LESSON NOTES

Year/Level: 11 C/D week 24 **Subject:** Chemistry

Strand	4 Materials
Sub Strand	4.3 organic substances
Content Learning Outcome	✓ List the different classes of hydrocarbons ✓ Describe properties of hydrocarbon

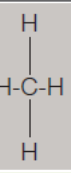
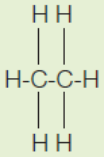
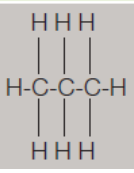
Hydrocarbons

Organic chemicals that contain only carbon and hydrogen are called hydrocarbons. There are three classes of hydrocarbons: ***alkanes***, ***alkenes*** and ***alkynes***

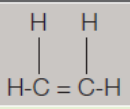
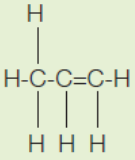
	Alkanes	Alkenes	Alkynes
Description	Alkanes are hydrocarbons that contain only single bonds between the carbon atoms	Alkenes are hydrocarbons that have a double bond between two carbon atoms.	Alkynes are hydrocarbons that have a triple bond between two carbon atoms.
General Formula	C_nH_{2n+2}	C_nH_{2n}	C_nH_{2n-2}
Naming (follows a system)	starts with the number of carbon atom and finishes with –ane. ›› C_1-meth, C_2-eth, C_3-prop, C_4-but, C_5-pent, C_6-hex,etc	starts with the number of carbon atom and finishes with –ene. ›› C_2-eth, C_3-prop, C_4-but, C_5-pent, C_6-hex,etc	starts with the number of carbon atom and finishes with –yne. ›› C_2-eth, C_3-prop, C_4-but, C_5-pent, C_6-hex,etc
Properties	5. colourless, insoluble in water and neutral. They will dissolve in oils and waxes. 6. burn in combustion reactions producing carbon dioxide, water and heat. 7. boiling and melting points increase as the number of carbon atom increases.	Similar to those of alkanes but are more reactive.	Similar to those of alkanes
Uses	1. fuels e.g. methane, ethane, etc 2. starting materials, for making other chemicals, including alcohols, plastics and fibres.	manufacture of plastics, alcohols, artificial ripening of fruits, polymers for PVC, Teflon, etc	Use in welding gas, rocket fuel and medicine.

A **homologous series** is a family of **hydrocarbons** with similar chemical properties who share the same general formula

Names and Formulas of Alkanes

Name	No. of carbon atoms	Molecular Formula	Structural Formula
Methane	1	CH_4	
Ethane	2	C_2H_6	
Propane	3	C_3H_8	

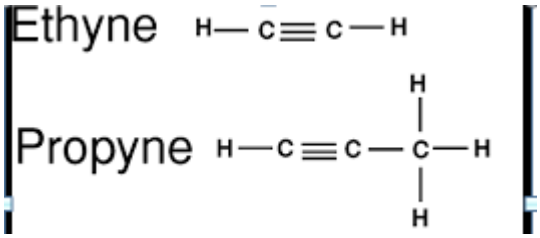
Names and Formulas of Alkenes

Name	No. of carbon atoms	Molecular Formula	Structural Formula
Ethene	2	C_2H_4	
Propene	3	C_3H_6	

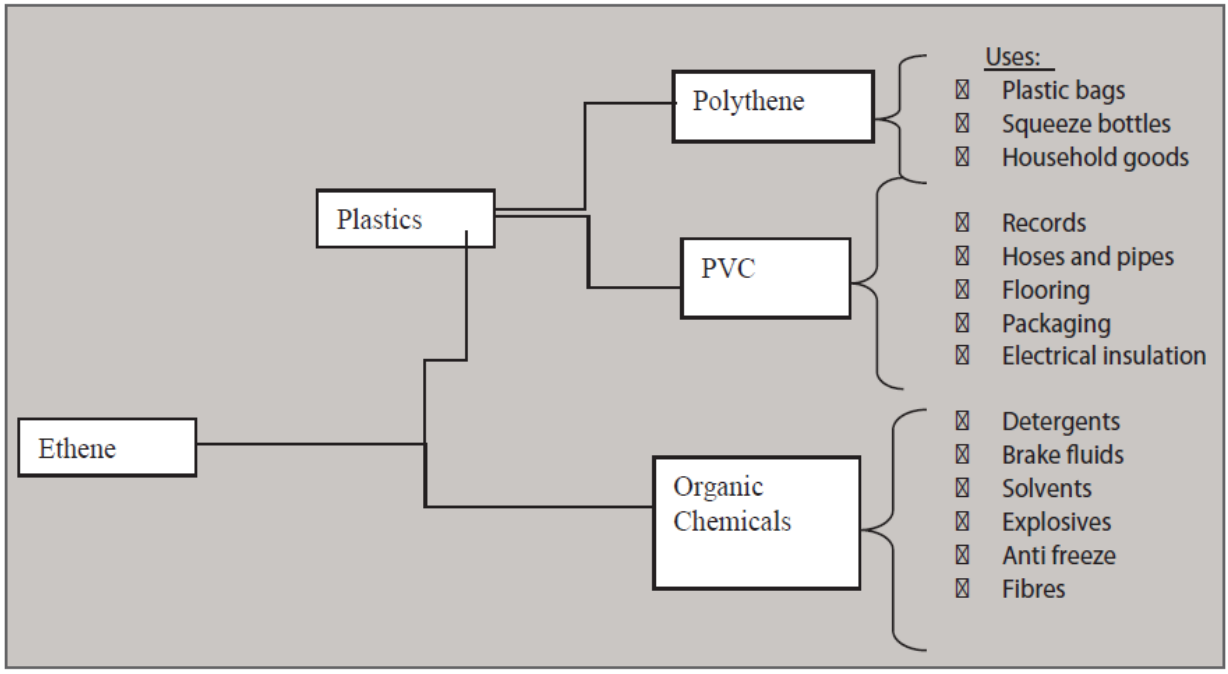
Names and Formulas of Alkynes

Name	No. of carbon atoms	Molecular Formula
Ethyne	2	C_2H_2
Propyne	3	C_3H_4

Structural formula



Plastics



Different Types of Plastics and Their Properties

Polythene

- Is a polymer of ethene. It is a soft, chemically resistant thermoplastic that is, it softens on heating, allowing it to be molded and extruded into thin sheets
- Polythene is made by addition polymerization, using the ethene molecules' ability to link together to form long chains

Note:

- A polymer is a very large molecule made from joining together thousands of small molecules.
- A monomer is a small molecule that is added together to make a polymer.
- Polymerization is the process of making a polymer.

Teflon

- Teflon is a compound of fluorine and carbon called poly tetrafluoroethylene (PTFE).
- It is a plastic material that is highly resistant against chemicals, corrosion and oxidation.
- It is used in the manufacture of chemical processing equipment and for coating cooking utensils.

Terylene

- Terylene is a synthetic fibre made by a process of polymerising ethylene glycol and terepthalic acid.
- It is very extensively used in textile industry to make hard wear clothes like sarees and dress material.

Polyproylene

- Polypropylene, also known as polypropene is a thermoplastic polymer made from the monomer propylene by addition polymerisation.
- It is used to make ropes, thermal underwear, carpets and stationary.

Rubber

- Synthetic rubber is obtained by polymerisation of unsaturated monomers.

- Synthetic rubbers are marketed as compressed bales and square blocks.
- It is used in the tyre industry, medical equipment and molded parts.
- Sulphur is the oldest vulcanisation agent for unsaturated rubber.

Polyvinyl chloride (PVC)

- Is a synthetic polymer that is made from vinyl chloride.
- Second only to polyethylene among the plastics in production and consumption, PVC is used in an enormous range of domestic and industrial products, from raincoats and shower curtains to window frames and indoor plumbing.

Note:

✓ Compounds which contain double or triple bonds are called Unsaturated.
✓ Saturated compounds contain only single bonds e.g. alkanes
✓ Condensation polymerisation – when monomers join together and a water molecule is lost.
✓ Addition Polymerisation – when monomers are added to each other to form long chain molecule (polymer) without by-products.

Chemical Properties

Combustion

- Refers to the type of reaction where a **hydrocarbon** reacts with oxygen to create carbon dioxide, water, and heat.

Substitution reactions

- Substitution reactions only occur in saturated hydrocarbons (single carbon–carbon bonds).
- In this reaction, alkanes react with a chlorine molecule.
- One of the chlorine atoms displaces a hydrogen atom.
- This forms hydrochloric acid as well as the hydrocarbon with one chlorine atom.

$$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$$

Addition reactions

- Addition reactions involve alkenes and alkynes.
- In this reaction a halogen molecule breaks the double or triple bond in the hydrocarbon and forms a bond

Density

- Alkenes are lighter than water and are insoluble in water due to their non-polar characteristics.
- Alkenes are only soluble in non-polar solvents.

Solubility

- Alkenes are virtually insoluble in water, but dissolve in organic solvents.
- The reasons for this are exactly the same as for the alkanes "Like dissolves Like"

Homologous Series

- Is a family of **hydrocarbons** with similar chemical properties who share the same general formula and same functional groups
- ***For example***; the homologous series of straight-chained alkanes begins with methane (CH_4), ethane (C_2H_6), propane (C_3H_8) etc. In that series, successive members differ in mass by an extra (-CH_2- unit) inserted in the chain.

Activity

1. Write the names, molecular formula and draw the structural formula of the alkanes with no. of carbons listed below.C_4

2. Write the names, molecular formula and draw the structural formula of the alkenes with no. of carbons listed below. C_6

3. Write the names, molecular formula and draw the structural formula of the alkynes with no. of carbons listed below. C_7