IMPROVING THE UNDERSTANDING OF TYPES OF HYDROCARONS AMONG X STUDENTS THROUGH SIMPLE ACTIVITIES

ACTION RESEARCH SUBMITTED TO

THE SCERT, CHENNAI-6

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2023 - 2024

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ACKNOWLEDGEMENT

I am grateful to The Director, SCERT, Chennai for encouraging us to do this Action Research and for the financial support.

I am happy to express my heartfelt thanks to our Principal, DIET, Vadalur for providing all facilities and their inspiration has induced me to complete the write-up in time.

I convey my sincere thanks to all my colleagues for their critical evaluation and our office staff for extending all facilities to complete the write-up.

Thanks to Head master, Science teacher, other subject teachers and X std students of GHS, Ko.Chathiram for their help and co-operation for the successful completion of this research work.

Last but not the least; my thanks are always to Dolphin Xerox and Computers for their neat computer work.

Dr. N. SUBATHRA

INTRODUCTION

1.0 INTRODUCTION

When we hear the word chemistry, we think of chemical reactions conducted in the laboratories. But chemistry is beyond that. We can find chemistry in everything in our surrounding. It is in the air we breathe, the food we eat and in everything we use in our daily life. Our body is made of elements like nitrogen, phosphorous, hydrogen, oxygen, calcium, potassium, sulphur, magnesium etc. All the chemical reactions taking place in our body are due to chemistry. Our whole life is dependent on various chemical compounds. Among them, hydrocarbons are the most important one. They find application in our daily life. We can say that the whole civilization is driven by hydrocarbons because they make up the fossil fuels petroleum, coal and natural gas. In this study we are going to grasp something about different types of hydrocarbons, fossil fuels like petroleum, coal and natural gas, characteristics of fuel and solar energy and its applications.

Chemists in the early nineteenth century knew that living things, such as the plants and panda produce an immense variety of carbon compounds. Chemists referred to these compounds as organic compounds because they were prodoced by living organisms.

Hydrocarbons

Hydrocarbons are the organic compounds consisting of carbon and hydrogen atoms. They are combustible and produce large amount of heat energy along with carbon dioxide and water vapour, on burning. Hence, many hydrocarbons are used as fuels.

Hydrocarbons are organic chemical compounds entirely made up of hydrogen and carbon atoms. Hydrocarbons are naturally occurring substances that serve as the foundation for crude oil, natural gas, coal, and other vital energy sources. They are highly combustible, emitting carbon dioxide, water, and heat when burned. As a result, hydrocarbons are an excellent source of fuel.

Hydrocarbons have the chemical formula CxHy. In these compounds, the carbon atoms bind together to form the compound's framework, and the hydrogen atoms attach to them in a variety of ways. Despite the fact that they are made up of only two types of atoms, hydrocarbons come in a broad range because they can have simple or very complex structures.

Many hydrocarbons have been discovered in plants, animals, and their fossils; others have been synthesized in the laboratory. Natural gas, acetylene, propane, butane, and the primary components of gasoline, diesel fuel, and heating oil are all examples of hydrocarbons that we all use every day. Hydrocarbons include the well-known polymers polyethylene, polypropylene, and polystyrene. Differences in the bonding between carbon atoms allow us to distinguish between different types of hydrocarbons.

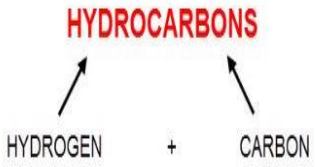
Sources of hydrocarbons

Hydrocarbons occur naturally and they are found in fossil fuels like crude oil, natural gas and coal. About 300 million years ago plants and animals died and they were buried on the ocean floor. Overtime they were covered by silt and soil layers. Then they were buried deep inside the earth and compressed through temperature and pressure and converted to fossil fuels like oil and natural gas. These fuels are found in porous rocks which lie below large bodies of water, especially oceans. By drilling these rocks hydrocarbons can be extracted. Hydrocarbons are present in different trees and plants also.

Coal, oil and natural gas are known as the fossil fuels. They are incredibly important to us because they provide us with the energy we need to power our cars, heat our homes and cook our food.

They are known as the fossil fuels because they were formed from dead plants and animals kept under pressure for millions of years.

These fossil fuels can also be classed as **hydrocarbons** because they are made of only two elements - hydrogen and carbon.



When hydrocarbons are burned, oxygen from the air will combine with each of the elements in the hydrocarbon (that's COMBUSTION).

Sources of Hydrocarbons

Properties of Hydrocarbons

1. The melting and boiling temperatures of hydrocarbon molecules are influenced by their size.
2. Certain hydrocarbons are gases at room temperature, whereas others are liquids or solids.
3. They are made up of strong bonds between carbon and hydrogen.
4. Hydrocarbons exhibit strong attractive molecular forces.
5. Due to their lower density than water, hydrocarbons are able to float on water's surface.

Among all the chemical compounds hydrocarbons have some unique properties. Some of them are given below.

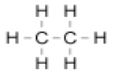
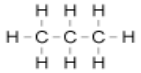
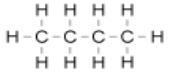
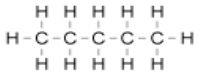
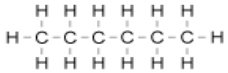
• Most of the hydrocarbons are insoluble in water.

• Hydrocarbons are less dense than water. So, they float on top of water.

• Most hydrocarbons react with oxygen to produce carbon dioxide and water.

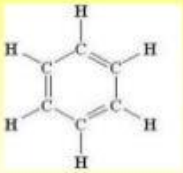
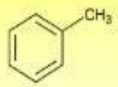
• Hydrocarbons can be gases (E.g. methane and propane), liquids (E.g. hexane and benzene) or waxes (paraffin).

• Hydrocarbons are capable of making bonds with one another. This property is known as catenation (chain formation). Due to this property, they form a greater number of complex molecules.

Name	Formula	Structure	State (at room temp.)
Methane	CH_4		Gas
Ethane	C_2H_6		Gas
Propane	C_3H_8		Gas
Butane	C_4H_{10}		Gas
Pentane	C_5H_{12}		Liquid
Hexane	C_6H_{14}		Liquid

Types of Hydrocarbons

Types of Hydrocarbon

Hydrocarbon Type	Characteristic Group	Example
Saturated Hydrocarbon: Alkanes	No double or Triple Bond	$CH_3CH_2CH_3$ Propane
Unsaturated Hydrocarbon: 1. Alkenes 2. Alkynes	Double Bond; Triple Bond	$CH_3–CH=CH_2$ Propene; $CH_3–C\equiv CH$ Propyne
Aromatic Hydrocarbons:	Benzene ring 	 Methyl Benzene

Based on their sources and qualities, chemists in the nineteenth century categorized hydrocarbons as aliphatic or aromatic. Aliphatic hydrocarbons (from Greek aleiphar, “fat”) were produced from the chemical breakdown of fats or oils. Aromatic hydrocarbons were a class of related compounds derived from the chemical breakdown of certain pleasant-smelling plant extracts. Modern terminology uses the terms aliphatic and aromatic hydrocarbons, but the substances that they describe are distinguished by structure rather than origin. So, Hydrocarbons are broadly classified into two categories depending upon the nature of their carbon skeleton (i.e. on the basis of their structure). These are:

1. Acyclic or open chain or aliphatic compounds
2. Cyclic or closed chain or ring compounds

1. Acyclic or open chain or aliphatic compounds

Aliphatic compounds or aliphatic hydrocarbons are hydrocarbon compounds that have carbon and hydrogen connected to one other in straight chains by single, double, or triple bonds, branching chains. Aliphatic chemicals can be saturated, such as hexane, butane, propane, ethane, and so on, or unsaturated, such as propene, ethyne, butyne, and so on. Aliphatic is a phrase derived from the Greek word meaning fat or oil. These molecules are known as aliphatic compounds because they were originally thought to be derived from fats and oils. Methane is the simplest aliphatic hydrocarbon.

Properties of aliphatic hydrocarbons

1. The vast majority of aliphatic chemicals are combustible. They are frequently employed as fuel sources, such as methane, propane, ethylene, acetylene, and so on.
2. Aliphatic compounds' melting points rise with size but in an unusual way.
3. The hydrocarbons are nonpolar; hence they are insoluble in polar solvents like water. However, they dissolve in non-polar solvents such as benzene and diethyl ether.

Aliphatic hydrocarbons are further divided into saturated and unsaturated hydrocarbons.

Saturated hydrocarbons

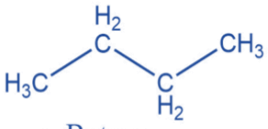
In saturated hydrocarbons, single bonds hold carbon-carbon and carbon-hydrogen atoms together. These single-bonded molecules are the most basic hydrocarbons. They have Sp3 hybridized carbon atoms but no Sp2 or Sp hybridized carbon atoms.

Saturated compounds are hydrocarbons with only carbon-carbon single bonds. These are the most frequent type of hydrocarbon. In other words, as carbon atoms are saturated with hydrogen atoms, carbon is connected with hydrogen atoms as possible. The vast majority of saturated hydrocarbons are alkanes, which are open chain hydrocarbons with a single carbon-carbon link. Typically, the bond is covalent. Because of their inert nature, these compounds do not easily react with acids, bases, or

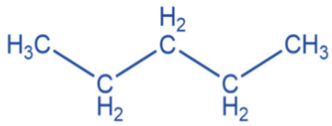
other reagents. The group of saturated hydrocarbons includes all alkanes. These can be branched, like isobutane, or straight chain, like n-butane.

Alkane

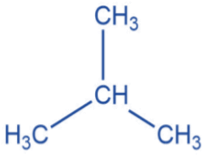
Alkanes are the most basic organic compounds, made up of only carbon and hydrogen. They are represented by the general formula CnH2n+2. As their carbon skeleton is completely saturated with hydrogens, they are also known as saturated hydrocarbons. Since alkanes are made up of strong C-C and C-H covalent bonds, they are chemically inert.



n-Butane
bp = 0°C



n-Pentane
bp = 36°C



Isobutane
bp = -12°C

Properties of alkane:

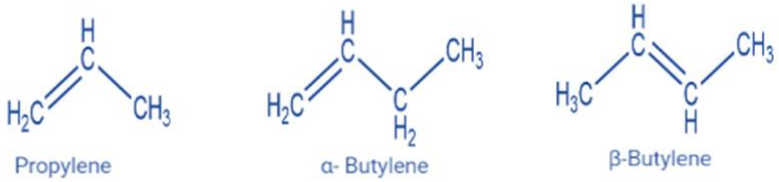
1. Methane, ethane, propane, and butane are present in the gas state. Higher alkanes are wax-like solids, whereas C5-C17 alkanes are colorless liquids.
2. They are nonpolar compounds, so they are insoluble in polar solvents. They are soluble in nonpolar solvents such as benzene and carbon tetrachloride.
3. With increasing molecular weight, the boiling point of alkanes rises. The boiling points of straight-chain alkanes are higher than those of branched alkanes.

Unsaturated hydrocarbons

These compounds are made up of a single, double, or triple bond between carbon atoms. Triple-bonded compounds are known as alkynes, while double-bonded ones are known as alkenes. The general formula for alkenes is CnH2n, whereas the general formula for alkynes is CnH2n-2. Unsaturated hydrocarbons include at least one carbon-carbon double (pi) bond or triple bond.

Alkene

Alkenes are unsaturated hydrocarbons with carbon-carbon double bonds. An alkene has the generic formula CnH2n, where n is an integer number. Alkenes have two fewer hydrogen atoms than alkanes.

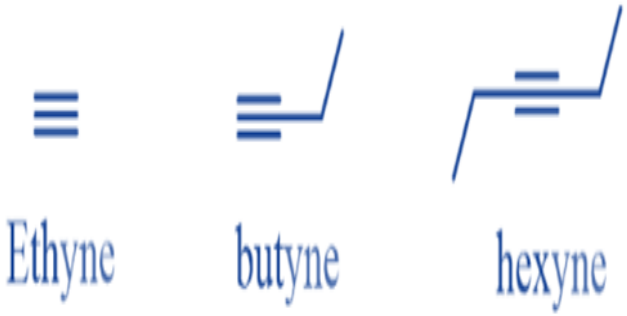


Properties of alkene

1. Lower alkenes are gases, while higher alkenes are liquids. Alkenes with more than 18 carbon atoms in the molecule are solids.
2. Except for ethene, they are colorless and odorless. Ethene has a mildly pleasant aroma.
3. Alkenes are water-insoluble however, they are easily soluble in organic solvents.
4. In general, as the molecular weight of a substance increases in a homologous series, so do its melting point, boiling temperature, and specific gravity.
5. Compared to the corresponding alkanes, alkenes are less volatile.

Alkyne

The alkynes are unsaturated hydrocarbons with one triple bond They are represented by the general formula CnH2n-2. The triple bond in alkyne is known as the ‘acetylenic bond’. There are numerous alkynes found in nature. Ethyne (C2H2) is the first member of the alkyne family, which consists of two carbons bonded together by triple bonds.



Properties of alkynes

1. Alkynes are non-polar organic molecules.
2. They are water insoluble but are soluble in non polar solvents.
3. They have a lower density than water.
4. Alkynes have very low melting and boiling points.
5. The melting and boiling points increase as the number of carbons increases.
6. Terminal alkynes are more acidic than other hydrocarbons.

2. Cyclic or closed chain or ring compounds

In chemistry, cyclic compounds are molecules with atoms bound to one other to form a ring structure. At least three atoms must be linked together to form a ring. These cyclic compounds are further divided into homocyclic and heterocyclic compounds.

Homocyclic compounds

Homocyclic compounds are cyclic compounds with ring members composed of the same element. Homocyclic compounds are organic molecules that exclusively include carbon atoms. These are also referred to as carbocyclic compounds or carbocycles. Homocyclic compounds are further divided into alicyclic and aromatic.

Alicyclic

The cyclic aliphatic compound is one in which the carbon chain forms a ring around itself. They may also be saturated and unsaturated. They are cyclic compounds in which the carbon atoms are linked together to form one or more rings. They do not

have aromatic properties. They might be saturated or unsaturated. They are categorized as cycloalkane, cycloalkene, and cycloalkyne, just as open-chain compounds.

A cycloalkane is a cyclic hydrocarbon that contains only single carbon-carbon bonds. Cycloalkanes, like other alkanes, are saturated molecules. The typical formula for cycloalkanes is CnH2n. The most basic cycloalkane is cyclopropane, which has a three-carbon ring.

Properties of alicyclic compounds

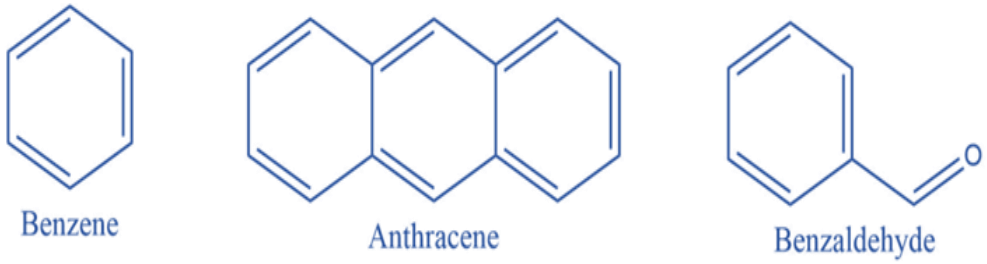
1. They might be saturated or unsaturated.
2. They don’t have an aromatic character.
3. In a ring, three or more carbon atoms are bonded together.
4. Single bonds with two electrons or double or triple bonds with four or six electrons can exist between nearby atoms.
5. Alicyclic compounds with three or four-carbon atom rings are less stable than compounds with higher rings.
6. They have a greater melting and boiling point.
7. They have a higher density.
8. Carbon atoms are in close proximity in their ring structure.
9. They are quite reactive.
10. They have angle strain.
11. The first four classes exist as gases at room temperature.
12. They are not soluble in water.
13. Their molecules are destroyed when they are burned.

Aromatic compounds

The word “aromatic” derives from the word “aroma,” which refers to a pleasing odor, therefore aromatic chemicals have a pleasant odor. A cyclic, planar molecule having a ring of resonance bonds is known as an aromatic compound. Such structures are more stable than regular rings. Arenes are another name for these hydrocarbons. Because the majority of aromatic hydrocarbons contain benzene rings, they are referred to as benzenoids. Some aromatic hydrocarbons lack benzene rings and are hence referred to as non-Benzenoids. As a result, aromatic compounds are broadly divided into two categories: benzenoids (those with a benzene ring) and non-benzenoids (those without a benzene ring).

Benzenoid

Benzenoid substances have at least one benzene ring in their chemical structure. A benzene ring is a cyclic structure made up of six carbon atoms. It is made up of three pi bonds (double bonds) and three sigma bonds organized in a different configuration. As a result, this pattern is known as a conjugated pi system. According to the number of benzene rings connected inside their structures, benzenoid compounds are classified as monocyclic, bicyclic, or tricyclic.



Non-benzenoids system

Non-benzenoid compounds are aromatic molecules that lack benzene rings in their chemical structure. Despite the lack of a benzene ring, these molecules have a conjugated pi system. Because of the existence of a conjugated pi system, these molecules have an aromatic character. This conjugated pi system offers extra stability to the molecule. Examples include azulenes, Oxaazulanones, Pentafulvene, Tropones and Tropolones, and more.

Properties of aromatic compounds

1. They are cyclic compounds with five, six, or seven-membered rings that have a flat (planar) structure.
2. They are highly unsaturated compounds that show electrophilic substitution reactions and are resistant to addition reactions.
3. They have proven to be more stable than expected. They have lower heats of hydrogenation and heats of combustion than expected.
4. Aromatic compounds have a lower reactivity than aliphatic substances.
5. The percentage of carbon in aromatic compounds is higher than in aliphatic compounds. As a result, they burn with a sooty flame.
6. Aromatic hydroxy compounds (phenols) are acidic, whereas alcohols are neutral.
7. Aromatic amines (anilines) have a lower basicity than aliphatic amines.
8. In comparison to aliphatic molecules, aromatic compounds quickly undergo sulphonation and nitration reactions.
9. Aromatic compounds have a delocalized Pi cloud that is uniformly distributed on the ring system. The electron cloud must contain $(4n+2)\prod$ electrons, i.e. they must fulfill Huckcl's $(4n + 2)\prod$ electron rule, where n = integer 0, 1, 2, 3, and so on. This is referred to as Huckel's rule.

Heterocyclic compounds

Heterocyclic organic compounds are compounds with at least one heteroatom (atom other than carbon) in the cyclic ring structure. Nitrogen (N), oxygen (O), and sulfur (S) are the three most prevalent heteroatoms. Heterocyclic compounds are

commonly found in plants and animal products, and they are an essential element of more than half of all natural organic compounds. Some examples of natural heterocyclic compounds include alkaloids, natural colors, medicines, proteins, enzymes, and others.

The heterocyclic compounds may be divided into two types based on their structural and electronic arrangement.

1. Aliphatic heterocyclic compounds
2. Aromatic heterocyclic compounds

Aliphatic heterocyclic compounds

Saturated heterocycles are aliphatic heterocycles that do not contain double bonds. The ring strain has the greatest influence on the characteristics of aliphatic heterocycles. Aziridine, Ethylene Oxide, Thiirane, Oxetane, Azetidine, Thietane, Tetrahydrofuran (THF), Dioxane, Pyrrolidine, Piperidine, and others are examples of aliphatic heterocyclic compounds.

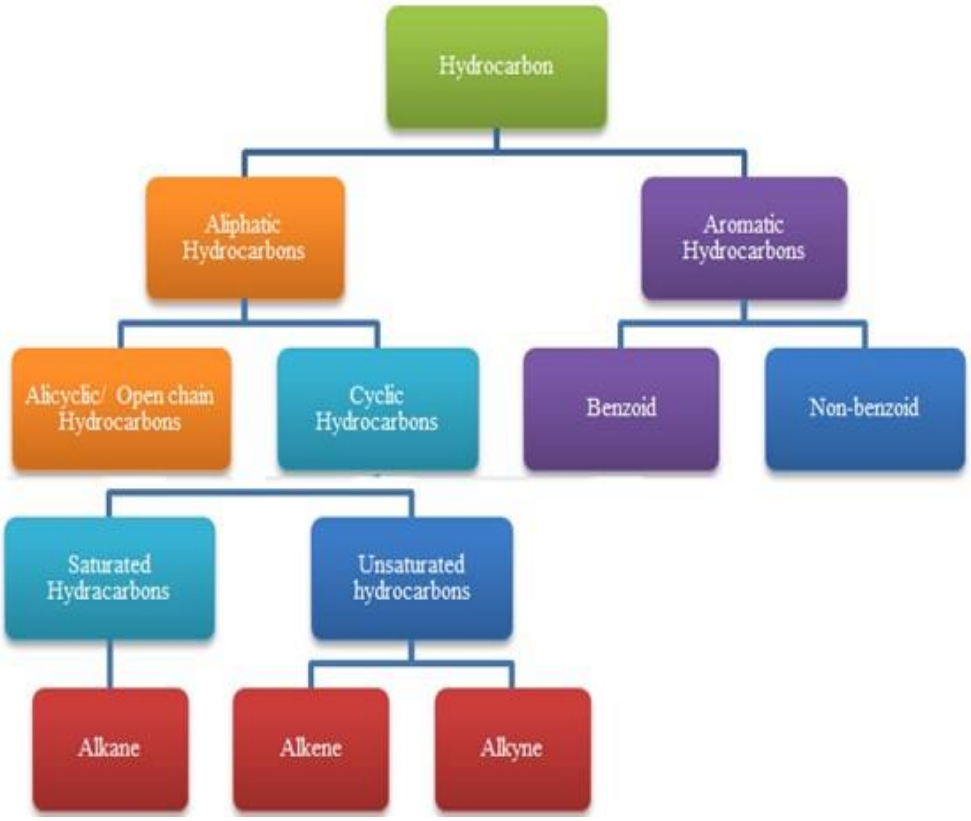
Aromatic heterocyclic compounds

Aromatic heterocyclic substances are benzene analogs.

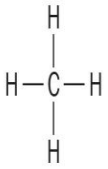
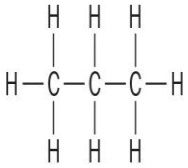
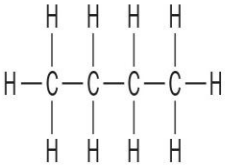
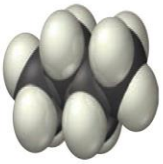
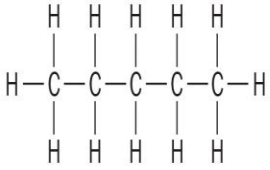
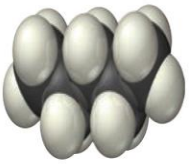
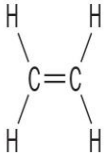
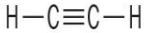
Aromatic heterocyclic compounds must also adhere to Huckel's rule (i.e. aromatic compounds must be cyclic in nature, have planar geometry due to conjugate double bonds, and have (4n+2) electrons). Furan, Pyrrole, Thiophene, Indole, Benzofuran,

Carbazole, Quinoline, Isoquinoline, Imidazole, Oxazole, Pyrazole, and Pyridazine are some examples of aromatic heterocyclic compounds.

In hydrocarbons carbon and hydrogen atoms are linked together through different chemical bonds. Depending on the bond between these atoms there are number of hydrocarbons. The four general classes of hydrocarbons are: alkanes, alkenes, alkynes and arenes. Some of the common hydrocarbons are methane, ethane, propane, butane and pentane.



Methane is the simplest hydrocarbon in which four hydrogen atoms are linked with one carbon atom. It is a colourless, odourless and inflammable gas. It is an eco-friendly fuel because it does not produce any harmful products. It is used as a fuel in electricity generation. Methane is also known as marsh gas as it is present in marshes. Dead and decaying plants and animals release methane gas. It is a renewable source of energy. Sewage sludge can also be decomposed by microorganisms to produce methane gas along with impurities like carbon dioxide and hydrogen sulphide. After removing these impurities, methane gas can be used as an efficient fuel.

Name	Molecular Formula	Structural Formula	Space-filling Model	Common Uses
Methane	CH_4			Primary component of natural gas
Propane	C_3H_8			LP gas for grills and outdoor stoves
n-Butane*	C_4H_{10}			Common fuel for lighters
n-Pentane*	C_5H_{12}			Component of gasoline
Ethene	C_2H_4			Ripening agent in fruit
Ethyne	C_2H_2			Fuel for welding torches

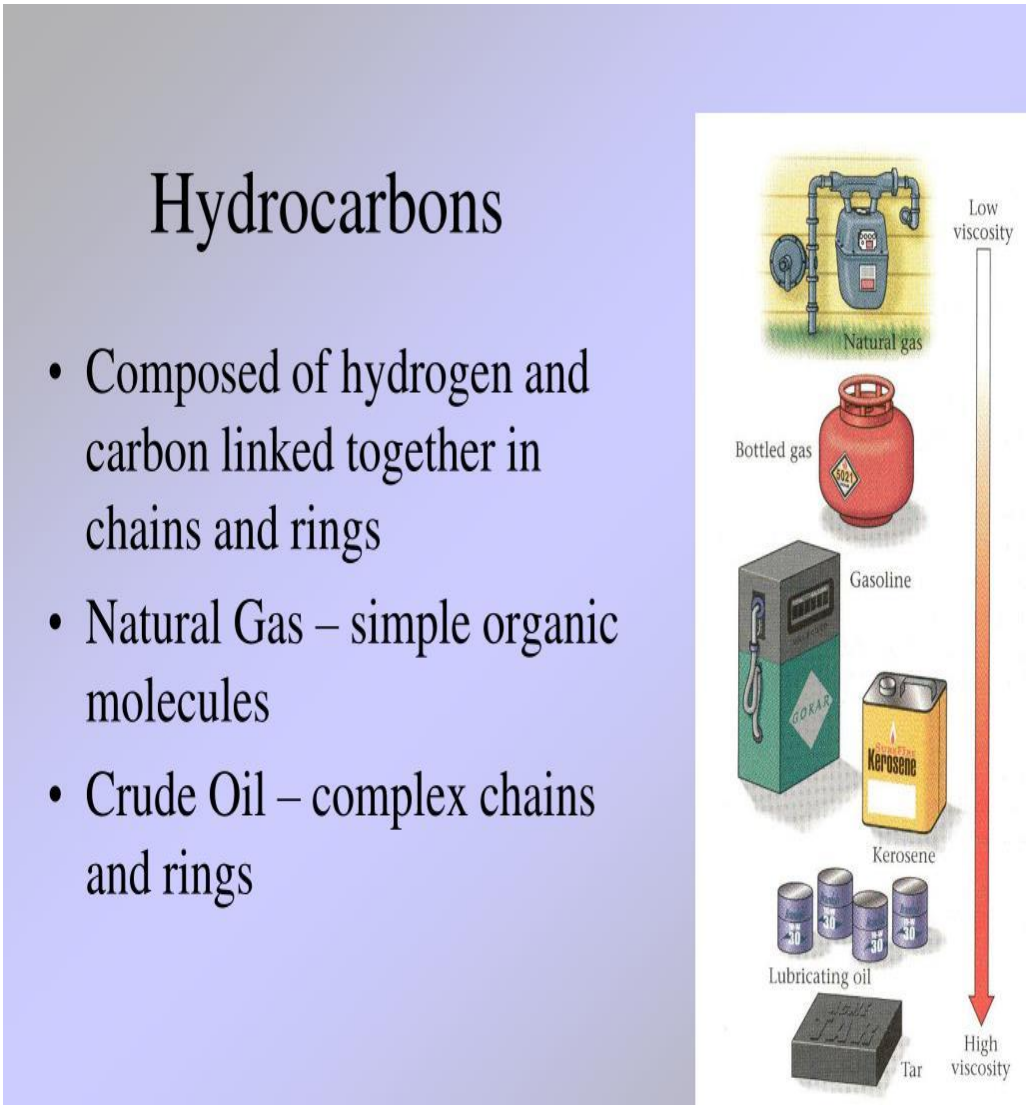
*The "*n*" in the names of these hydrocarbons stands for "normal," which means straight chain.

Propane is an odourless and highly inflammable gas. It is heavier than air. It is liquefied through pressurisation and commonly used as LPG (Liquefied Petroleum Gas) along with butane. Propane is used as fuel in heating, cooking and vehicles. Propane can also be used as refrigerants.

Propane is used in LPG cylinders. Since it is an odouress gas, any leakage cannot be detected. Hence, a chemical by name Mercaptan is mixed with LPG to help in detection of any leakage of LPG. Butane is a gas at room temperature and atmospheric pressure. They are highly flammable, colorless gases that quickly vaporize at room temperature. Butane is used as a fuel gas and propellant in aerosol sprays such as deodorants. Pure forms of butane can be used as refrigerants. Butane is also used as lighter fuel for a common lighter or butane torch. Pentanes are liquids with low boiling point. They are used as fuels and solvents in the laboratory. They are also used to produce polystyrene.

Natural gas is a naturally occurring hydrocarbon gas mixture consisting primarily of methane along with other higher alkanes and a small percentage of carbon dioxide, nitrogen and hydrogen sulphide (H_2S). If the natural gas contains lower hydrocarbons like methane and ethane, it is called dry gas. If higher hydrocarbons like

propane and butane are also present in the gas, it is called wet gas. Natural gas is always found above the oil in the oil wells. This gas is trapped inside the small spaces in underground rocks called reservoirs.



Conventional natural gas can be extracted through drilling wells. Natural gas can also be found in reservoirs with oil and is extracted along with oil. This is called associated gas. Natural gas is a fossil fuel used as a source of energy for heating, cooking and electricity generation. Natural gas occurs in Tripura, Rajasthan, Maharashtra, Andhra Pradesh (Krishna, Godavari Basins) and Tamil Nadu (Cauveri

Delta). It is also formed by the decomposition of organic matter in marshy areas and waste sewages. The natural gas formed by this way contains mainly methane.

Organic chemistry is a branch of chemistry that studies carbon-based compounds, the simplest of which is the hydrocarbon. A hydrocarbon is a compound that is composed entirely of covalently bonded carbon and hydrogen atoms. Butane (CH410), a fuel used in lighters, octane (CH818), a component of gasoline, and naphthalene (CH108), a moth repellent, are all examples of hydrocarbons.

A hydrocarbon is a molecule composed of only carbon and hydrogen atoms.

A. It can be used as a fuel.
B. It contains hydrogen and carbon.
C. It is made from crude oil.
D. It contains only hydrogen and carbon.
E. It contains hydrogen and carbon in the correct ratio.

Hydrocarbons may be classified as either aliphatic or aromatic. Aromatic hydrocarbons describe a class of compounds that include at least one planar, cyclic, carbon-based structure of alternating single and double bonds. Aliphatic hydrocarbons consist of carbon atoms bonded in open chains by either single, double, or triple bonds. They also include cyclic hydrocarbons that may contain single or double bonds. When all of the bonds between the carbon and hydrogen atoms are single covalent bonds, the hydrocarbon is said to be saturated because the compound contains the maximum number of hydrogen atoms that can bond with the number of carbon atoms present.

A straight-chain alkane is an alkane whose carbon atoms are bonded in one continuous chain. A straight-chain hydrocarbon is a hydrocarbon whose carbon atoms are bonded together in one continuous chain.

The alkane name consists of a prefix, which indicates the number of carbon atoms in the continuous chain, and a suffix, “-ane,” which indicates that the compound is an alkane.

The table below shows the names of the first ten straight-chain alkanes.

Number of Carbon Atoms in a Straight Chain	Molecular Formula	Prefix-	Name of Hydrocarbon
1	CH4	Meth-	Methane
2	CH26	Eth-	Ethane
3	CH38	Prop-	Propane
4	CH410	But-	Butane
5	CH512	Pent-	Pentane
6	CH614	Hex-	Hexane
7	CH716	Hept-	Heptane
8	CH818	Oct-	Octane
9	CH920	Non-	Nonane
10	CH1022	Dec-	Decane

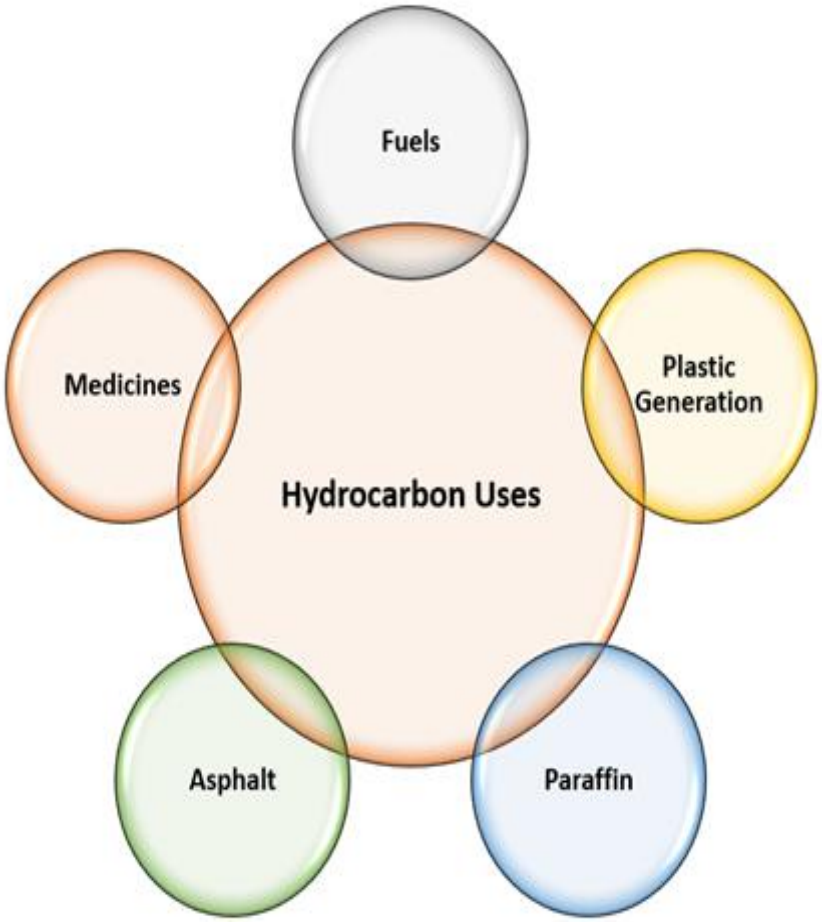
Name	Molecular Formula	Condensed Structural Formula
Methane	CH_4	CH_4
Ethane	C_2H_6	CH_3CH_3
Propane	C_3H_8	$CH_3CH_2CH_3$
Butane	C_4H_{10}	$CH_3CH_2CH_2CH_3$
Pentane	C_5H_{12}	$CH_3CH_2CH_2CH_2CH_3$
Hexane	C_6H_{14}	$CH_3CH_2CH_2CH_2CH_2CH_3$
Heptane	C_7H_{16}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$
Octane	C_8H_{18}	$CH_3(CH_2)_6CH_3$
Nonane	C_9H_{20}	$CH_3(CH_2)_7CH_3$
Decane	$C_{10}H_{22}$	$CH_3(CH_2)_8CH_3$

Uses of hydrcarbons

1. Hydrocarbons are commonly employed as fuels. Examples include LPG (Liquefied Petroleum Gas) and CNG (Liquefied Natural Gas).
2. They are employed in the production of polymers such as polyethylene and polystyrene.
3. As a starting material, these organic compounds are used in the manufacture of pharmaceuticals and colors.
4. Hydrocarbons are found in oil supplements, vaccinations, injections, and pills in medicine. By themselves, these structures aren't very useful in

medicine, however, reactions can be used to add beneficial functional groups, creating pharmaceutical drugs.

5. They are used as lubricants and grease.
6. Heterocyclic compounds are widely used in pharmaceuticals, agrochemicals, and veterinary medicines. Many heterocyclic chemicals are extremely beneficial and necessary for human survival. Hormones, alkaloids, antibiotics, vital amino acids, hemoglobin, vitamins, dyestuffs, and pigments all contain a heterocyclic structure.
7. Halogenated hydrocarbons are those in which hydrogen atoms are substituted with fluorine, chlorine, bromine, or iodine. In medicine, halogenated hydrocarbons are used to manufacture anesthetics such as halothane, propellants for inhalers, and sedatives such as chloral hydrate.
8. Freon and other halogenated hydrocarbons are used as refrigerants.
9. It is used on farms to heat animal shelters and greenhouses, for drying crops, managing pests and weeds, and powering agricultural machinery and irrigation pumps.
10. Hydrocarbons are also used in powering forklifts, electric welders, and other equipment in companies and industries.


Fuels
Medicines
Plastic Generation
Hydrocarbon Uses
Asphalt
Paraffin

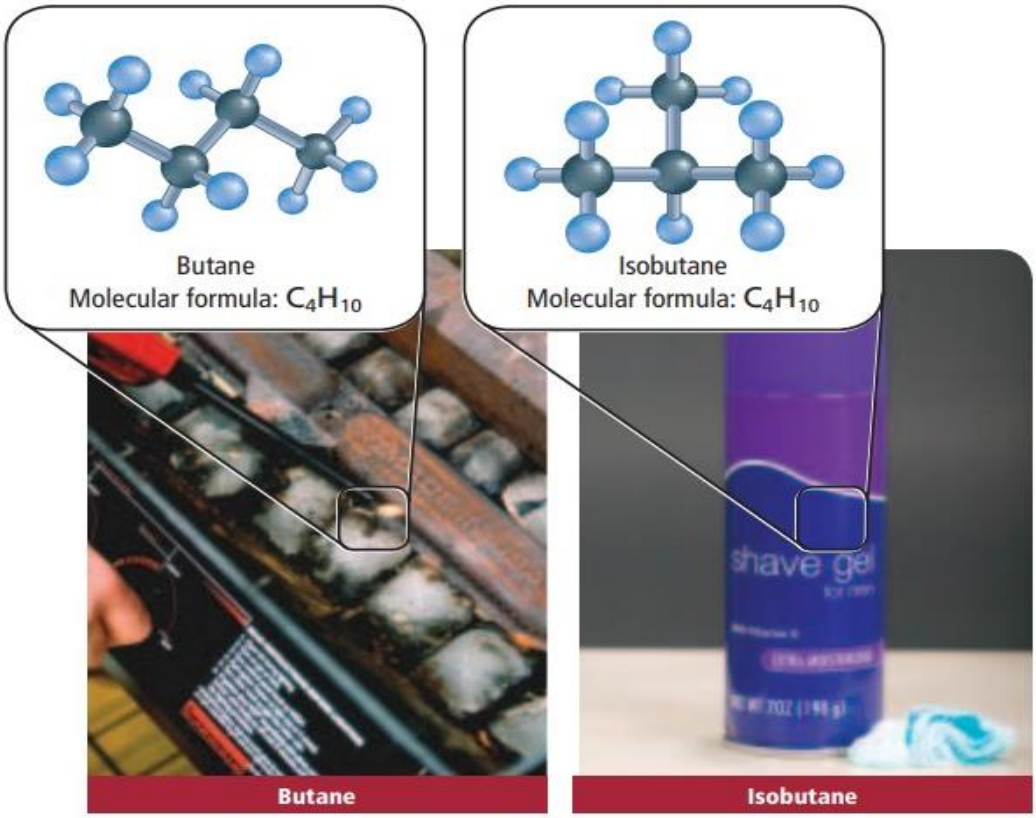
Uses of Hydrocarbons

Number of C atoms	State	Major Uses
1-4	gas	heating and cooking fuel
5-7	liquids, (low boiling)	solvents, gasoline
6-18	liquids	gasoline
12-24	liquids	jet fuel; camp stove fuel
18-50	liquids, (high boiling)	diesel fuel, lubricants, heating oil
50+	solids	petroleum jelly, paraffin wax

USES OF HYDROCARBON GAS AS REFRIGERANTS

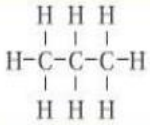
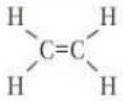
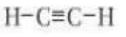
- **Saves energy**: regular refrigerants consume a huge amount of energy to provide cooling effects but the hydrocarbon gases can save up to 30 percent of the total energy consumption
- **Easy to use**: it is a common notion among the industry people and common masses that getting the cfc replacement will add on their budget but to use them there is no need of getting the machineries or the cooling unit changed. .

Ethene- Fruit Ripening



Lighters and Shaving Gel

Hydrocarbon

Alkane	Alkene	Alkyne
		
		
The **propane** in this camping stove is a saturated hydrocarbon.	Fruits make **ethene**, which is a compound that helps ripen the fruit.	**Ethyne** is better known as acetylene. It is burned in miner's lamps and in welding torches.

Motor oil

Asphalt

Candle

Lighter

Rain boots

Transportation

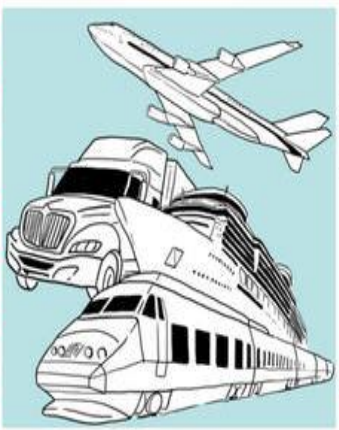
Asphalt pavement on highways is made of hydrocarbons found in petroleum.

This fireplace lighter burns the alkane named butane.

Motor oil consists of several hydrocarbons. It lubricates the moving parts of car engines.

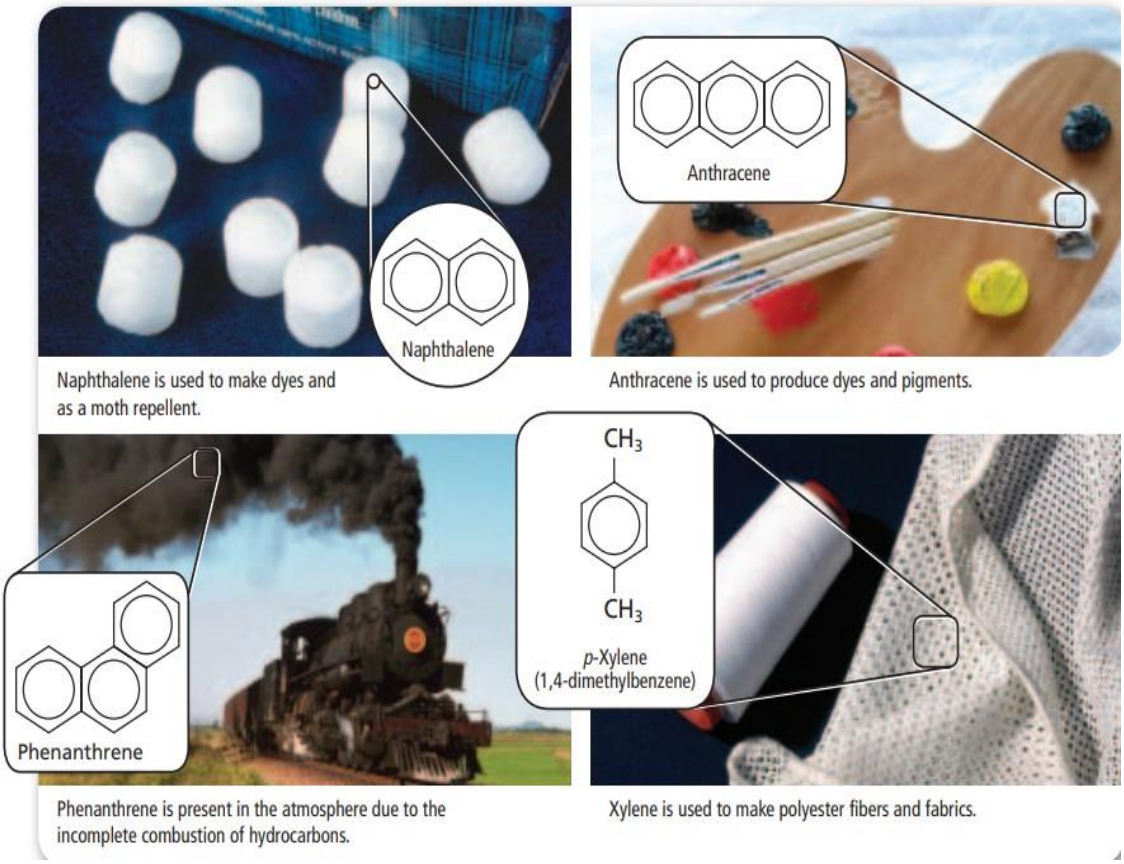
Many candles are made of paraffin wax, a solid mixture of alkanes.

These synthetic rubber boots are made mainly of a mixture of alkenes.



All of these forms of transportation are fueled by a mixture of many hydrocarbons.

This power plant burns the hydrocarbons in coal. A large pile of coal is conveniently located next to this power plant.



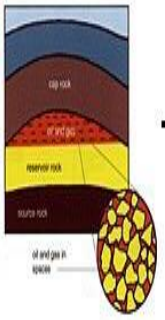
Environmental and Health Effects of Hydrocarbons

1. Hydrocarbons can injure the lungs directly by breathing or produce systemic intoxication through ingesting, inhalation, or skin absorption. Many hydrocarbons are also irritating to the eyes and skin.
2. Injecting hydrocarbons into the skin, subcutaneous tissue, or muscle can result in liquefaction necrosis and a severe local inflammatory reaction.
3. On the other hand, many aromatic and halogenated hydrocarbons, alcohols, ethers, ketones, and other substituted or complex hydrocarbons have the potential to produce acute systemic toxicity, including coma, convulsions, and cardiac arrhythmias.
4. Hydrocarbon-emitted gases have been found to affect respiratory systems and affect the environment through climate change and the greenhouse effect.

5. By discharging pollutants, the oil and gas extraction process also causes significant damage to the surface environment and nearby groundwater of the extraction site. Unexpected spills pose a significant threat to marine and aquatic life.

The journey of a hydrocarbon

1



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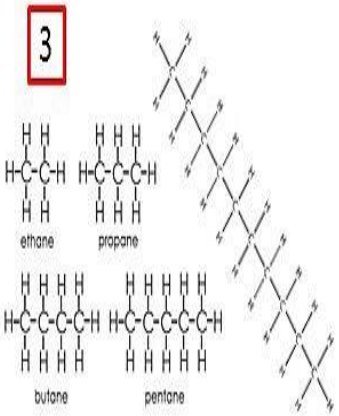

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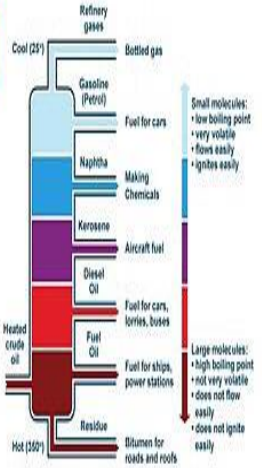

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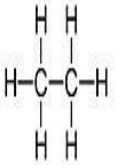
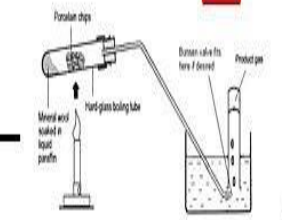
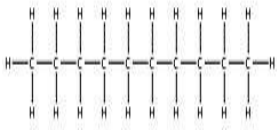


$C_2H_6 + O_2 + \rightarrow ? + ?$

6

in the lab.....





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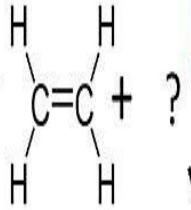

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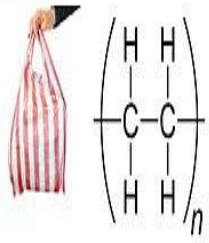

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10

1.1 NEED FOR THE STUDY

Hydrocarbons are an integral part of various industries, making it essential for young students preparing for various exams. Our economy is slowly decarbonizing. It is still primarily dependent on hydrocarbons and other fossil fuels such as coal (which is a mineral). In the form of fuel, hydrocarbons continue to be the main engine of human activities. Unfortunately, extracting and using it pollutes the soil, the atmosphere, and the oceans. In recent decades, alternatives have been achieved in terms of energy generation, such as renewables, and even in their use as fuel, as is the case with aerothermal heating and batteries in electric cars. However, many systems are still dependent on hydrocarbons, such as the incredibly efficient transportation of large container ships. The study of hydrocarbons can provide insight into the chemical properties of other functional groups and their preparation. So, it is very important to learn the topic.

1.2 OBJECTIVES

- To understand the concept of hydrocarbons.
- To identify different types of hydrocarbons.
- To describe the sources of hydrocarbons.
- To illustrate the properties of hydrocarbons.
- To appreciate the uses of hydrocarbons.

1.3 PROBABLE CAUSES

1. Less interest of students.
2. Lack of motivation.

2. ACTION PLAN

This chapter contains the core component of action research like the nature of samples, time chart, budget, expansion of various concepts on hydrocarbons by Games and activities, design of activities and the tools used. The number of samples involved has been detailed in the component samples. The time chart talks about then number of days taken for each activity. Information on the taken-up concept has been explained

under “hydrocarbons”. The alternative teaching strategy generated for teaching the concepts have been explained in detail under the design of activities. A brief sketch on tools used has been given under the final part.

2.1 SAMPLE

The X Std students of Government High School, Ko.Chathiram, Kurinjipadi Block, Cuddalore District numbering 29 with 13 boys and 16 girls have been taken as sample.

2.2 TIME CHART

Altogether 60 days were spent to procure materials and to carry out the new strategy for this action research.

The number of days allotted for each activity is listed below:

Preparation and collection of learning materials	- 20 Days
Execution of teaching activities	- 10 Days
Conduct of tests	- 02 Days
Report preparation	- 28 Days
	Total - 60 Days

2.3 TOPIC:

“IMPROVING THE UNDERSTANDING OF TYPES OF HYDROCARONS AMONG X STUDENTS THROUGH SIMPLE ACTIVITIES.”

2.4 DESIGN OF ACTIVITIES:

Hydrocarbons are a subgroup of organic compounds composed entirely of only carbon and hydrogen atoms. They can be simple or complex. They are generally classified into four subcategories namely

1. Alkanes,
2. Alkenes,
3. Alkynes, and
4. Aromatic hydrocarbons.

An example of a hydrocarbon is shown in Figure 1. Salicylic acid, also shown in Figure 1, is an organic compound but is not a hydrocarbon because it contains an oxygen group.

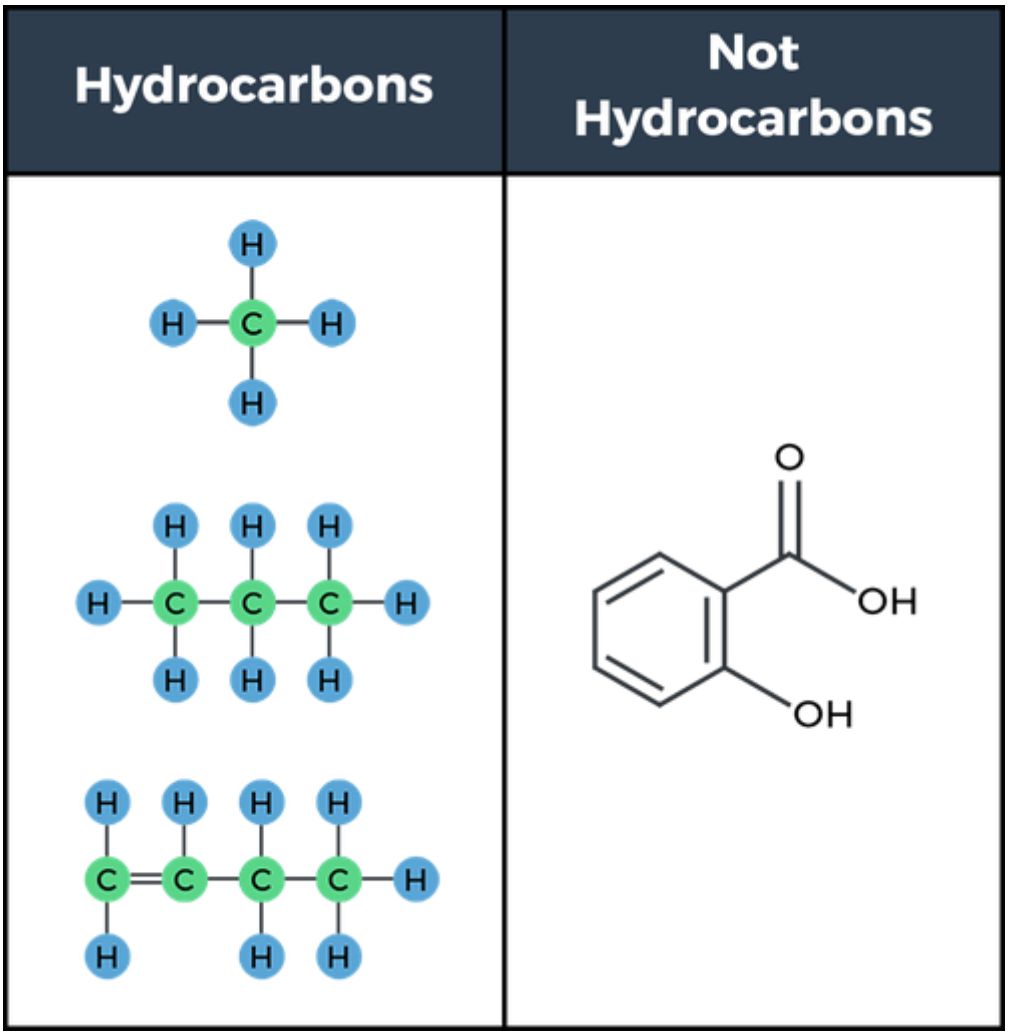


Fig: Left: is a molecular structure that is a hydrocarbon, such as methane, propane, and 1-butene. Right: is the structure of salicylic acid, which is not a hydrocarbon.

Why hydrocarbon nomenclature and representation can be tricky to learn

There are three reasons in particular why hydrocarbon nomenclature can be difficult, even for the most hard-working students.

1. There is a need for a basic understanding of the classification of hydrocarbons

Hydrocarbons can contain single, double, or triple bonds, which determines the nomenclature of the compound.

1. Alkanes are straight-chain hydrocarbon molecules containing only single-bonded carbon atoms. When you name these molecules, the last syllable of the name is "ane".
2. Alkenes are straight-chain hydrocarbon molecules that contain at least one carbon with a double bond. When you name these molecules, the last syllable of the name is "ene".
3. Alkynes are straight-chain hydrocarbon molecules that contain at least one carbon triple bond. When you name these molecules, the last syllable of the name is "yne".
4. Aromatic Hydrocarbons: Hydrocarbon with one or more rings. It may contain a single, double or triple bond.

Alkanes are the least reactive hydrocarbons due to their stability. They contain only strong single sigma bonds. Single bonds require a lot of energy to break and are therefore the least reactive.

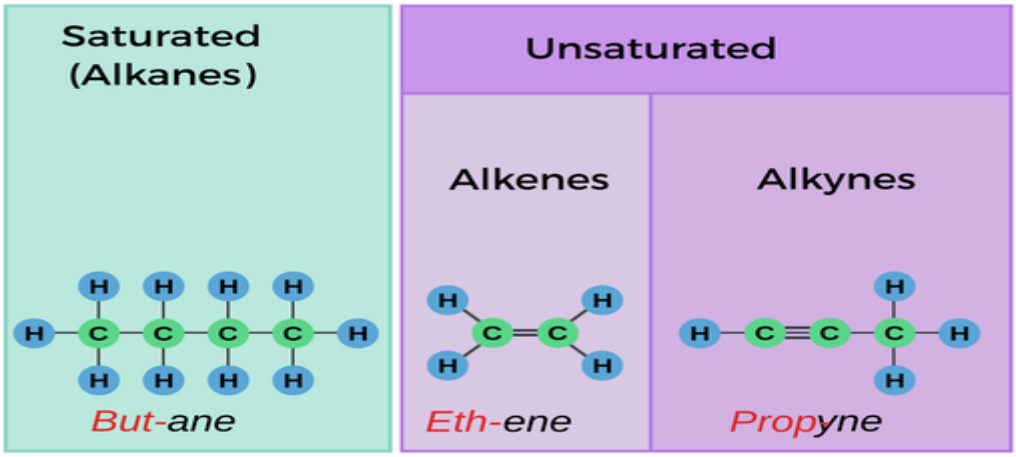


Fig: Role of the prefixes in names of hydrocarbons.

A hydrocarbon is saturated if it contains no double or triple bonds. When any of these are present in the compound, it becomes unsaturated. The molecular formulas of non-cyclic alkanes follow this rule for the amount of carbon and hydrogen: CnH2n+2. Noncyclic alkenes follow this rule: CnH2n. Noncyclic alkynes follow this rule: CnH2n-2.

2. It involves functional groups

The functional group is the part of the molecule that is responsible for its reactivity. Different functional groups cause different types of reactions in organic chemistry. The functional group can be a specific arrangement of carbon and hydrogen, e.g. double bonds, or may also contain other elements. Oxygen and nitrogen are the most common elements in organic compounds, apart from carbon and hydrogen. Other examples of elements are phosphorus and halogens.

3. It includes suffixes and prefixes in its nomenclature

Simple hydrocarbons are named using a few simple rules.

The first part of the name - the prefix - is determined by the number of carbon atoms in the longest carbon chain. A prefix is added to the last syllable to indicate the number of carbon atoms in the hydrocarbon chain. The table below shows the prefixes for hydrocarbons with 1-10 carbon atoms in the longest carbon chain. Note that the second column shows only the prefix and the full name includes the suffix, which for a hydrocarbon depends on whether there are double or triple bonds in the compound.

The second part of the name - the suffix - is determined by whether double or triple bonds are present. A visual representation of these principles can be seen below

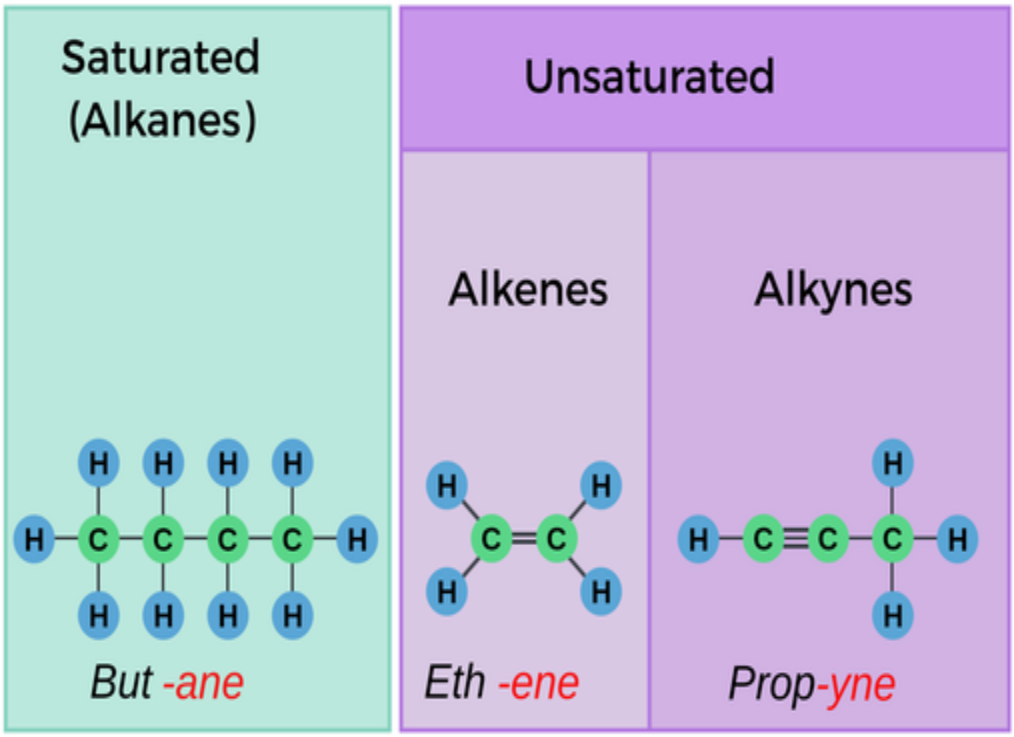


Fig: Overview of the nomenclature principles of simple hydrocarbons.

Only the carbon and hydrogen side groups in organic compounds have the same prefix as the hydrocarbon and the suffix '-yl' is used.

Hydrocarbons are simple organic compounds consisting of hydrogen and carbon atoms, which are the basic structures of many natural and synthetic substances. Teaching hydrocarbons is a challenging task, especially for high school chemistry teachers, due to the complex nature of chemical structures and reactions. However, utilizing context-based instructions can make this task easier and more effective. In this essay, we will explore why context-based instructions are useful in teaching hydrocarbons and how they can be applied in the classroom to enhance students' understanding of the topic.

1. Making connections between hydrocarbons and real-world contexts:

Context-based instruction involves relating classroom concepts to real-world situations or scenarios. This approach can help students understand abstract concepts by making them relevant and tangible. Teachers can use hydrocarbons as an example to explain the properties and applications of fuels, such as gasoline and diesel. By

connecting hydrocarbons to the everyday world, students can see their relevance and importance and become more interested in the subject. Hydrocarbons are very useful in our everyday lives. For instance, we need some energy to carry out our daily activities. This energy could be in the form of fuels for powering mechanical and electrical activities that enable us to drive to and from work, power machinery, etc., Hydrocarbons are mostly used for fuel. Gasoline, diesel fuel, natural gas, fuel oil, jet fuel, coal, kerosene, and propane are some commonly used hydrocarbon fuels. Hydrocarbons are also used to make things, including plastics, glue, and synthetic fabrics like polyester.

2. Incorporating problem-based learning:

Problem-based learning is an instructional strategy that allows students to solve problems by applying the concepts they have learned. For example, teachers can present a real-world problem, such oil spill, and ask students to design a hydrocarbon-based solution to address the issue. This approach not only enhances students' critical thinking skills but also strengthens their understanding of hydrocarbons and their applications.

3. Using visual aids and technology:

Visual aids, such as molecular models or videos, can enhance students' understanding of hydrocarbons' complex structures and reactions. Teachers can use 3D molecular models or videos to show students how hydrocarbons interact with other compounds. Moreover, teachers can utilize digital tools like augmented reality (AR) or virtual reality (VR) to simulate chemical reactions and engage students in a more vivid learning experience.

4.Encouraging inquiry-based learning:

Inquiry-based learning is a process that allows learners to discover information through exploration and questioning. Teachers can facilitate students' investigation of hydrocarbons by presenting a problem or challenge and allowing them to explore and

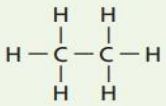
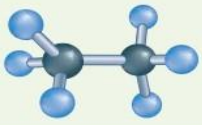
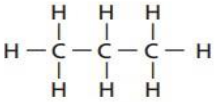
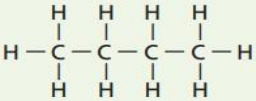
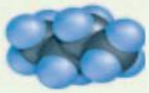
find information independently. The approach not only enhances students' curiosity and interest in the subject but also helps them develop research and analytical skills.

5. Show the people behind the science

Antoine-Laurent Lavoisier was born into a privileged family on August 26, 1743, in the French capital, Paris. His father was Jean-Antoine Lavoisier, a lawyer in the Paris Parliament. His mother was Emily Puntis, whose family fortune came from a butcher shop. She died when Antoine was five years old, leaving him a large sum of money. Lavoisier studied law to please his family but was especially interested in science. He proposed the law of mass conservation. Lavoisier spent a lot of time isolating elements and breaking down chemical compounds. He discovered a system of naming chemical compounds consisting of several elements. Most of the systems are still in use today. He also named the element hydrogen.

6. Encourage the use of virtual lab simulations

A unique way to teach about hydrocarbon nomenclature and representation is through a virtual laboratory simulation. At Labster, we're dedicated to delivering fully interactive advanced laboratory simulations that utilize gamification elements like storytelling and scoring systems, inside an immersive and engaging 3D universe.

Molecular Formula	Structural Formula	Ball-and-Stick Model	Space-Filling Model
Ethane (C_2H_6)			
Propane (C_3H_8)			
Butane (C_4H_{10})			

Gist of the Activities

- Making connections between hydrocarbons and real-world contexts.
- Using ball-and-stick models to assist students to form covalent bonds in alkanes, alkenes, alkynes.
- Drawing the structures of alkanes, alkenes, alkynes.
- Incorporating problem-based learning.
- Open class discussion.
- Using visual aids and technology.
- IUPAC naming of structures of alkanes, alkenes, alkynes.
- Using worksheets on alkanes, alkenes, alkynes.
- Using puzzles.
- Showing the Virtual laboratory simulations.
- Encouraging inquiry-based learning.
- Showing the people behind the science

2.5 TOOLS USED:

A question paper was prepared with 20 questions. Each question consists of four different options. Each question carries maximum of one mark. So, the test was conducted for 20 marks.

3. ANALYSIS AND INTERPRETATION:

Before adapting the strategy, to find the academic performance of the students, a pre-test was conducted. Then after using the strategy a post-test was conducted. The academic performance of the students, a pre-test and post-test is given in annexure. The mean, median and mode were calculated for both the pre-test and post-test.

Analysis of the pre-test

The pre-test score of the 29 students is 35, 15, 35, 25, 25, 20, 30, 20, 30, 10, 10, 50, 15, 25, 15, 35, 20, 10, 40, 20, 25, 20, 10, 35, 15, 05, 20, 40 and 15.

Arithmetic mean/Average:

The mean is an average that all of us have been exposed to. The mean is simply the arithmetic average and it is a very common measure of central tendency. The overall total marks obtained by the 29 students are 670. So, Mean =670/29 =23.10

Median:

The median is the value below which half the values in the sample fall. To find the median of the pre-test, marks have been arranged in the ascending order and the average of the two mid values be found, as the total number of the sample is an even number. 05, 10, 10, 10, 10, 15, 15, 15, 15, 15, 20, 20, 20, 20, 20, 20, 25, 25, 25, 25, 30, 30, 35, 35, 35, 35, 40, 40, 50. Thus arrived value of the pre-test median is 20.

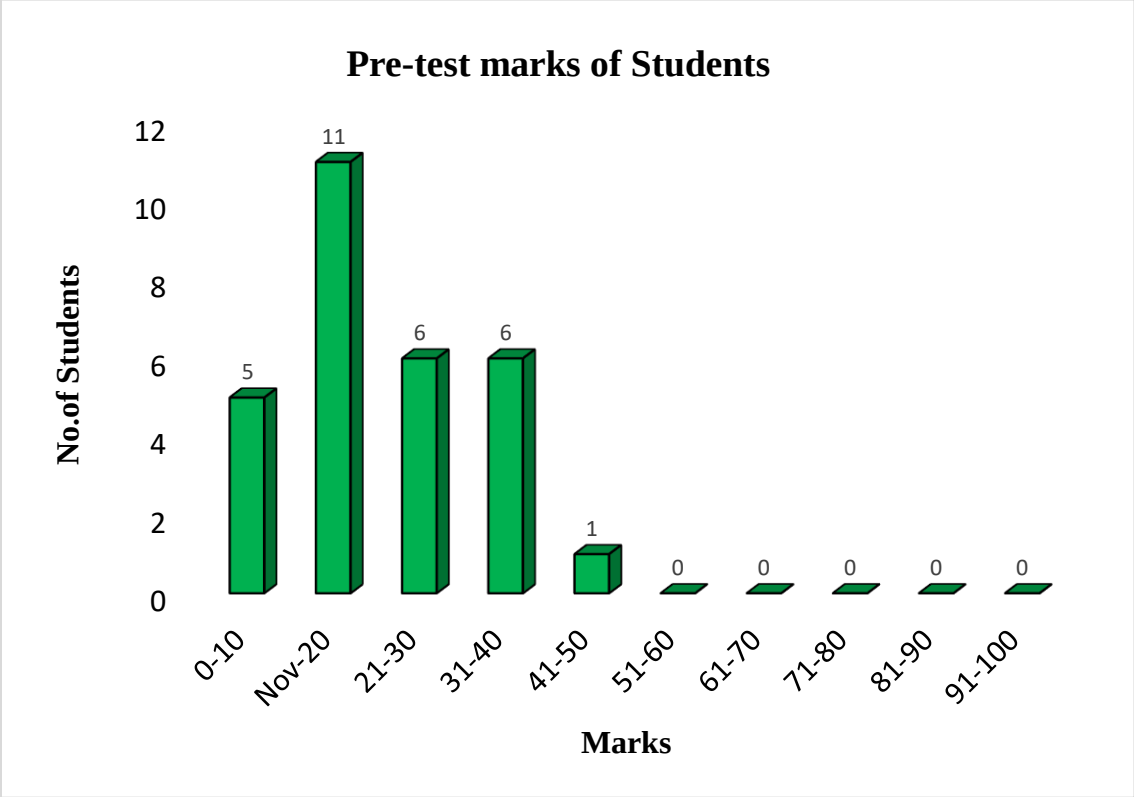
Mode:

Mode is the value that occurs most often. So, the value of pre-test mode is 20. The highest mark obtained is 50 and the lowest mark obtained is 20. The number of students scored more than the average mark is 13. The pre-test marks scored by the students arranged in ascending order and their frequency of occurrence in 10 marks ranges are tabulated in Table - 1 below.

Table - 1

Class Interval of pre-test marks	Frequency

0-10	5
11-20	11
21-30	6
31-40	6
41-50	1
51-60	0
61-70	0
71-80	0
81-90	0
91-100	0



From the above observation, one could observe the fact that overall performance of the students was not up to the mark.

Analysis of the post-test:

The post-test score of the 29 students is 75, 50, 75, 55, 65, 50, 65, 60, 70, 40, 35, 80, 45, 55, 40, 60, 45, 40, 75, 55, 60, 45, 45, 75, 50, 35, 50, 70 and 50.

Arithmetic mean/Average:

The mean is an average that all of us have been exposed to. The mean is simply the arithmetic average and it is a very common measure of central tendency. The overall total marks obtained by the 29 students are 1610. So, Mean =1610/29=55.51

Median:

The median is the value below which half the values in the sample fall. To find the median of the post-test, marks have been arranged in the ascending order and the average of the two mid values be found, as the total number of the sample is an even number.

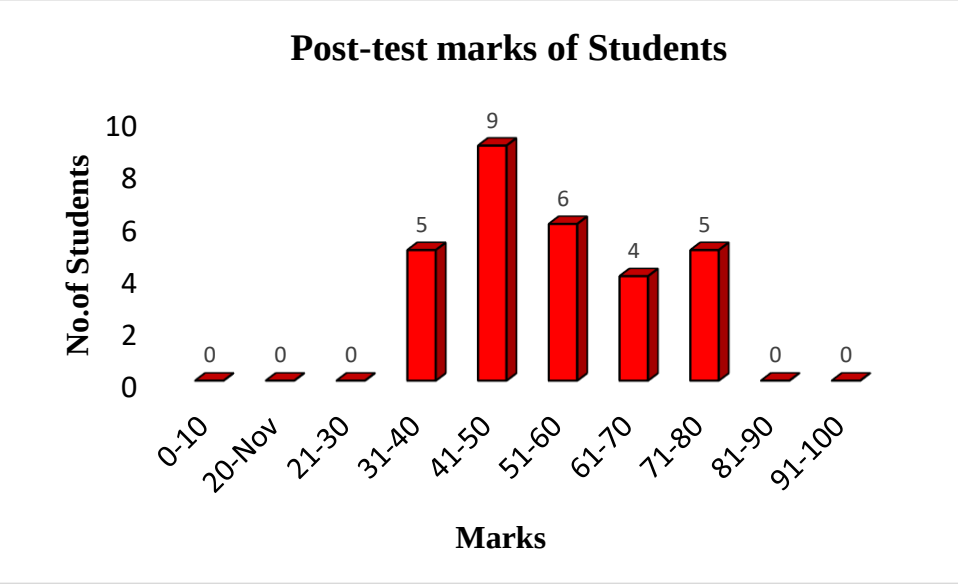
Mode:

Mode is the value that occurs most often. So, the value of post-test mode is 50. The highest mark obtained is 80 and the lowest mark obtained is 35. The number of students scored more than the average mark is 12. The post-test marks scored by the students arranged in ascending order and their frequency of occurrence in 10 marks ranges are tabulated in Table - 2 below.

Table – 2

Class Interval of post-test marks	Frequency

0-10	0
11-20	0
21-30	0
31-40	5
41-50	9
51-60	6
61-70	4
71-80	5
81-90	0
91-100	0



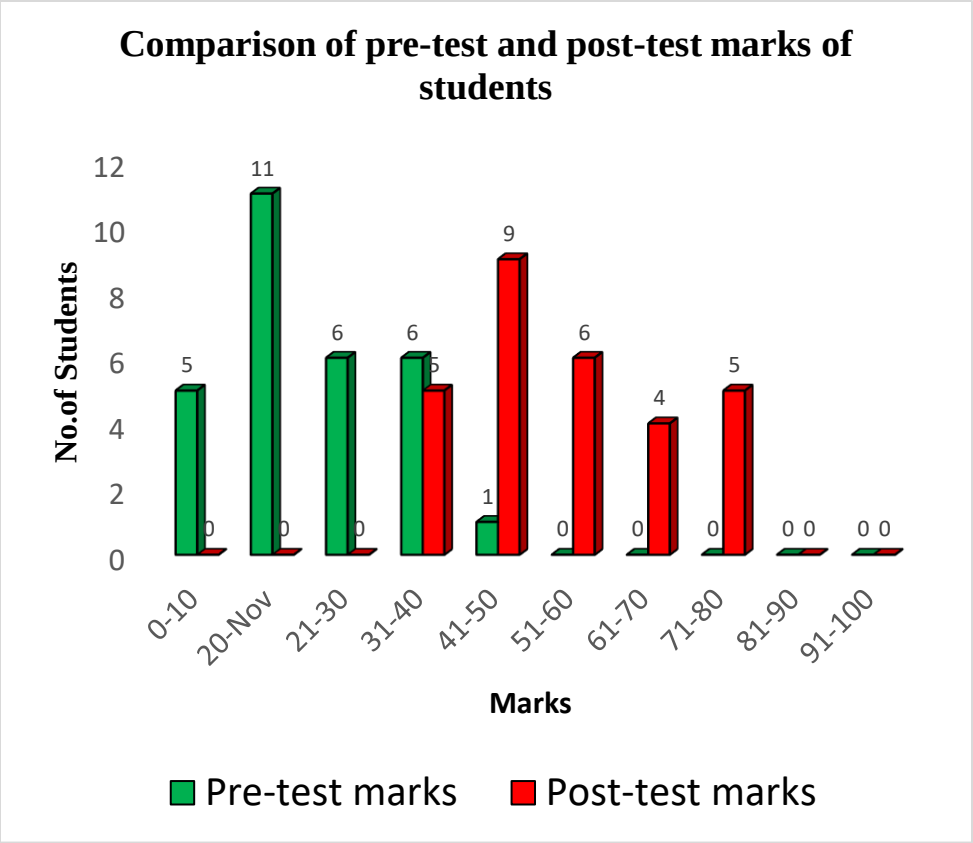
From the above observation, one could observe the fact that overall performance of the students was up to the mark.

Table – 3

Comparison of pre-test and post-test performances:

Size of the sample	**Pre test**	**Post test**

29	Mean	Median	Mode	Mean	Median	Mode
	23.10	20	20	55.51	55	50



4. FINDINGS

The students' performance in the post test was better than the pre-test. The technique of regular practices and simple activities were missing in the classrooms. The students explained the concept very well. Understanding of the concepts is improved maximum extent. A student who scored 05 marks during the pre-test was scored 35 marks in the post- test, which is a clear indication of the effectiveness of the research. The scores proved that according to their level and speed of understanding, the students had scored marks. Anyhow, the overall performance was found to be satisfactory.

5. RECOMMENDATIONS

Teaching hydrocarbons can be challenging due to the complexity of the topic. However, incorporating context-based instructions can make the learning process more effective and engaging for students. By connecting hydrocarbons to a real-world context, incorporating problem-based and inquiry-based learning and technology, teachers can enhance students' understanding and appreciation of hydrocarbons. As a result, the use of context-based instructions can be an effective strategy for teaching hydrocarbons and other complex topics in chemistry.

6. SUMMARY

The concept of hydrocarbon was not linked with students' everyday life. Although students interact with many materials in their everyday life, they never link the school science and everyday life. So, it was decided to conduct action research. To find their problems in the concept of hydrocarbon, a pre-test was conducted. After reviewing their difficulties, the researcher explained the concepts thoroughly and some activities were given to individual and also in group. Then finally a post test was conducted. The post test result exposed a better performance by the students. The average of pre-test score was 23.10 and the average of post test score was 55.51. The findings clearly showed that the students were improved academically by adopting suitable teaching methods.

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Annexure – I

Marks scored by the students in pre-test and post-test:

S.No	Name	Pre-test	Post-test
1.	D. DEVADHARSHINI	35	75
2.	V. DHARSHINI	15	50
3.	E. ENIYA	35	75
4.	M.GOKILA SRI	25	55
5.	V. INDHUMATHI	25	65
6.	K. KAVITHA	20	50
7.	S. KAVIYA	30	65
8.	D. KEERTHANA	20	60
9.	K. KEERTHANA	30	70
10.	V. MONICA VIJI	10	40
11.	S. POOJA	10	35
12.	A. PRABHAVATHY	50	80
13.	P. PREETHI	15	45
14.	A. SANTHIYA	25	55
15.	V. VASANTHI	15	40
16.	P. VISHWA	35	60
17.	D. ABINASH	20	45
18.	S. ARIKRISHNAN	10	40
19.	P. BHARANITHARAN	40	75
20.	K. CHANDRU	20	55
21.	K. GUNASEELAN	25	60
22.	K. GURUNATHAN	20	45
23.	K. KALAISELVAN	10	45

24.	**S. KISHORE**	**35**	**75**
25.	**K. PRASANNA**	**15**	**50**
26.	**S. RUBAKUMAR**	**05**	**35**
27.	**M. SATHYA NARAYANAN**	**20**	**50**
28.	**S. STEBAN RAJ**	**40**	**70**
29.	**J. THAMILARASAN**	**15**	**50**

Annexure – II

மாவட்ட ஆசிரியர் கல்வி மற்றும் பயிற்சி நிறுவனம், வடலூர்– 607 303

முன் தேர்வு/ பின் தேர்வு

பாடம் : அறிவியல் **மதிப்பெண்கள்: 20**

பெயர்: **வகுப்பு: 10**

சரியான விடையைத் தேர்ந்தெடுத்து எழுதுக.

1. ஹைட்ரோ கார்பனில் அடங்கியுள்ள தனிமங்கள்
   அ) கார்பன் மற்றும் ஹைட்ரஜன் ஆ) கார்பன் மற்றும் நைட்ரஜன்
   இ) கார்பன் மற்றும் ஆக்சிஜன் ஈ) ஆக்சிஜன் மற்றும் ஹைட்ரஜன்
2. கார்பன் எண்ணிக்கை அதிகரிக்கும் போது ஹைட்ரோ கார்பனின் கொதிநிலை ----------
   அ) அதிகரித்து பின் குறையும் ஆ) குறையும்
   இ) மாறாது ஈ) அதிகரிக்கும்
3. ஹைட்ரோ கார்பன் ஆக்சிஜனுடன் வினைபுரிந்து ---------- ஐ கொடுக்கின்றன.
   அ) கார்பன் டை ஆக்சைடு மற்றும் நீர் ஆ) கார்பன் மற்றும் நீர்
   இ)) கார்பன் மோனாக்சைடு மற்றும் நீர் ஈ)) கார்பனேட்டுகள்
4. பின்வருவனவற்றில் அழுத்தப்பட்ட இயற்கை வாயுவின் கூறு எது?
   அ) பென்டேன் ஆ) புரப்பேன்
   இ) பென்சீன் ஈ) மீத்தேன்
5. வேதியல் ரீதியாக ஹைட்ரோ கார்பன்களை கொண்ட தாதுக்களின் குழு
   அ) ஆக்சைடு குழு ஆ) கரிமக்குழு
   இ) ஹைட்ரைடு குழு ஈ) சிலிகேட் குழு
6. இரண்டு கார்பன் அணுக்கள் இரட்டை பிணைப்பால் இணைக்கப்பட்ட ஹைட்ரோ கார்பன் எவ்வாறு அழைக்கப்படுகிறது?
   அ) அல்கேன் ஆ) அல்கீன்
   இ) அல்கைன் ஈ) அயனி பிணைப்பு
7. புரப்பேன் மூலக்கூறின் வாய்ப்பாடு
   அ) CH_4 ஆ) C_4H_{10} இ) C_3H_8 ஈ) C_2H_6
8. பின்வரும் தனிமங்களில் எது அதிக எண்ணிக்கையிலான சேர்மங்களை உருவாக்குகிறது?
   அ) ஆக்சிஜன் ஆ) ஹைட்ரஜன் இ) குளோரின் ஈ) கார்பன்

9. சமையல் எரிவாயு முக்கியமாக பின்வரும் எவ்விரு வாயுக்களின் கலவையாகும்?
அ) மீத்தேன் மற்றும் ஈத்தேன் ஆ) ஈத்தேன் மற்றும் புரப்பேன்
இ) புரப்பேன் மற்றும் பியூட்டேன்ஈ) பியூட்டேன் மற்றும் பென்டேன்
10. சமையல் எரிவாயு (LPG) முக்கியமாக ……..ஐ உள்ளடக்கியது.
அ) ஈத்தீன் ஆ)ஈத்தைன்இ)புரப்பீன்ஈ)புரப்பேன்மற்றும்பியூட்டேன்
11. சாலை கட்டுமான பணிக்கு பின்வரும் தயாரிப்புகளில் எது பயன்படுத்தப்படுகிறது?
அ) சுட்ட நிலக்கரி ஆ) பிட்டுமின் இ) பாரஃபின் ஈ) நாப்தலீன்
12. பின்வரும் சேர்மங்களில் எது வாசனையை பெற்றிருக்காது?
அ) பென்சீன் ஆ) நாப்தலீன் இ) ஆந்த்ரசீன் ஈ) ஹெக்சீன்
13. பெட்ரோலியம் என்பது ---------- கலவையாகும்.
அ) ஹைட்ரோ கார்பன் ஆ)உப்புகள் இ) பாலிமர் ஈ) தனிமங்கள்
14. பின்வரும் எரிபொருளில் எது அதிக வெப்ப மதிப்பீட்டு எண்ணைக் கொண்டுள்ளது?
ஆ) மண்ணெண்ணெய் ஆ) ஹைட்ரஜன்
இ) மீத்தேன் ஈ) திரவமாக்கப்பட்ட பெட்ரோலிய வாயு
15. அல்கீன்களின் மற்றொரு பெயர்
அ) ஒலிஃபீன்கள் ஆ) பாரஃபீன்கள் இ)அசிட்டிலீன் ஈ) எத்திலீன்
16. வாசனை திரவியம் மற்றும் சாயம் தயாரித்தலில் பயன்படுவது ----------
அ) எத்தில் ஆல்கஹால் ஆ) எத்தில் அசிட்டேட்
இ) எத்தில் குளோரைடு ஈ) எத்தனோயேட்
17. அல்கேன்கள் நிறைவுற்ற ஹைட்ரோ கார்பன் என்றழைக்கப்பட காரணம்
அ) முப்பிணைப்பிணைப் பெற்றிருக்கும்
ஆ) இரட்டைப் பிணைப்பினை பெற்றிருக்கும்
இ) ஒற்றைப் பிணைப்பினை பெற்றிருக்கும்
ஈ) பிணைப்பினை பெற்றிருக்காது
18. அல்கேன்களின் பொது வாய்ப்பாடு
அ) C_nH_{2n} ஆ) C_nH_{2n+2} இ) C_nH_{2n-2}
ஈ)$C_nH_{2n}OH$
19. 5 முதல் 17 வரையிலான கார்பன் அணுக்களை கொண்ட அல்கேன்கள் ---------- நிலையில் காணப்படும்
அ) திட ஆ) திரவ இ) வாயு ஈ) பிளாஸ்மா
20. வெல்டிங் பட்டறையில் உலோகங்களை வெட்டும்போது பயன்படுத்தப்படும் டார்ச் விளக்குகள் எதனால் ஆனவை?
அ) ஈத்தைன் ஆ) ஈத்தீன் இ) ஈத்தேன் ஈ) மீத்தேன்

Researcher interacting with the students