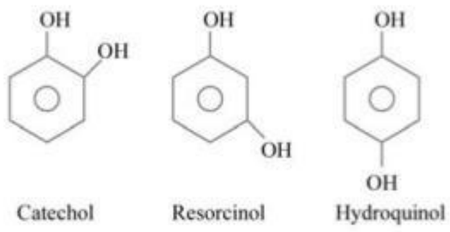
monohydric dihydric trihydric

- The simplest hydroxyl derivative of benzene is phenol which is also its accepted IUPAC name.
- The hydroxyl derivatives of toluene are o–, m– and p– cresol.



o-cersol m-cersol p-cersol

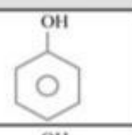
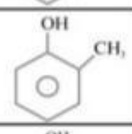
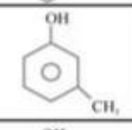
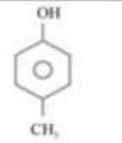
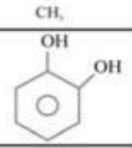
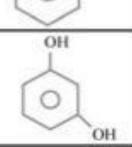
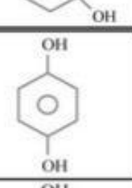
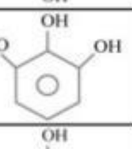
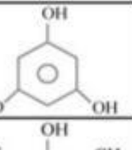
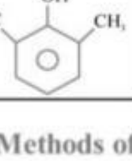
- Dihydroxy derivatives of benzene are called benzene diols.



Catechol Resorcinol Hydroquinol

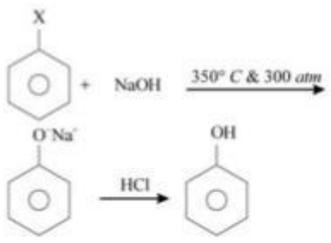
- In phenols, the –OH group is attached to sp^2 hybridized carbon of an aromatic ring.
- The bond angle of C–O–H in phenol is 109^0. The carbon-oxygen bond length is 136 pm which is slightly less than that in methanol. This is due to partial double bond character on account of conjugation of unshared electronpair of oxygen with the aromatic ring.

Nomenclature

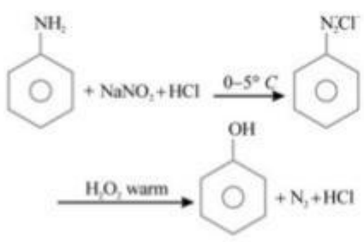
Molecule	Common name	IUPAC name
	Phenol	Phenol
	o-cresol	2-methyl Phenol
	m-cresol	3-methyl Phenol
	p-cresol	4-methyl Phenol
	Catechol	Benzene-1, 2-diol
	Resorcinol	Benzene-1, 3-diol
	Hydroquinol	Benzene-1, 4-diol
	Pyrogallol	(Benzene 1,2, 3-triol)
	Phloroglucinol	(Benzene 1,2, 5-triol)
		2,6-dimethyl Phenol

Methods of preparation: Phenol was first isolated from coaltar.

From Haloarenes:



From Diazonium salt:



From Benzene Sulphonic acid:

From cumene: Phenol is manufactured from cumene (isopropyl benzene)

Physical properties: Phenol has higher boiling point than the arenes or haloarenes or ethers of same molecular weight. It is due to the formation of intermolecular hydrogen bond.

- Compared relative to pure aromatic hydrocarbons phenols are more soluble in water due to their ability to form hydrogen bonding with water.
- As the hydrocarbon part increases in size and mass, the solubility decreases due to increasing of hydrophobic nature.

Chemical properties:

Acidic nature of phenol: Alcohols and phenols react with active metals like Na, K, Al etc to liberate hydrogen gas.

$2ROH + 2Na \rightarrow 2RONa + H_2$

$2C_6H_5OH + 2Na \rightarrow 2C_6H_5ONa + H_2$

- Phenols also react with aqueous NaOH solution to produce the salt sodium phenoxide and water.

  $C_6H_5OH + NaOH \rightarrow C_6H_5ONa + H_2O$
- The acidic nature of alcohols is due to the polar nature of O-H group.
- Electron releasing groups like alkyl groups increase the electron density on oxygen and decrease the polarity of O-H bond. This decreases the acidic strength.
- Even though the electron releasing groups like $-CH_3$,$-C_2H_5$ etc decrease the acidic strength of phenol, Phenol does not liberate CO_2 with Na_2CO_3 or $NaHCO_3$ because phenol is weakly acidic than carbonic acid and carboxylic acids.

Note: Acids stronger than carbonic acid, decomposes Na_2CO_3 and $NaHCO_3$ solutions liberating CO_2 with brisk effervescence.

Relative acid strength: Carboxylic acid > Carbonic acid > Phenol > Methyl alcohol > Water > Other alcohols

- The reactions of phenol with metals as well as NaOH indicate that phenol is relatively more acidic than alcohols and also water.
- This is explained on the basis of the structure of phenol.