

ORGANIC COMPOUNDS

PHYSICAL PROPERTIES

1. ALKANES

State : $C_1 - C_4 \rightarrow$ Gases (colorless)
 $C_5 - C_{17} \rightarrow$ Liquids (colorless)
 C_{18} and above \rightarrow Wax like (soft) solids

Solubility : Soluble in non-polar solvents and insoluble in polar solvents

Boiling Point : Increase with increasing R-group
Though straight chain $>$ Isomeric Branched Chain

Melting Point : Increase with increasing molecular weight
(However show no regularity)

Specific Gravity : Increase with increasing molecular weight

Viscosity : Increase with increasing R-Group

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ALKYNES

State : $C_2 - C_4 \rightarrow$ Gases
 $C_5 - C_{17} \rightarrow$ Liquids
 C_{18} and above \rightarrow Solids

Colour : Colourless

Odour : With exception of acetylene having garlic like odour, all other are odourless

Solubility : Soluble in non-polar solvents
slightly soluble in water

Boiling Points : Slightly higher than corresponding alkanes and increase regularly with increase in number of C-atoms

Melting Point : Increase irregularly

Density : Slightly more denser than corresponding alkanes and alkenes

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BENZENE

State : Colorless liquid

Smell : Peculiar smell

Taste : Burning taste

Specific Gravity : 0.8788

Melting Point : 5.5°C

Boiling Point : 80.2°C

* Inflammable

Solubility : Non-polar so soluble in ether, alcohol and petrol.
Insoluble in water

Solvent : used as solvent for many fats and resins but it is safer to use its derivative, methyl benzene (toluene)

Toxic : Benzene is highly toxic and absorbed through skin

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ALKYL HALIDES

State : Lower Alkyl Halides (CH_3Cl , $\text{C}_2\text{H}_5\text{Cl}$, CH_3F) \rightarrow Gases
Higher upto C_{18} \rightarrow Colorless liquids
Beyond C_{18} \rightarrow Colorless solids

Solubility : Insoluble in water (or slightly soluble in water)
Soluble in organic solvents

Density : R-Cl and R-F \rightarrow Lighter than water
 R-Br and R-I \rightarrow Denser than water

Boiling Points : Higher Boiling points than corresponding alkanes.
Boiling Points increase with increase in no. of carbon atoms

Polarity : The carbon-halogen bond (apart from carbon-iodine bond) are polar bcz the electron pair is pulled closer to the halogen atom than the carbon. This is bcz (apart from iodine) the halogens are more electronegative than carbon.

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AMINES

State: Lower Aliphatic amines are gaseous in nature. They have a fishy smell. Amines with 3 or 4 carbon atoms are liquid at room temperature whereas higher ones are solids.

Smell: characteristic ammonia-like smell

Colour: Aniline and other aryl amines are generally colorless. However they get colored when we store them in open due to atmospheric oxidation.

Boiling Points: Higher B.Ps than corresponding alkenes due to presence of intermolecular hydrogen bondings.

Primary > Secondary > Tertiary

Solubility: Form hydrogen bonding with water so soluble in water.

Primary > Secondary > Tertiary

Increasing R-group (hydrophobic part) decreases its solubility

Basic Strength (Basicity)

Tertiary Amines > Secondary Amines > Primary Amines

ALCOHOLS

State : Lower alcohols are colorless, toxic liquids

Smell : characteristic sweet smell

Boiling Points : much higher than corresponding alkanes (due to hydrogen bonding) Boiling Points increase regularly with increasing number of carbon atoms

In isomers :

Branched Alcohols > Straight-chain Alcohols

Solubility : Lower Alcohols → completely soluble

Higher Alcohols → Solubility falls

Solubility decrease with increasing R-group (non-polar part)

PHENOL

State : colorless liquids or low melting crystalline solids at RTP

Smell : characteristic odour

Toxicity : Vapours are highly toxic

Boiling Points : slightly higher than aliphatic alcohols of comparable molecular weights due to presence of strong hydrogen bonding in phenols than in alcohols.

Solubility : Phenol > Alcohol (due to stronger hydrogen bonding)
Above 65°C both phenol and water are miscible in all proportions

Carbolic Acid : Liquid phenol containing 5% of water is known as carbolic acid and is used as disinfectant and germicide.

ETHER

State : Dimethyl ether and ethyl methyl ether \rightarrow Gases
Others \rightarrow colorless volatile liquids

Smell: Pleasant odour

Highly Inflammable

Boiling Points : Much lower boiling points than alcohols of comparable molecular weight.

Solubility : Low molecular weight ethers are soluble in water as they form H-bonding with water
 \rightarrow Readily soluble in organic solvents

Density: less denser than water

ALDEHYDES AND KETONES

State: Formaldehyde \rightarrow Gas

Higher Aldehydes and Ketones \rightarrow Colorless liquids

Smell : Formaldehyde \rightarrow sharp pungent odour

Higher Aldehydes and ketones \rightarrow Pleasant smell

Solubility: $C_1 - C_4 \rightarrow$ water soluble

C_5 and above \rightarrow Insoluble in water

Aldehydes are more soluble than ketones but they have $\#$ at one end

Polar Compounds: $\overset{+6}{C} = \overset{-6}{O}$

Boiling Points: High B.Ps than corresponding alkanes and non-polar compounds like ethers but lower than alcohol

Methanal $\rightarrow -21^\circ\text{C}$

Ethanal $\rightarrow 21^\circ\text{C}$

Acetone $\rightarrow 56^\circ\text{C}$

CARBOXYLIC ACID

State : $C_1 - C_{10} \rightarrow$ Liquids
Higher members \rightarrow Wax like solids

Smell : Distinctive Penetrating Odours

* Acetic Acid (ethanoic acid) \rightarrow characteristic smell which is recognizable in vinegar

* Butyric Acid (Butanoic Acid) \rightarrow smelled in rancid butter

Polarity: More Polar than Alcohols

Melting and Boiling Points: High melting and boiling points bcz can form H-bonding with themselves or with their own molecules.

Solubility: Soluble in water however solubility decrease with increasing R-group (non-polar part)

GENERAL FORMULAS

1. Alkane: C_nH_{2n+2}
2. Alkene: C_nH_{2n}
3. Alkyne: C_nH_{2n-2}
4. Alkyl Halide: $C_nH_{2n+1}X$ $R-X$
5. Alcohol or Alkanol: $C_nH_{2n+1}OH$ $R-OH$
6. Amine: $C_nH_{2n+1}NH_2$ $R-NH_2$
7. Ether: $(C_nH_{2n+1})_2O$ $R-O-R$
8. Ketone: $(C_nH_{2n+1})_2CO$ $R-\overset{O}{\parallel}C-R$
9. Aldehyde: $C_nH_{2n+1}CHO$ $R-\overset{O}{\parallel}C-H$
10. Carboxylic Acid: $C_nH_{2n+1}COOH$ $R-\overset{O}{\parallel}C-OH$
11. Cycloalkanes C_nH_{2n} $n \geq 3$