

CLASS 12

CHEMISTRY

REVISION NOTES

Class 12 Chemistry Chapter 7 Alcohols, Phenols and Ethers – Revision Notes

Quick revision notes for Class 12 Chemistry Chapter 7 – Alcohols, Phenols and Ethers, covering classification, nomenclature, preparation, acidity trends, key name reactions, and ether chemistry. Ideal for last-minute board exam revision.

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Classification and Nomenclature

Alcohols ($R-OH$) are classified as **primary, secondary or tertiary** based on the number of carbon groups attached to the carbinol carbon; phenols have $-OH$ directly on an aromatic ring; ethers ($R-O-R'$) have oxygen bonded to two carbon groups, symmetrical (same groups) or unsymmetrical (different groups).

Preparation and Physical Properties

Alcohols are prepared from alkenes (acid-catalysed hydration – Markovnikov; oxymercuration–demercuration – Markovnikov, no rearrangement; hydroboration–oxidation – anti-Markovnikov) or from alkyl halides/Grignard reagents. Phenol is manufactured industrially from cumene (**cumene process**, via cumene hydroperoxide+dilute acid, co-producing acetone) or from chlorobenzene (**Dow's process**). Alcohols and phenols show **strong intermolecular hydrogen bonding**, giving them much higher boiling points and water solubility than comparable hydrocarbons or ethers of similar molecular mass (e.g. ethanol, bp 351K, vs. isomeric methoxymethane, bp $\approx$ 250K).

Acidity of Phenols

Phenol ($pK_a \approx 10$) is far more acidic than an alcohol because the **phenoxide ion is resonance-stabilised** by delocalisation into the ring, while an alkoxide has no such stabilisation. Electron-withdrawing ring substituents (e.g. $-NO_2$) further stabilise the phenoxide and **increase acidity** (picric acid, with three $-NO_2$ groups, is a very strong acid); electron-donating groups (e.g. $-OCH_3$, alkyl) **decrease acidity** relative to phenol.

Key Name Reactions

Kolbe's reaction: sodium phenoxide+ CO_2 , then acidify $\rightarrow$ salicylic acid. **Reimer–Tiemann reaction:** phenol+ $CHCl_3/NaOH$ (via dichlorocarbene) $\rightarrow$ salicylaldehyde. **Williamson ether synthesis:** sodium alkoxide+a primary alkyl halide (S_N2) $\rightarrow$ an ether; using a secondary/tertiary halide instead causes $E2$ elimination to an alkene rather than substitution. **Lucas test:** conc. HCl /anhyd. $ZnCl_2$ distinguishes $1^\circ/2^\circ/3^\circ$ alcohols by turbidity onset time (3° immediate, 2° $\sim$ 5 min, 1° no reaction in the cold).

Oxidation of Alcohols

Primary alcohols oxidise to **aldehydes** with mild agents (PCC) or all the way to **carboxylic acids** with strong agents (acidified $KMnO_4/K_2Cr_2O_7$, excess). Secondary alcohols oxidise only to **ketones**. Tertiary alcohols, having no hydrogen on the carbinol carbon, **resist oxidation** under these conditions.

Ethers

Ethers are generally unreactive except toward strong acids like **HI/HBr** , which cleave the $C-O$ bond: with a dialkyl ether, the smaller/less hindered alkyl group is converted to the alkyl iodide; with an aryl alkyl ether like anisole, only the **alkyl–oxygen bond breaks** (never the aryl–oxygen bond), giving phenol+an alkyl

iodide. The –OR group in aromatic ethers (e.g. anisole) is strongly **activating and ortho/para-directing** in electrophilic aromatic substitution, due to resonance donation of an oxygen lone pair into the ring.

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