Alkanes

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Formulas & Theorems Covered Today:
- CnH2n+2- general formula

Hydrocarbons- group of organic compounds containing several homologous series.
- Aliphatic hydrocarbons- straight and branched chain molecules
- Alicyclics- hydrocarbons with closed rings
- Arenes- based on benzene, with rings of carbon atoms stabilised by delocalised electrons

All hydrocarbons are:
- Insoluble in water
- They all burn, and in sufficient O2, give CO2 AND H2O as the only products
- Usable hydrocarbons- fossil fuels- coal, petroleum and natural gas which yield pure hydrocarbons after processing

Aliphatic- belong to alkenes, alkanes or alkynes

General properties:
- Saturated hydrocarbons
- Single bonds only
- CnH2n+2- general formula
- Occur as both straight or branched chain molecules

- Alkanes= fossil fuels
- Over time, as decomposing plants and animals are exposed to high pressure and heat, crude oil or petroleum is formed with another product, natural gas which is made in a similar process
- Natural gas is largely methane
- Fossilised land plants form coal

Crude oil:
- Primary distillation- process of turning dark, thick, smelly but very valuable crude oil into useful chemicals with a variety of properties
- Primary distillation is an industrial version of the distillation you can carry out in the lab
- Petroleum is boiled and the vapours are cooled and liquefied at particular temperatures
- Fraction- liquid collected over a range of temperatures

- Lighter fractions are in demand whereas heavier are not
- Scientists crack heavy fractions to make them lighter fractions

- Heating long chain alkanes to high temperatures causes them to split to form shorter chains
- Some will be alkanes and some will be alkenes, particularly ethene
- Carried out in cat cracking used catalysts that lower temperatures can be used to reduce cost

5 main fractions formed when crude oil is distilled:

1. 1-2% refinery gas-
   - the lightest fraction
   - Lowest boiling point
   - Gaseous alkanes, 1-4 carbon atoms in chain
   - Large proportion of methane
   - Used mainly as a fuel
   - Used as starting point for other organic syntheses
2. 15-30% gasoline-
   - Mixture of liquid hydrocarbons, C5-C10
   - Used as fuel for internal combustion engines in cars
   - Mixture of straight and branched chain alkanes
   - More branched there are, more useful fuel
3. 10-15% kerosene-
   - Mainly C11 and C12
   - Fuel for aircraft engines
   - Can be cracked to produce gasoline and other useful chemicals
4. 15-20% diesel oil/gas oil-
   - Fuel for industrial boilers
   - Diesel engines in cars
   - Diesel oil can be split further in a catalytic cracker to yield other useful fractions
5. 40-50% residue-
   - Very viscous
   - High boiling temperature
   - Fuel for furnaces of power stations or large ships
   - Further fractioned into lubricating oils and waxes and also bitumen (tar in roads)
   - Has to be processed in a vacuum to avoid high temperatures which could crack the components

Bond fission- breaking bonds
- When bonds are broken in a covalent bond, the shared electrons can be shared out in two ways:

1. Homolytic fission:
   - equal sharing out of electrons in the bond
   - so each participant gets one electron when the bond is broken
   - The unpaired electron gained is represented by a dot
   - Becomes extremely reactive because the unpaired electron has a tendency to want to pair up with another substance
   - Equal sharing usually occurs when there is little or no ionic character in the covalent bond

2. Heterolytic fission:
   - Unequal sharing of the electrons in the covalent bond
   - Both electrons go to one atom
   - Two charged particles are made
   - Usually seen when the covalent bond has some degree of polarity