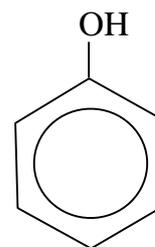


PHENOL

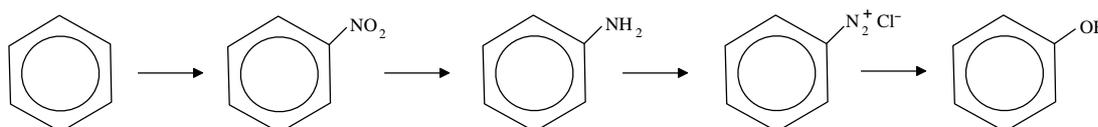
Structure

- phenol is an **aromatic alcohol**
- the **OH group is attached directly to the benzene ring**
- it is an almost colourless **crystalline solid of formula C₆H₅OH**



Preparation

- you **cannot put an OH group directly onto a benzene ring** by electrophilic substitution
- phenol is synthesised in a multi-stage process



Nitration of benzene

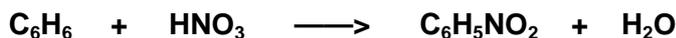
reagents

conc. nitric acid and **conc.** sulphuric acid (catalyst)

conditions

reflux at **55°C**

equation



mechanism

electrophilic substitution

Reduction of nitrobenzene

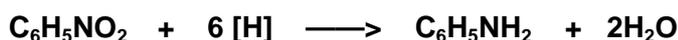
reagents

tin and **conc.** hydrochloric acid

conditions

reflux

equation



Diazotisation of phenylamine

reagents

nitrous acid and hydrochloric acid (use sodium nitrite)

conditions

keep **below 10°C**

equation



reaction type

diazotisation

Substitution

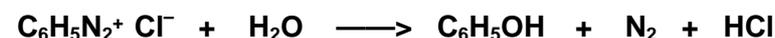
reagents

water

conditions

warm above 10°C

equation



CHEMICAL REACTIONS

Reactions of the -OH group

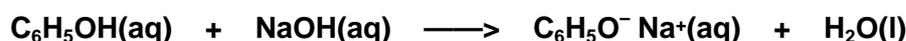
Water

- phenol is a **weak acid**
- it is a stronger acid than aliphatic alcohols
- the aromatic ring helps weaken the O-H bond and stabilises the resulting anion
- it dissolves very slightly in water to form a weak acidic solution



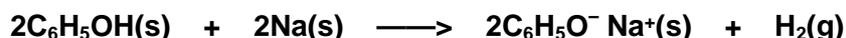
NaOH

- phenol reacts with sodium hydroxide to form a salt - sodium phenoxide
- it is ionic and water soluble



Sodium

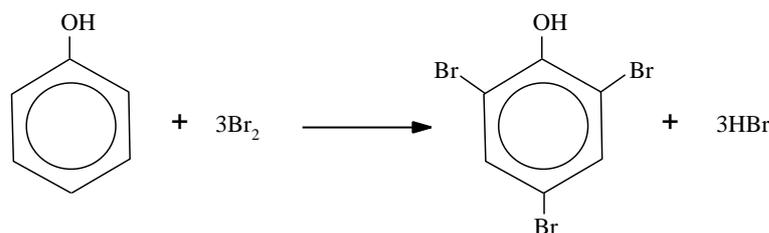
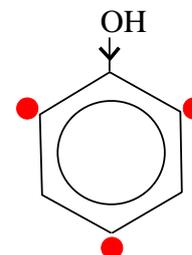
- phenol reacts with sodium to form an ionic salt - sodium phenoxide
- **hydrogen** is also produced
- this reaction is similar to that with aliphatic alcohols such as ethanol



Reactions of the benzene ring ELECTROPHILIC SUBSTITUTION

Bromine

- the OH group is electron releasing
- it increases the electron density of the delocalised system
- it makes substitution much easier compared to benzene
- the electron density is greatest at the 2,4 and 6 positions
- substitution takes place at the 2,4 and 6 positions
- phenol **reacts readily with bromine water WITHOUT A CATALYST**
- it is **so easy that multiple substitution takes place**



2,4,6-tribromophenol

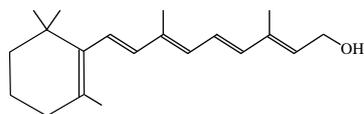
- other electrophiles such as NO_2^+ react in a similar way

Q.1 For each of the following compounds...

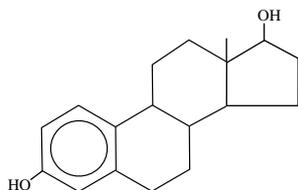
(a) work out the molecular formula (b) state its use or importance

(c) classify as 1°, 2° or 3° aliphatic alcohols or phenols (or both)

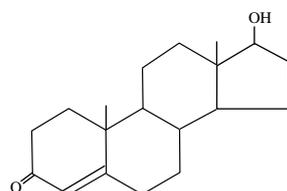
Vitamin A



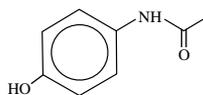
Estradiol



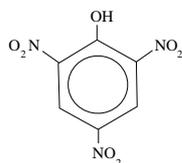
Testosterone



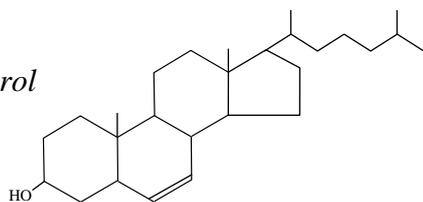
Paracetamol



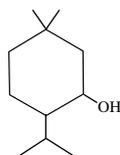
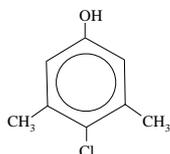
Picric acid



Cholesterol



Menthol

4-chloro-3,5-dimethylphenol
'Dettol'

Ethane-1,2-diol

