INTRODUCTION TO ORGANIC CHEMISTRY

Organic Chemistry is the branch of chemistry which deals with the study of carbon and its compounds with exception of its oxides, carbonates, bicarbonates and carbides of metals.

Why carbon forms many compounds?

1. Multiple bond formation: Carbon can form multiple bonds (double and triple bonds).
2. It has catenation property: Catenation is the ability of an atom to join with the other atoms of the same element and form long chains.

Importance of Organic chemistry.

It is important in industries and life process in the following ways:

1. All organisms are made of organic compounds and some substances are food to organisms. eg. proteins lipids
2. Some organic compounds are used as medicine, ie. to treat illnesses.
3. Some organic compounds are used in textile industries eg. clothes are made from organic compounds called fibres. Fibres can be natural or synthetic.
4. Some organic compounds are source of energy example coal, petroleum and natural gas.
5. Some organic compounds are source of plastic products eg. containers, shoes & building materials.

Harmful effects of Organic compounds

1. Chlorofluorocarbon (CFCs) contribute to global warming
2. plastic materials are non-biodegradable wastes thus cause pollution to the environment.
3. Some insecticides have harmful effects to life processes in animals especially birds.

ORIGIN OF ORGANIC CPDS

(i) Prehistoric sources.

(a) Coal

It was formed when animals and plants that lived on the land millions of years ago died and pressed down layers of earth and rock They slowly decayed into coal.

(b) Crude oil & natural gas

Are the remains of millions of tiny plants and animals that lived in the sea. Their bodies were covered by layers of silt. Bacteria attacked the dead remains turning them into natural gas and oil.

(ii) Living organisms

Plants are capable of producing complex organic cpds such as starch and glucose from simple morganic substances eg. carbon dioxide and water.

(iii) Synthetic cpds

There are several organic compounds prepared in factories and laboratory through various processes. eg. nylon polyesters.

Synthetic Organic Compounds

Substance	Uses
Polyester	Making cloth items
Polyvinylcyanide	Making clothing, blankets and carpets.
Perspex	Used as a substitute for glass in aircraft and in buildings
Polythene	Making packaging materials, baskets, cups, bowls and a wide range of kitchenware.
Polychloroethene (or Polyvinyl chloride PVC)	Used to make water pipes, crates, electrical appliances
Neoprene	Used as a substitute for natural rubber.

FRACTIONAL DISTILLATION OF CRUDE OIL

Crude oil (or Petroleum) is a black viscous liquid found underground. Fractional distillation is a process by which a mixture of liquids is separated by using the differences in their boiling points.

Fractions from Crude oil.

Fraction	Boiling range	No of Carbon atoms	Uses
Fuel gas	-160 – 20°C	1 - 4	Fuel for cooking and lighting, making chemicals
Petrol or gasoline	20°C – 70°C	5 - 10	- Fuels for vehicles - solvents for substances like paint
Naphtha	70°C – 120°C	8 - 12	- Manufacture of chemicals
Paraffin (Kerosene)	120°C - 240°C	10 - 16	- Fuel for central heating, jet engines, kerosene lamps
Diesel oil & lubricating oil	240°C – 350°C	15 - 70	- Fuel for diesel engines and central heating - lubricators in machine parts.
Bitumen	Above 350°C	More than 70	- Roofing, water proofing & road surfacing

* Fractional distillation of crude oil above only yields 20% of the Petrol more petrol is produced by the cracking process.

* Cracking is the breaking down of large hydrocarbon molecules into smaller, more useful hydrocarbon.

(i) Thermal Cracking - This involves heating of large hydrocarbons at high temperatures to break them into smaller molecules.

(ii) Catalytic cracking - This involves the use of a catalyst to breakdown large and complex hydrocarbons into simpler ones.

(i) $C_6H_{14} \rightarrow C_4H_{10} + C_2H_4$

(ii) $C_{10}H_{22} \rightarrow C_8H_{18} + C_2H_4$

Terms ~~commonly~~ used in organic chemistry

Molecular formula of a cpd — the chemical formula which shows the actual number of atoms of each element in a ~~compound~~ molecule. It does not show the arrangement of atoms in the molecule.

- Structural formula - shows how the ~~the~~ atoms are arranged in a molecule. Closed or condensed and open formula are types of structural formula.

- General formula is a general rule that can be used to calculate the number of each type of atom in a molecule.

- Homologous series is arrangement of various members of a family of organic compounds in order of increasing Molecular masses.

Axial group —

Characteristics of Homologous Series.

1. All members are represented by the same general formula.
2. Each member differs from the next/previous member by $-CH_2$ groups.
3. Each member in the series can be prepared by the same general method of preparation.
4. They show a gradual change of physical properties.
5. Members have ~~the same~~ similar chemical properties.
6. Each member differs from the next member in molecular weight by 14.

A: HYDROCARBONS

Hydrocarbons are compounds of carbon and hydrogen only.

There are three families or homologous series of hydrocarbons. These are Alkanes, alkenes and alkynes.

Hydrocarbons can be classed into
(i) saturated hydrocarbons
(ii) Unsaturated hydrocarbons.

Saturated hydrocarbons

Saturated hydrocarbons are the hydrocarbons with only single bonds between carbon atoms.

Unsaturated hydrocarbons

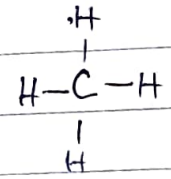
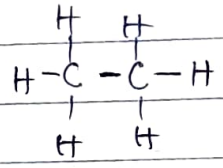
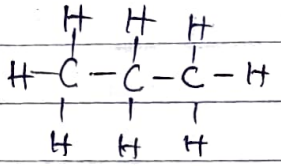
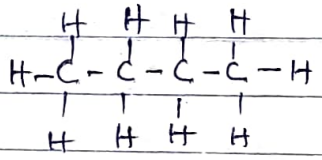
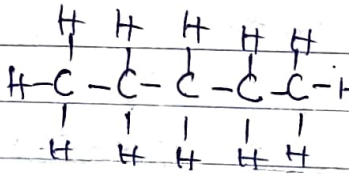
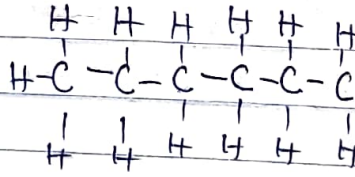
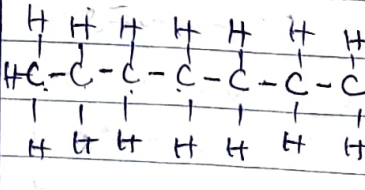
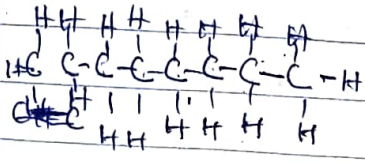
Are hydrocarbons with double or triple bonds between carbon atoms. $-C=C-$ or $-C\equiv C-$

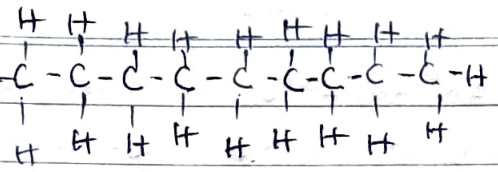
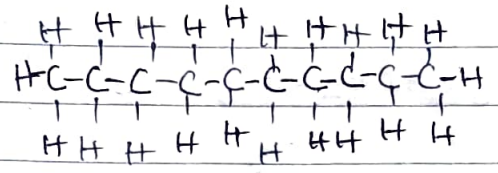
	Saturated hydrocarbons	Unsaturated hydrocarbons
1	They undergo substitution reaction	They undergo addition reaction
2	They do not decolourize bromine water	They decolourize bromine water
3	They do not decolourize potassium manganate (VII) solution	They decolourize potassium permanganate (VII) solution.
4	They contain single bond between their carbon atoms	They contain triple or double bond between carbon atoms.

ALKANES

- Alkanes are hydrocarbons that contain only single covalent bonds between the carbon atoms.
- They have a general formula of C_nH_{2n+2} where $n \geq 1$ where n is the number of carbon atoms.

Homologous Series of Alkanes

	Name	Molecular Formula	open structure	condensed structure
~~1~~	~~Methane~~	~~CH_4~~		
1	Methane	CH_4		CH_4
2	Ethane	C_2H_6		CH_3CH_3
3	Propane	C_3H_8		$CH_3CH_2CH_3$
4	Butane	C_4H_{10}		$CH_3CH_2CH_2CH_3$
5	Pentane	C_5H_{12}		$CH_3CH_2CH_2CH_2CH_3$
6	Hexane	C_6H_{14}		$CH_3CH_2CH_2CH_2CH_2CH_3$
7	Heptane	C_7H_{16}		$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$
8	Octane	C_8H_{18}		$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$

9	Nonane	C_9H_{20}		$CH_3CH_2CH_2CH_2CH_2$ $CH_2CH_2CH_3$
10	Decane	$C_{10}H_{22}$		$CH_3CH_2CH_2CH_2CH_2$ $CH_2CH_2CH_2CH_2CH_3$

NOMENCLATURE OF ALKANE

Rules:

(a) Select the longest continous chain. This is a parent chain

(b) Number the carbon atoms of the parent chain starting from the end nearer to a substituent group.

(c) For the parent chain with a substituent group nearer to both ends, start from the end having the next nearer substituent group.

(d) If both the substituent groups are placed equally nearer to both ends start from any end.

(e) Write the name of the alkyl group attached to the parent chain in alphabetical order preceded by number of carbon atom in which it is attached.

(f) If identical groups are present in the parent chain use prefixes di, tri, tetra etc and use one number for each group. and use one number for each group.

(g) Separate numbers from each other by commas and separate numbers from names of substituent by hyphens.

ALKYL GROUP - is a group of atoms that results when one hydrogen atom is removed from the corresponding alkane. has a general formula of C_nH_{2n+1}

The group is named by replacing the "-ane" suffix of the parent hydrocarbon with "-yl" — OR — The group formed by the removal of one hydrogen atom from an alkane molecu