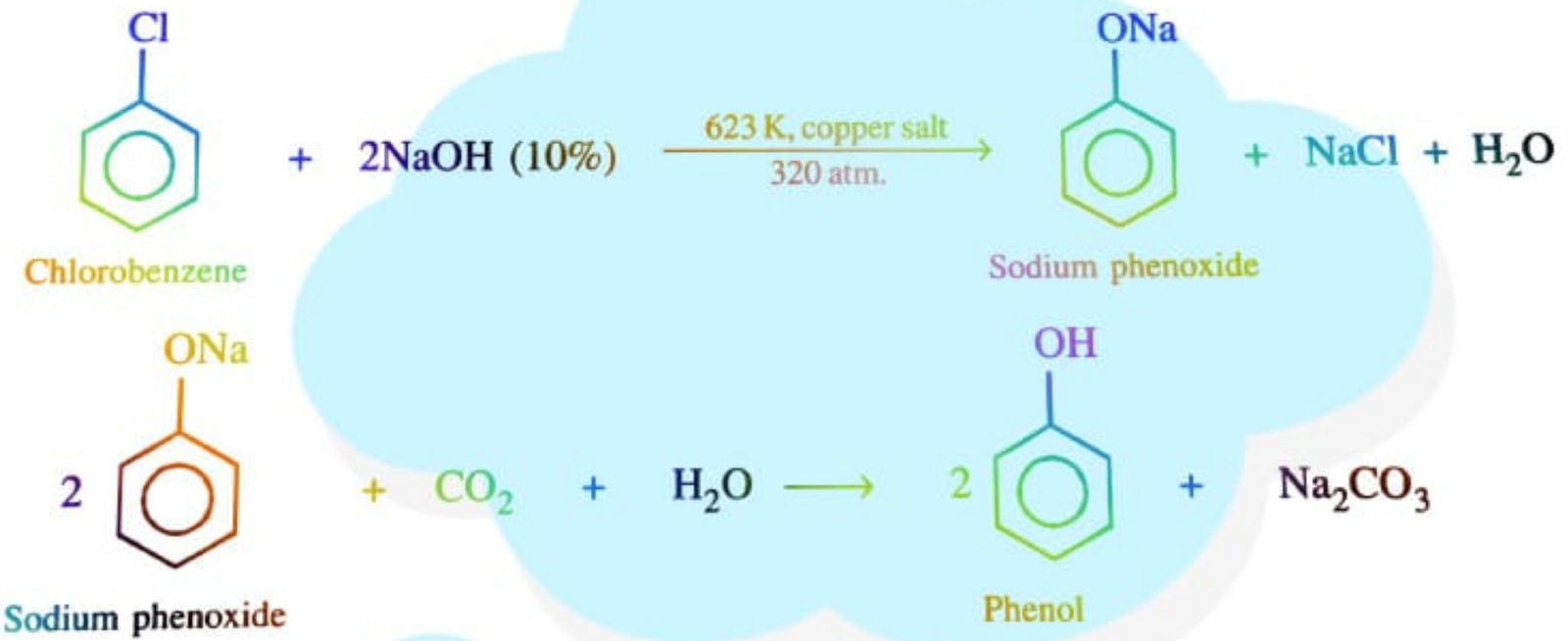
preparation of Phenols

Phenol, also known as carbolic acid, was first isolated in the early nineteenth century, from coal tar. Nowadays, phenol is commercially produced from benzene derivatives by any of the following methods :

From Chlorobenzene (Dow's Process)

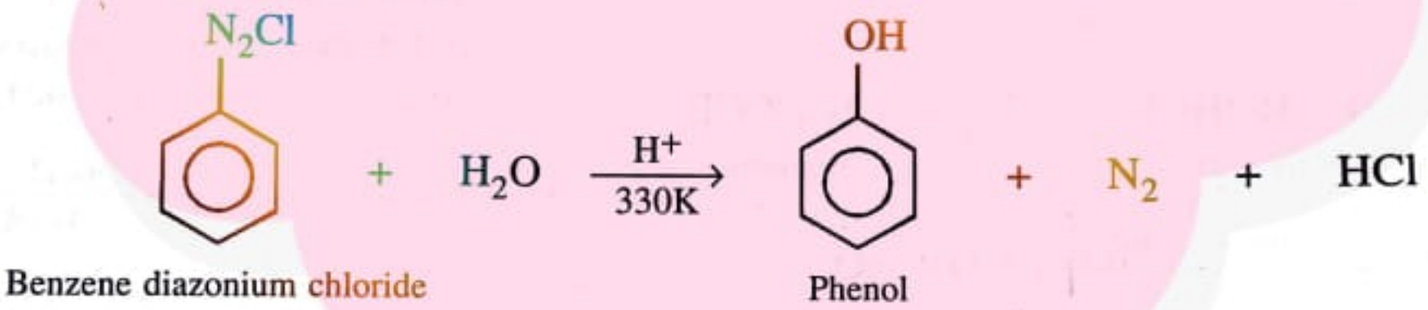
The process is based on alkaline hydrolysis of chlorobenzene. Chlorobenzene is heated with 10% sodium hydroxide solution at 623 K under a pressure of 320 atmospheres, in the presence of copper salt acting as a catalyst to form sodium phenoxide. The aqueous solution of sodium phenoxide on treatment with carbon dioxide gas or on acidification gives phenol. The conversion of chlorobenzene to phenol is almost quantitative.



By the Hydrolysis of Diazonium Salts

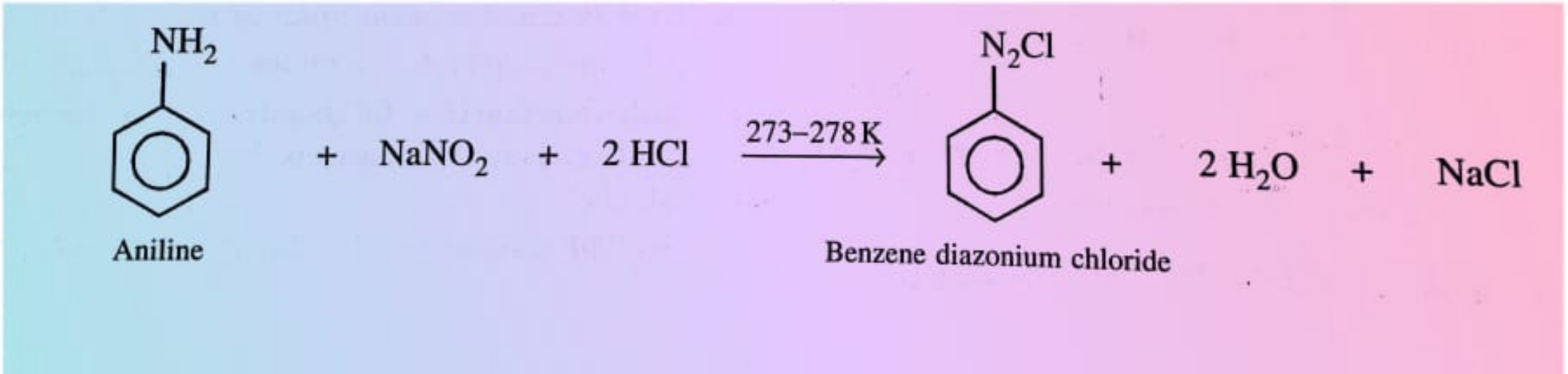
When aryl diazonium salts are heated with dilute sulphuric acid at 330K, phenols are produced. This is one of the best methods for the preparation of phenols.

$$\underset{\text{Aryl diazonium salt}}{ArN_2X} + H_2O \xrightarrow[\text{Heat, 330K}]{H^+} \underset{\text{Phenol}}{ArOH} + HX + N_2$$



Benzene diazonium chloride — Phenol

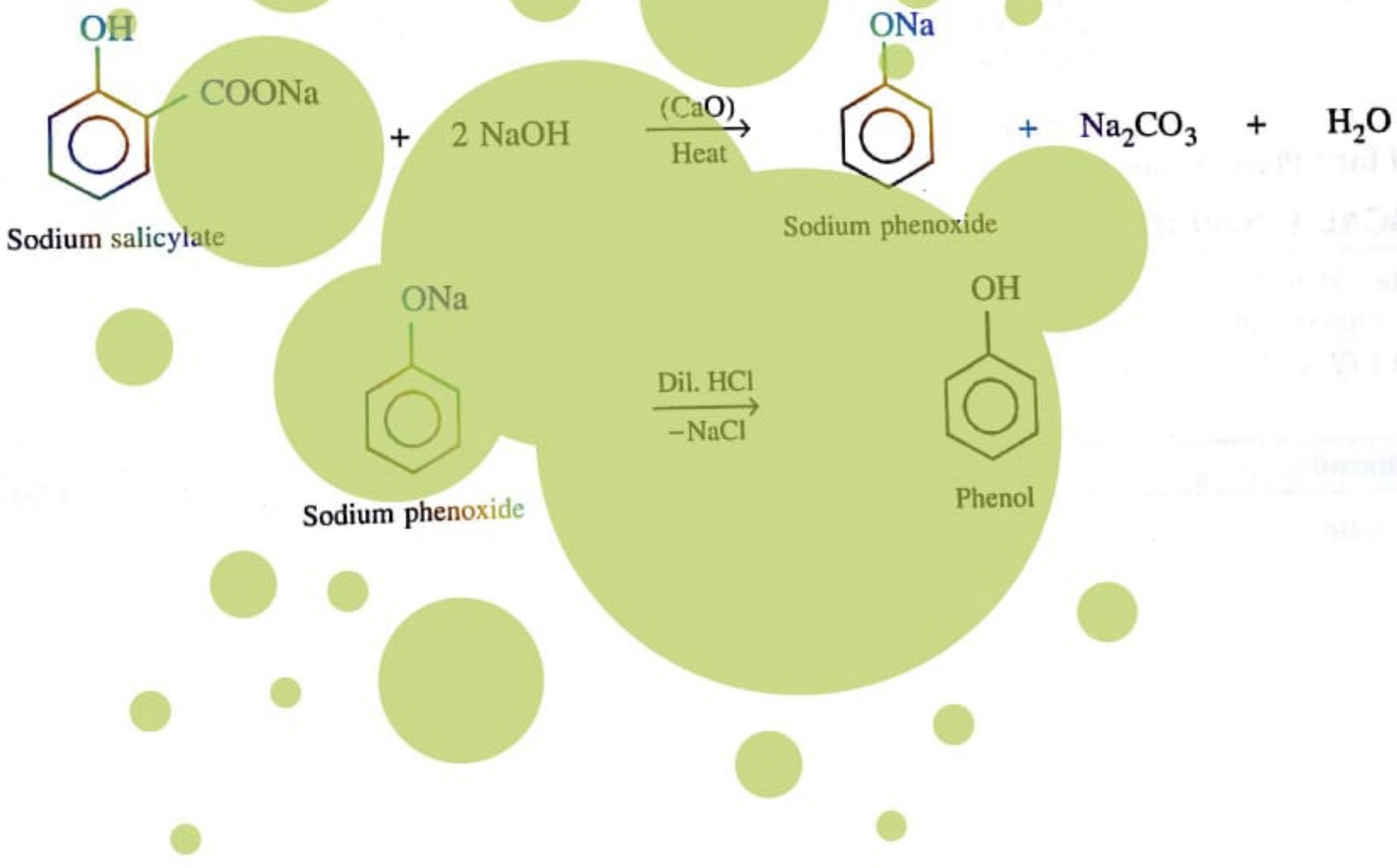
The aryl diazonium salts required for the reaction are prepared by **diazotisation of aniline.** For example, benzene diazonium chloride can be prepared by the reaction involving reaction between aniline, sodium nitrite and hydrochloric acid at low temperature (273–278K) as given below.



Aniline — Benzene diazonium chloride

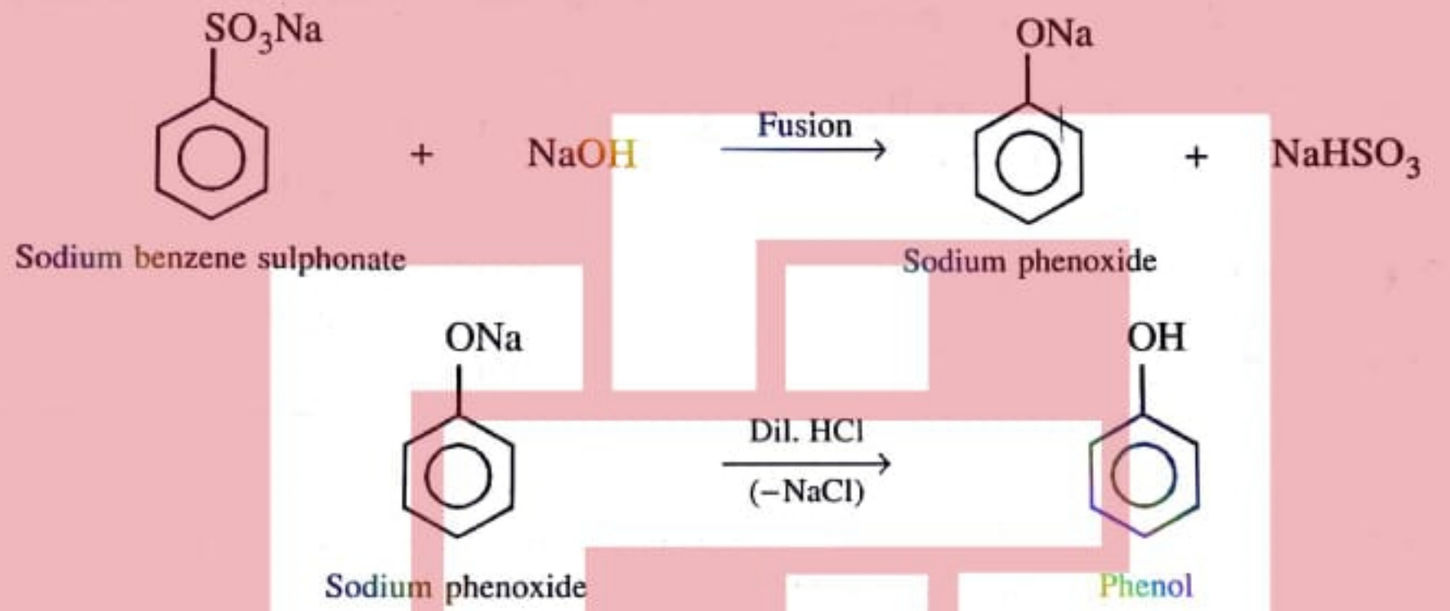
By Decarboxylation of Sodium Salicylate

When sodium salicylate is distilled with soda lime (mixture of CaO and NaOH) it undergoes decarboxylation to form sodium phenoxide, which on treatment with dil. HCl gives phenol.



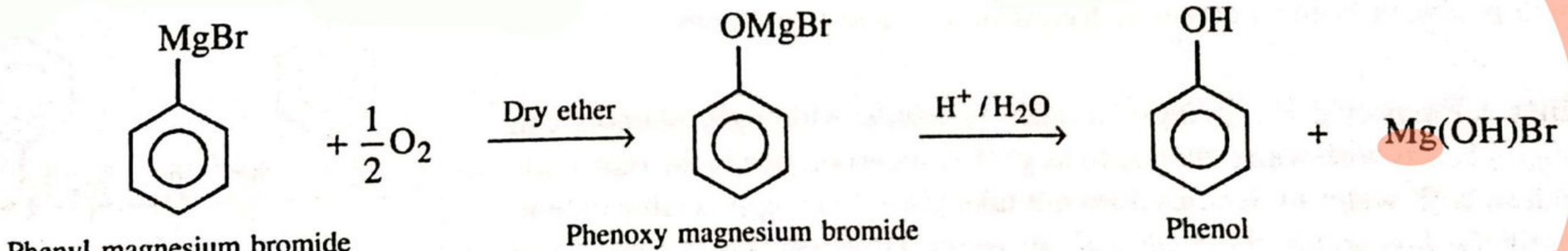
By Fusing Sodium Benzene Sulphonate with Sodium Hydroxide

When sodium benzene sulphonate is fused with sodium hydroxide at 573–623 K, sodium phenoxide is formed, which on hydrolysis with dilute hydrochloric acid gives phenol.



This is an important method in conversion of aromatic sulphonic acids to corresponding phenols and finds application in various organic conversions.

From Grignard Reagents

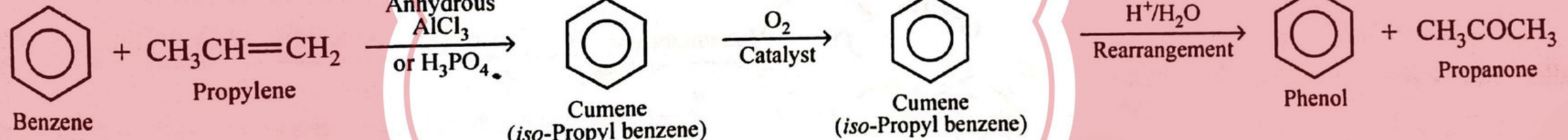


Phenyl magnesium bromide

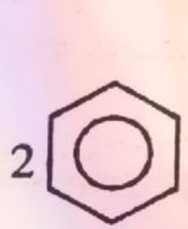
Phenoxy magnesium bromide

Phenol

By the oxidation of cumene :



Raschig process



Benzene

$$2 + 2\,HCl + O_2 \xrightarrow[500K]{CuCl_2 / FeCl_3} + 2\,H_2O$$

Chlorobenzene

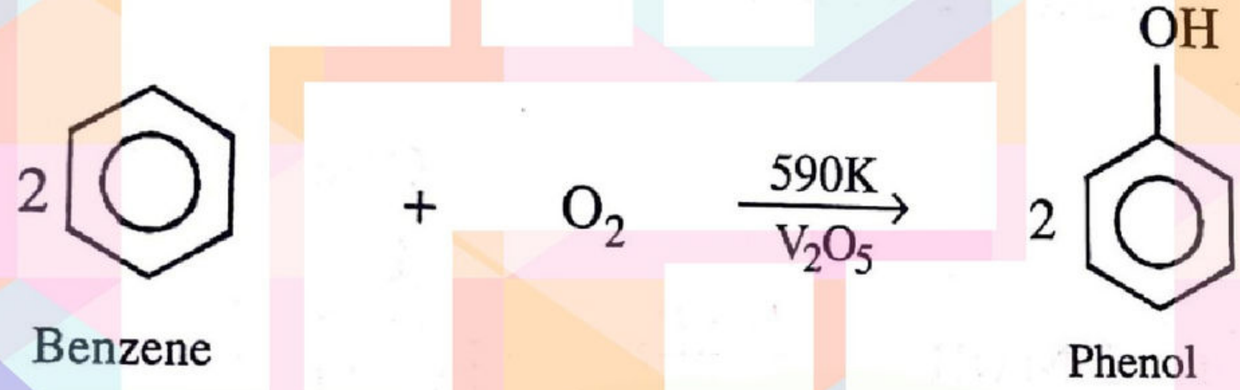
Chlorobenzene

$$+ \quad H_2O \xrightarrow[700\ K]{SiO_2} +$$

(Steam)

Phenol

$$+ \quad HCl$$


OH
590K
V_2O_5
O_2
2
2
Benzene
Phenol