## MONKEYS EAT PURPLE BANANAS

First letter of each word tells alkene/alkane in order

## Crude oil and hydrocarbons:

Hydrocarbons are molecules made up of hydrogen and carbon atoms ONLY

Alkanes general formula – $C_nH_{2n+2}$

Alkanes are saturated molecules because the carbon atoms are fully bonded to hydrogen atoms (single bond)

**Need to know the structure:**

- Methane
- Ethane
- Propane
- Butane

## Properties of hydrocarbons:

Viscosity **–** Thickness of fluid

Fluids with high viscosity flow slowly and vice versa

Increasing the size of the hydrocarbons makes it more viscous

Flammability – How easily hydrocarbons combust (burns)

Increasing the size of the hydrocarbons makes it less flammable

Short chain hydrocarbons have low boiling points

Increasing the size of the hydrocarbon increases the boiling point

Double bond makes alkenes more reactive

**Why some hydrocarbons not used as fuel:**

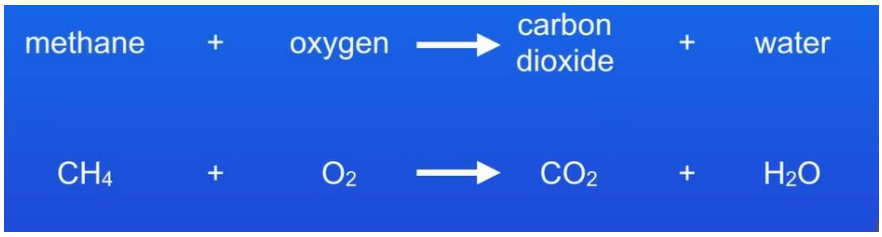
- Too viscous
- Not flammable

## Combustion of hydrocarbons:

Hydrocarbon fuels release energy when they combust

When they combust the carbon and hydrogen atoms in the fuel react with oxygen (oxidation)

Complete combustion – When oxygen is unlimited, carbon dioxide and water is produced




**Complete combustion:**

Alkane/alkene + oxygen => Carbon dioxide + Water

**Incomplete combustion:**

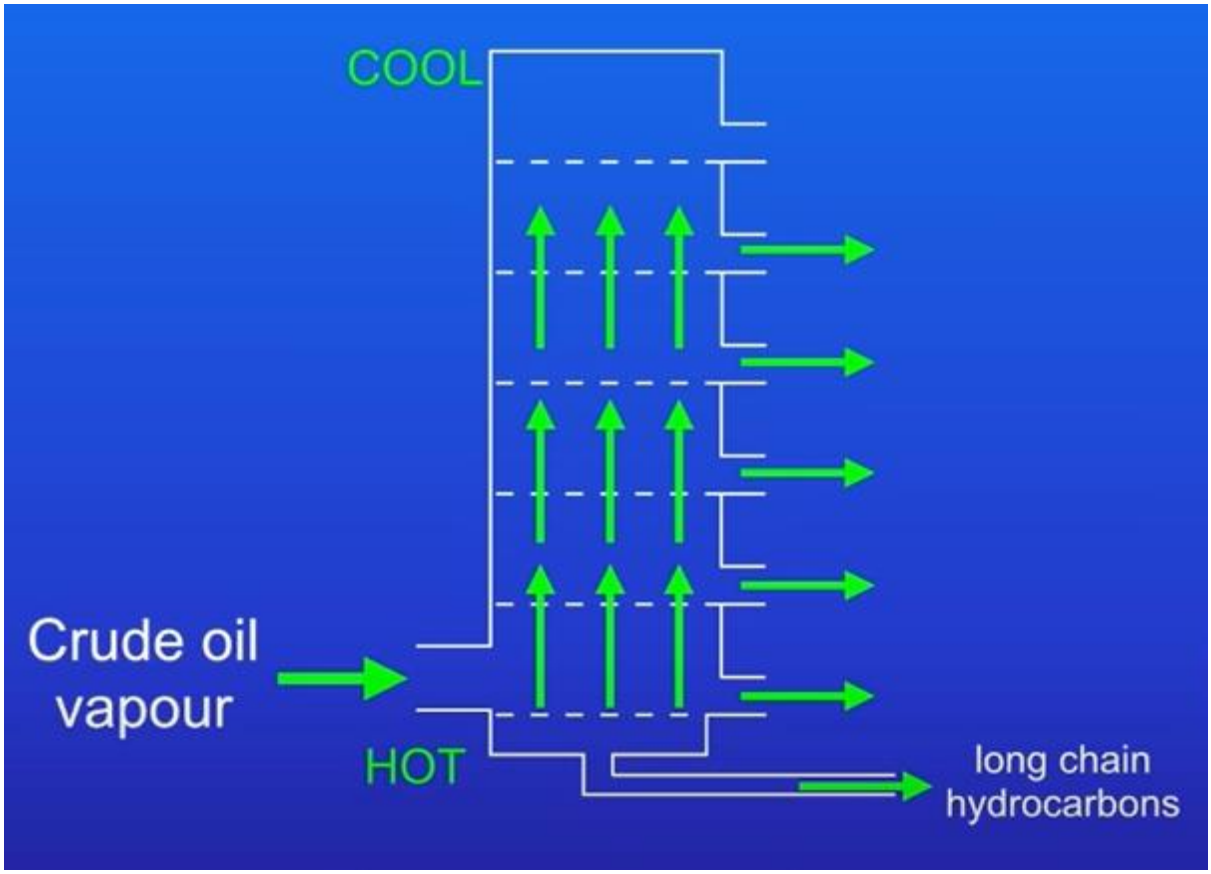
Alkane/alkene + oxygen => Carbon monoxide + Carbon + Water

Alkenes are more likely to undergo incomplete combustion because of the double bond

When an alkene undergoes incomplete combustion, unburnt carbon particles are produced.

Alkenes burn in air with a smoky flame

## Fractional distillation:




1. Crude oil is heated to a high temperature which causes the crude oil to boil
2. Crude oil vapour is fed into the fractional distillation column
3. Hydrocarbons condense when they reach their boiling point
4. The liquid fractions are then removed

5. Remaining hydrocarbons move up the column and then condense
- Long chain hydrocarbons are removed from the bottom because they have very high boiling points
- Short chain hydrocarbons are removed from the top as gases

**Key:**

1. Crude oil heated
2. Evaporates
3. Condenses at different boiling points

In fractional distillation of crude oil, the fractions contain hydrocarbons with similar number of carbon atoms

Some fractions are used to make feedstock which means chemicals which make other chemicals

Crude oil furnace temperature = 400-500$^{o}$C

**<u>Cracking:</u>**

Long chain hydrocarbons are not good fuels because they not very flammable and they are too viscous

There is a high demand for short chain hydrocarbons to be used as fuels because they are more useful

Cracking – Long chain alkanes are broken down to produce smaller more useful molecules

**Two ways of cracking:**

- Catalytic cracking – Involves the usage of high temperatures and a catalyst
- Steam cracking – Involves the usage of high temperatures and steam

Some crude oils are better than others for cracking because they have a higher percentage of larger molecules

**Why larger hydrocarbon molecules are cracked:**

- Greater demand for smaller hydrocarbon molecules
- Because more useful

Alkenes have a double bond between the carbons

**Alkenes are very useful:**

- Used to make polymers
- Used as starting materials for other chemicals
- Used to test for alkenes because it is more reactive than alkanes

**Test for alkenes:**

1. Add bromine water to the alkene
2. Shake the alkene with the bromine water
3. Bromine water turns from orange to colourless

- Alkanes does not decolourise water
- Alkenes decolourise water

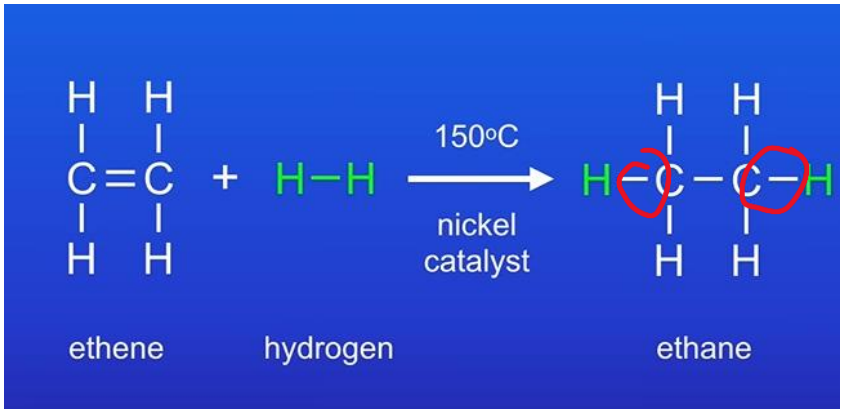
## Alkenes:

General formula – $C_nH_{2n}$

Alkenes are unsaturated because they have two fewer hydrogen atoms than the alkane with the same number of carbon atoms (double bond)

## Reactions of alkenes:

Reacting an alkene with hydrogen, produces an alkane: (hydrogenation)

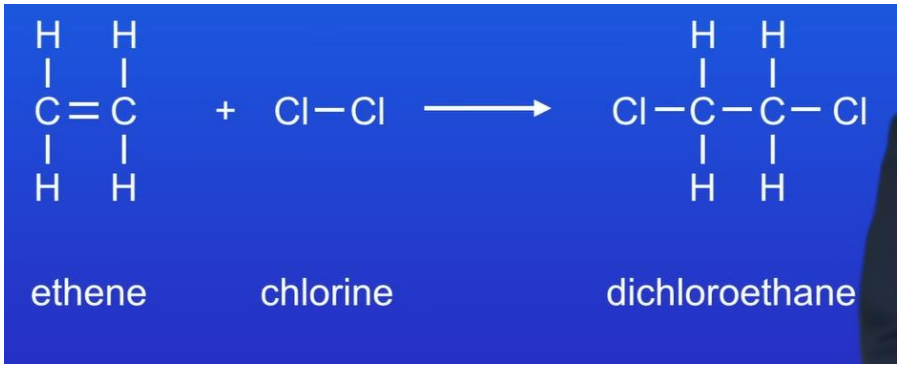



Must need temp about 150°C and a catalyst

**Reaction of alkenes with water: (hydration)**

- Water must be in the form of steam
- Must be around 300°C
- Must be around 70 atm
- We use phosphoric acid as a catalyst
- Increase the yield of alkene we pass it back through the catalyst

Reaction with halogens – Halogen adds across the double bond turning it into an alkane



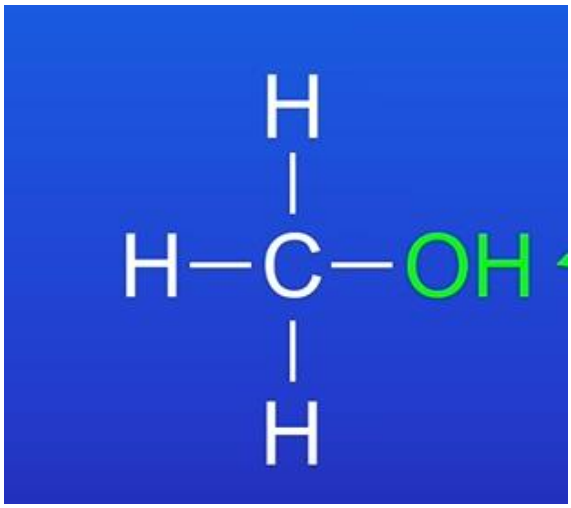

Alkene + Halogen => Di<halogen>o<alkane>

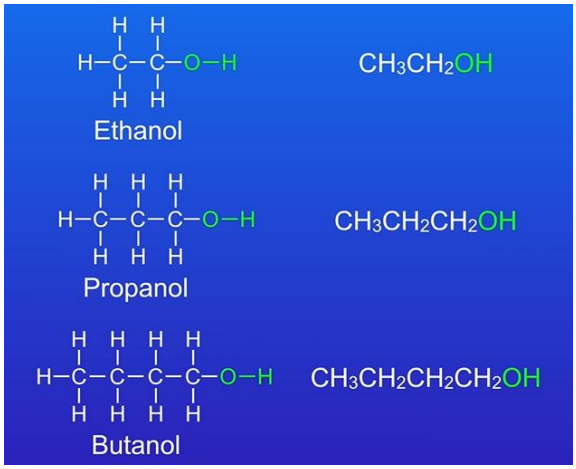
**<u>Alcohols:</u>**

**Uses of alcohols:**

- Fuels
- Solvents
- Alcoholic drinks
- Disinfectant and antiseptic

Alcohols functional group - OH



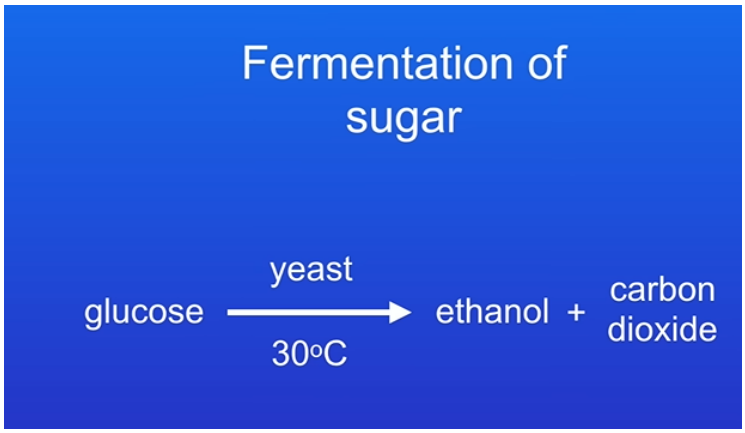

$C_nH_{2n+1}OH$

**Structure of alcohols:**

- Methanol = $CH_3OH$
- Ethanol = $CH_3CH_2OH$
- Keep adding one carbon so then you add two hydrogens and then add alcohol functional group

An advantage of making ethanol by hydration is that it produces a high yield of ethanol

A disadvantage is that it requires a lot of energy for a high temperature and the ethene comes from crude oil which is non-renewable




Must take place without oxygen

Advantages:

- Doesn't require a lot of energy because of the low temperature
- Sugar comes from plants which is renewable

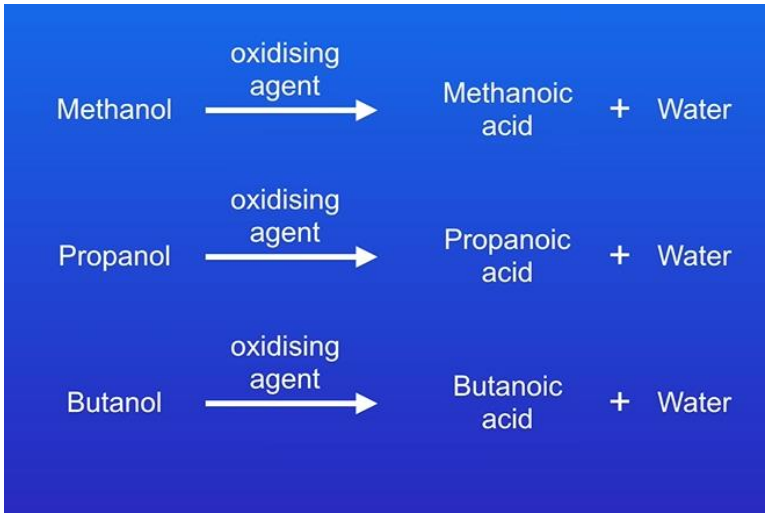
Disadvantage:

- Product is aqueous solution of ethanol (ethanol dissolved in water)
- Purification is required on the aqueous solution which requires energy

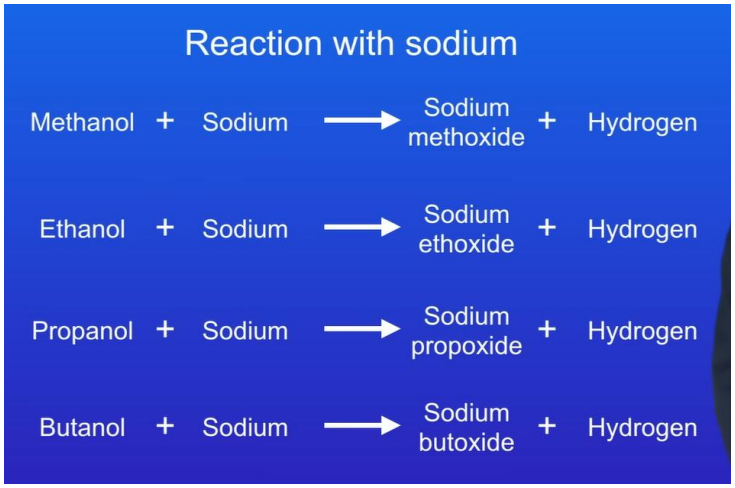
## **Reactions of alcohols:**

Alcohols are soluble in water and form neutral solutions

As the number of carbon atoms increases, the solubility increases




Alcohol + oxidising agent => Carboxylic acid + Water



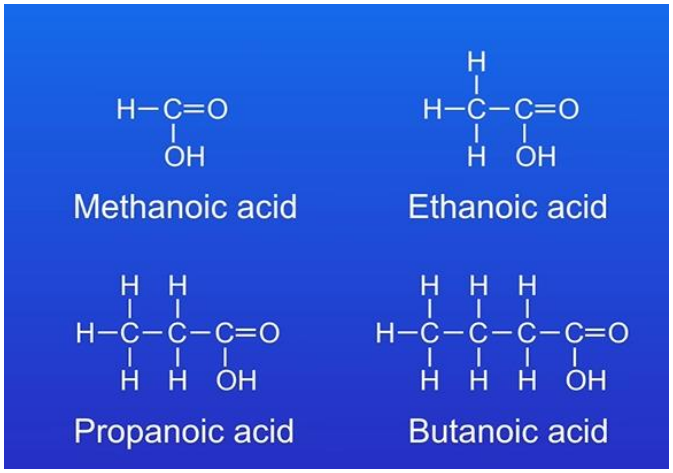

Alcohol + Sodium => Sodium <alcohol(oxide)> + hydrogen

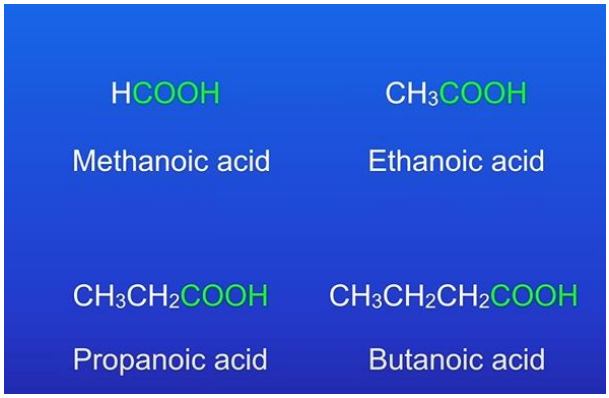
Combusting alcohols – Alcohol + Oxygen => Carbon dioxide + Water

Combusting alcohols releases energy

Combusting alcohols in air, produces carbon dioxide and water

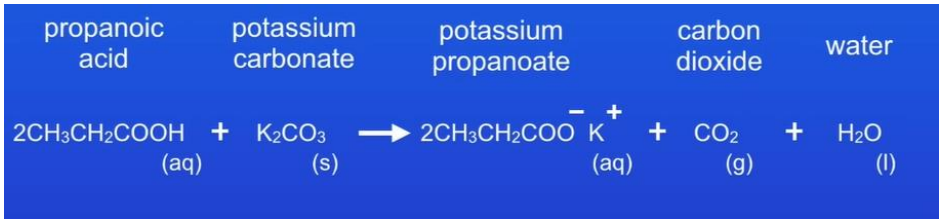
# Carboxylic acids:



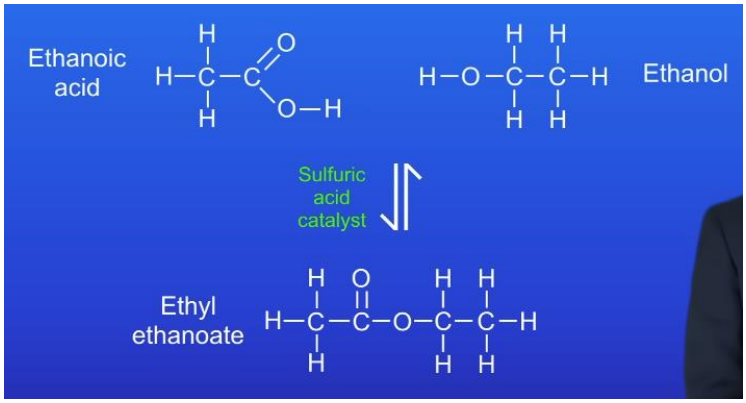




In water, carboxylic acids are weak because they partially ionise

Carboxylic acid + metal carbonate => Salt + Carbon dioxide + Water




Carboxylic acid + Alcohol => Ester + Water




Ester name = Alcohol carboxylic acid

Requires sulfuric acid as a catalyst

Metal + Carboxylic acid => Salt + hydrogen

Esters smell nice

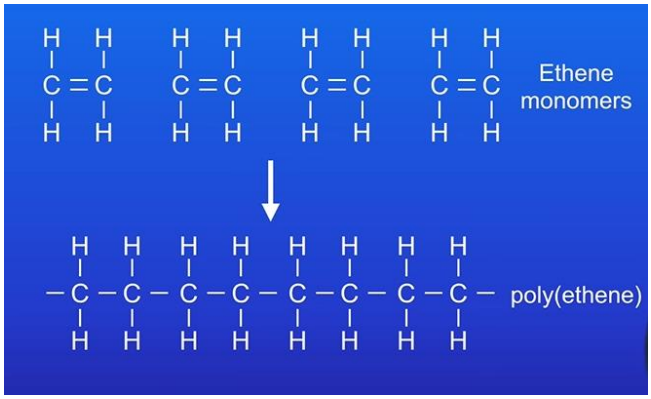
## Addition polymers:

Polymers are made of thousands of monomers

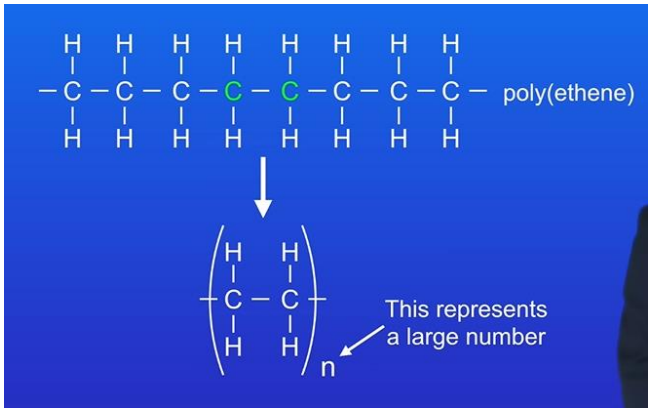
**Alkenes can only polymerise**

### Addition polymers:

- Monomers are alkenes
- Monomer has double bond but then polymer has single bond
- Name of polymer is poly(<alkene>)



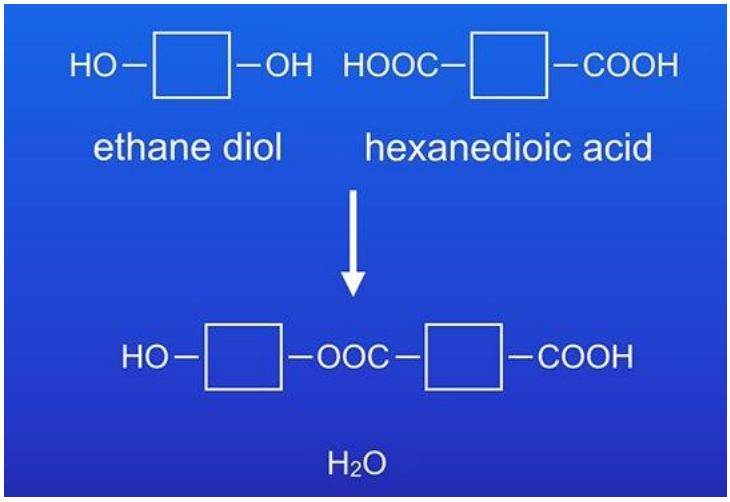

**Repeating unit:**



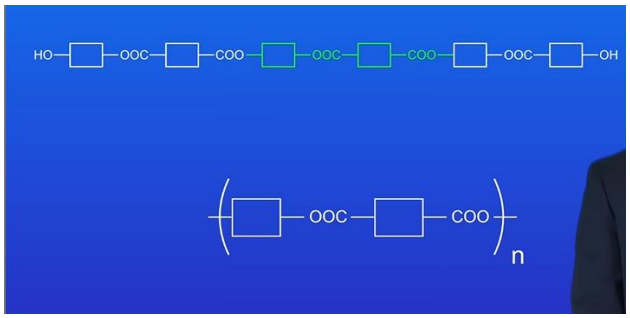

## <u>Condensation polymers:</u>

## Condensation polymers:

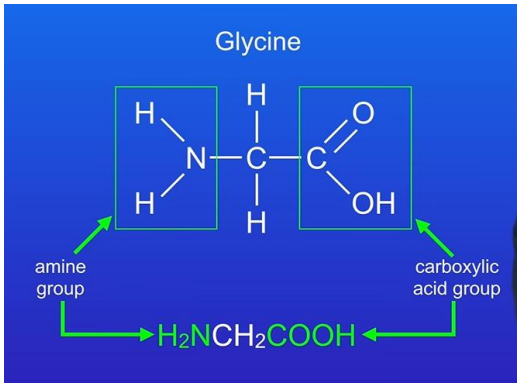
- Made from monomers
- Monomers are **not** alkenes
- When the monomers react, small molecules such as water is lost
- Start with two different monomers
- Each monomer has two of the same functional groups




The boxes are to show the repeating monomers



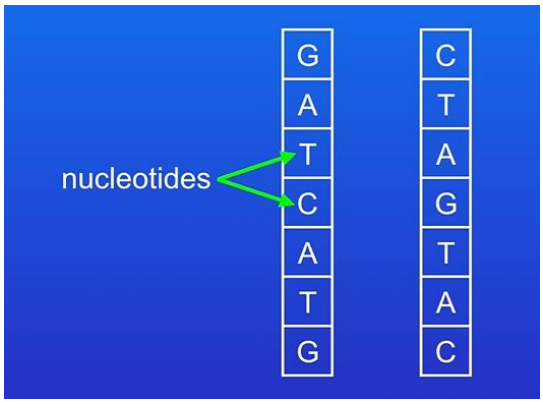

## **Amino acids:**




Combining different amino acids into the same chain would be called a protein

## DNA:

DNA consists of two polymer chains made from monomers called nucleotides




Different nucleotide monomers include **GATC**

Two monomers wrap around together forming a **double helix**