

WJEC (Wales) Chemistry GCSE

2.5 - Crude Oil, Fuels and Organic Chemistry

Flashcards

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What is crude oil?



What is crude oil?

- A finite resource found in rocks, formed over millions of years from the remains of simple marine organisms
- It contains a complex mixture of hydrocarbons



What are the processes in the fractional distillation of crude oil?



What are the processes in the fractional distillation of crude oil?

- The crude mixture is put into the fractionating column at the bottom and heated
- The hydrocarbons evaporate and rise up the column
- As the hydrocarbons rise, they eventually reach a fraction which is cool enough for them to condense back into a liquid
- The mixture left at the bottom, which does not evaporate at all, is called bitumen



What are fractions in fractional distillation?



What are fractions in fractional distillation?

- Fractions contain mixtures of hydrocarbons (alkanes) with similar boiling points



What are the trends in properties of fractions with increasing chain length?



What are the trends in properties of fractions with increasing chain length?

- Boiling and melting point increases
- Viscosity increases
- Flammability increases
- Volatility increases
- Their colour darkens
- Their usefulness as fuels decreases



What is the economic importance of the oil industry?



What is the economic importance of the oil industry?

- Oil companies set the price of oil so there is an influence globally on the economy - it can be hard for poorer countries to buy oil
- Wars or internal crisis within a country that produces oil can affect the flow of oil to other countries which they sell to



What is the political importance of the oil industry?



What is the political importance of the oil industry?

- Countries that are large producers of oil can essentially cut off oil supplies to other countries
- This is used as a political tool



What is the social impact of the oil industry?



What is the social impact of the oil industry?

- The oil industry supplies jobs and money to the economy



What are the environmental impacts of the oil industry?



What are the environmental impacts of the oil industry?

- Burning fossil fuels releases large amounts of carbon dioxide, a greenhouse gas, into the atmosphere, contributing to global warming and climate change
- The building of power stations and the process of drilling for oil causes damage to the landscape and loss of habitats
- Oil spillages into the ocean result in the deaths of marine life and birds and are often dealt with by setting them alight



What are the combustion reactions of hydrocarbons?



What are the combustion reactions of hydrocarbons?

- When hydrocarbons burn in plenty of oxygen it will combust as follows: hydrocarbon + oxygen \rightarrow carbon dioxide + water
- When hydrocarbons burn with insufficient oxygen it will combust as follows: hydrocarbon + oxygen \rightarrow carbon monoxide + water



What is calorimetry?



What is calorimetry?

- An experimental technique used to work out the energy released when burning a fuel



What is the method of calorimetry?



What is the method of calorimetry?

- A known volume of water is added to a calorimeter and the temperature is recorded
- A known mass of fuel is burnt beneath the calorimeter
- The maximum temperature of the water and the final mass of the fuel is recorded
- Energy released (Joules) = mass of water (g) x temp change x 4.2
- Energy per gram of fuel = energy released (J) / mass of fuel burned (g)



What is the combustion reaction of hydrogen and what are its uses?



What is the combustion reaction of hydrogen and what are its uses?

- Hydrogen burns in oxygen and forms water
- Hydrogen is used as fuel in rockets and some cars



What are the advantages of using hydrogen as a fuel?



What are the advantages of using hydrogen as a fuel?

- No greenhouse gases are produced in the combustion of hydrogen
- An alternative fuel option as current fuels are running out



What are the disadvantages of using hydrogen as a fuel?



What are the disadvantages of using hydrogen as a fuel?

- Hydrogen is extremely flammable
- Most of hydrogen produced comes from fossil fuels or electrolysis so it still has a negative impact on the environment
- Hard to store and transport - must be cooled to very low temperatures so it liquifies for storage and transport



What is the fire triangle?



What is the fire triangle?

- A symbol that contains 3 things needed for a fire to burn: oxygen, fuel and heat
- Removing any of these will cause the fire to stop burning, so knowledge of the fire triangle can be used to prevent and put out fires



What is hydrocarbon cracking?



What is hydrocarbon cracking?

- Breaking long chain hydrocarbons down into shorter and more useful chains



What are the products of hydrocarbon cracking?



What are the products of hydrocarbon cracking?

- Alkanes and unsaturated hydrocarbons called alkenes
- Alkenes are monomers that are used to make plastics



What is the general formula of alkanes?



What is the general formula of alkanes?

- $C_n H_{2n + 2}$ where n is the number of carbon atoms in the molecule



What is the general formula of alkenes?



What is the general formula of alkenes?

- $C_n H_{2n}$ where n is the number of carbon atoms in the molecule



What are some examples of simple alkanes? List down their names, molecular and structural formulas.



What are some examples of simple alkenes? List down their names, molecular and structural formulas.

- Methane, CH_4 , CH_4
- Ethane, C_2H_6 , CH_3CH_3
- Propane, C_3H_8 , $\text{CH}_3\text{CH}_2\text{CH}_3$
- Butane, C_4H_{10} , $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$



What are some examples of simple alkenes? List down their names, molecular and structural formulas.



What are some examples of simple alkenes? List down their names, molecular and structural formulas.

- Ethene, C_2H_4 , $CH_2=CH_2$
- Propene, C_3H_6 , $CH_2=CHCH_3$
- Butene, C_4H_8 , $CH_2=CHCH_2CH_3$



What is isomerism?



What is isomerism?

- When two compounds have the same molecular formula (same number and type of each atom) but their structures differ in some way



What is isomerism in alkanes?



What is isomerism in alkanes?

- The main carbon chain length differs but the molecule still has the same number of carbon atoms



What is isomerism in alkenes?



What is isomerism in alkenes?

- The position of the double bond in the molecules can differ but the molecular structure stays the same



How do you name complex alkanes and alkenes?



How do you name complex alkanes and alkenes?

- Locate the longest continuous linear chain of carbon atoms
- Number the carbon atoms from the end closest to a functional group or branch point
- Alphabetically list the functional groups attached to the carbon chain and state the carbon number the group is attached to
- For double bonds, count the position of the double bond by counting bonds not carbon atoms



What are addition reactions?



What are addition reactions?

- Reactions in which two or more molecules combine to form a larger one with no other products



What is the test for alkenes?



What is the test for alkenes?

- Bromine water is an orange solution and when shaken with an alkene the bromine water will decolourise as the bromine reacts with the alkene to form substituted alkanes - this is an addition reaction



What is addition polymerisation?



What is addition polymerisation?

- Alkenes can be used to make polymers
- Polymers are large molecules made up of repeating units called monomers
- Alkenes can be polymerised because they have double bonds that open up to connect to other alkene monomers in a chain
- E.g. polyethene is formed from ethene monomers



What are the uses of polyethene?



What are the uses of polyethene?

- Bin liners
- Plastic bottles
- Hoses and tubes
- Plastic bags



What are the uses of poly(propene)?



What are the uses of poly(propene)?

- Plastic for cars
- Packaging
- Textiles



What are the uses of polyvinyl chloride (PVC)?



What are the uses of polyvinyl chloride (PVC)?

- Water pipes
- Electrical wires
- Window panes
- Medical tubing and IV bags



What are the uses of
poly(tetrafluoroethene) (PTFE)?



What are the uses of poly(tetrafluoroethene) (PTFE)?

- Coating non-stick pans
- Nail polishes
- Coating hair straighteners and curlers



What are the general properties of polymers?



What are the general properties of polymers?

- Thermosoftening polymers melt when heated and can be remoulded and reshaped
- Thermosetting polymers do not melt when heated
- High-density polymers tend to be harder and stronger than low-density polymers



What are the environmental issues relating to the disposal of plastics?



What are the environmental issues relating to the disposal of plastics?

- Plastics are non-biodegradable
- Increasing pressure on landfill sites for waste disposal



What are the methods for disposing plastics?



What are the methods for disposing plastics?

- Landfill sites
- Incineration disposal - however this releases carbon dioxide, a greenhouse gas
- Recycling - this manages the other issues of disposal, provides jobs and helps preserve the non-renewable source of crude oil



How is ethanol produced?



How is ethanol produced?

- The fermentation of sugar using yeast - the enzymes in yeast catalyse the reaction
- Glucose \rightarrow Ethanol + Carbon Dioxide



What is the test for alcohol?



What is the test for alcohol?

- Add a few drops of sulfuric acid and potassium dichromate solution to the sample
- Gently heat
- If alcohol is present the solution will change from orange to green



What are the uses of ethanol?



What are the uses of ethanol?

- Found in alcoholic drinks
- As a solvent - it dissolves a large number of substances easily
- As a fuel



What are the social impacts of alcoholic drinks?



What are the social impacts of alcoholic drinks?

- Bad for health and causes a number of illnesses including liver diseases, cancers and cardiovascular problems
- Can increase the number of violent fights and other crimes



What are the economic impacts of alcoholic drinks?



What are the economic impacts of alcoholic drinks?

- Taxation of alcoholic drinks and alcohol export out of the UK bring money to the economy
- The alcohol industry provides jobs
- Costs the economy due to healthcare and police costs from alcohol-related issues



What are the advantages of using ethanol as a fuel?



What are the advantages of using ethanol as a fuel?

- Carbon neutral fuel - no net addition of carbon dioxide into the atmosphere
- Good fuel alternative for countries without their own crude oil supply
- Renewable source - made from sugar cane



What are the disadvantages of using bioethanol as a fuel?



What are the disadvantages of using bioethanol as a fuel?

- Energy is needed in growing sugar canes, distillation and transportation of ethanol which will require the burning of fossil fuels so it will still cause global warming
- Engines must be altered before they can use bioethanol as a fuel
- Can cause deforestation to provide land for growing sugar cane
- Some areas of the world are not hot enough and don't have enough light hours in the day to be able to completely switch to biofuel
- Using food as fuel can increase food prices



How do you name alcohols?



How do you name alcohols?

- The suffix -ol which is preceded by the number of the carbon the hydroxyl (OH) functional group is attached to
- If there are multiple alcohol functional groups the suffix becomes -diol, -triol, -tetrol



What are potential isomers of alcohols?



What are potential isomers of alcohols?

- Isomers are compounds which have the same molecular formula but different structural formula.
- This means that isomers of alcohols have the same molecular formula but the -OH alcohol group is positioned at a different carbon atom thus giving the compound a different structural formula



What is the microbial oxidation of ethanol?



What is the microbial oxidation of ethanol?

- When ethanol is oxidised it forms ethanoic acid, a carboxylic acid which has the functional group -COOH
- This oxidation can be carried out by microbes
- Other alcohols can undergo microbial oxidation to form carboxylic acids
- An oxygen atom is gained and hydrogen atoms are reduced



What is infrared spectroscopy?



What is infrared spectroscopy?

- An experimental technique that can be used to work out the structure of a compound or molecule
- When infrared light is shone at a compound, its bonds absorb some of the infrared light
- Different bonds absorb at different frequencies of infrared light
- An infrared spectrum, which contains peaks corresponding to different bond types, is produced
- By identifying different peaks, functional groups in the compound can be identified

