Edexcel Chemistry GCSE

Topic 8 - Fuels and Earth Science

Flashcards

What are hydrocarbons?

What are hydrocarbons?

Compounds that contain hydrogen and carbon atoms only.

What is crude oil?

What is crude oil?

- A complex mixture of hydrocarbons.
- Contains molecules with rings or chains of carbon atoms.
- An important source of useful substances like fuels and feedstocks for the petrochemical industry.
- A finite resource.

Where can crude oil be found?

Where can crude oil be found?

Under the sea and ground.

What does it mean when crude oil is described as ‘finite’?

What does it mean when crude oil is described as ‘finite’?

It will to run out.

How can crude oil be separated?

How can crude oil be separated?

Fractional distillation.

How does the process of fractional distillation work to separate crude oil?

How does the process of fractional distillation work to separate crude oil?

- Crude oil is vaporised before it enters a fractionating column.
- The fractionating column is hotter at the bottom than at the top. The vapours rise up and condense at different fractions depending on their boiling points.
- Hydrocarbons with low boiling points will be tapped off the top of the column and hydrocarbons with high boiling points will be tapped off the bottom of the column.

Why is crude oil separated?

Why is crude oil separated?

Unseparated crude oil isn't very useful but the separated products (such as petrol) are very useful.

Refinery gas is a fraction of crude oil. What are its common uses?

Refinery gas is a fraction of crude oil. What are its common uses?

Heating and cooking.

Which fraction of crude oil is used as fuel in cars?

Which fraction of crude oil is used as fuel in cars?

Petrol (gasoline).

Diesel is also less commonly used.

Kerosene is a fraction of crude oil. What is a common use of kerosene?

Kerosene is a fraction of crude oil. What is a common use of kerosene?

Aircraft fuel

Diesel oil is fraction of crude oil. What is it commonly used for?

Diesel oil is a fraction crude oil. What is it commonly used for?

Fuel for some cars and trains.

Which fraction of crude oil is used for road surfacing and roofs?

Which fraction of crude oil is used for road surfacing and roofs?

Bitumen

Fuel oil is a fraction of crude oil. What is it commonly used for?

Fuel oil is a fraction of crude oil. What is it commonly used for?

Fuel for large ships and in some power stations.

How do the hydrocarbons at each faction differ?

How do the hydrocarbons at each faction differ?

- Boiling points.
- Ease of ignition.
- Viscosity.
- The number of hydrogen and carbon atoms their molecules have.

Where in the fractionating column do hydrocarbons with the highest viscosity condense?

Where in the fractionating column do hydrocarbons with the highest viscosity condense?

Viscosity is how thick and sticky a substance is.

The hydrocarbons with the highest viscosity (like bitumen) are collected at the bottom of the fractionating column.

What are the properties of hydrocarbons that are tapped from the top of the fractionating column, like petrol and refinery gas?

What are the properties of hydrocarbons that are tapped from the top of the fractionating column, like petrol and refinery gas?

- Low boiling point.
- Highly volatile.
- Easily ignited.
- Shorter carbon chains (small molecules).

What is a homologous series?

What is a homologous series?

Series of compounds which:

- Have the same general formula.
- Have similar chemical properties.
- Differ by CH_2 in molecular formula form neighbouring molecules.
- Slight variation in physical properties.

Products from crude oil mostly belong to which homologous series?

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Alkane homologous series.

What are the only products when a hydrocarbon fuel undergoes complete combustion?

What are the only products when a hydrocarbon fuel undergoes complete combustion?

Water (H_2O) and carbon dioxide (CO_2).

True or false?
Energy is given out when a fuel undergoes complete combustion

True or false? Energy is given out when a fuel undergoes complete combustion

TRUE

The reaction is exothermic.

Write a balanced symbol equation for the complete combustion of ethane

Write a balanced symbol equation for the complete combustion of ethane

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

When does incomplete combustion occur? What is required to ensure complete combustion occurs?

When does incomplete combustion occur? What is required to ensure complete combustion occurs?

Incomplete combustion occurs when there is an insufficient supply of oxygen.

To ensure complete combustion occurs, the reaction should be carried out with excess oxygen.

What are the products of incomplete combustion?

What are the products of incomplete combustion?

Carbon particulates - soot (C).

Carbon monoxide (CO).

Water (H_2O).

Write a balanced symbol equation for the incomplete combustion of methane to form carbon monoxide

Write a balanced symbol equation for the incomplete combustion of methane to form carbon monoxide

$$2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$$

Write a balanced symbol equation for the incomplete combustion of methane to form carbon particulates

Write a balanced symbol equation for the incomplete combustion of methane to form carbon particulates

$$CH_4 + O_2 \rightarrow C + 2H_2O$$

What are the problems with carbon monoxide?

What are the problems with carbon monoxide?

Carbon monoxide is a toxic gas.

It is colourless and odourless and if breathed in can cause death by preventing the red blood cells from carrying oxygen around the body.

What are the problems with incomplete combustion?

What are the problems with incomplete combustion?

- Produces carbon monoxide which is toxic and can be fatal if breathed in.
- Produces carbon particulates (soot) which cause global dimming and respiratory problems.

Why is sulfur dioxide sometimes produced when burning hydrocarbon fuels?

Why is sulfur dioxide sometimes produced when burning hydrocarbon fuels?

Some hydrocarbon fuels contain sulfur impurities. When the fuel is burned, the sulfur reacts with oxygen to form sulfur dioxide.

How is acid rain produced?

How is acid rain produced?

Sulfur dioxide (produced when combusting impure hydrocarbon fuels) evaporates into the air. It reacts with water in the clouds to form sulfuric acid. This is ‘acid rain’.

What problems can acid rain cause?

What problems can acid rain cause?

- Corrodes buildings and statues made of limestone.
- Kills/damages the vegetation.
- Lowers the pH of large bodies of water, killing the wildlife.

How are oxides of nitrogen produced from car engines?

How are oxides of nitrogen produced from car engines?

The high temperature and pressure of a car engine causes nitrogen and oxygen from the air to react together.

What problems are associated with oxides of nitrogen?

What problems are associated with oxides of nitrogen?

- Pollutants.
- Produce acid rain with similar effects as SO_2.
- Cause respiratory problems.

What are the advantages of using hydrogen as a fuel in cars?

What are the advantages of using hydrogen as a fuel in cars?

- It releases more energy per kg compared to most other fuels.
- Water is the only product so no pollutants.
- Renewable source as hydrogen can be extracted from water.

What are the disadvantages of using hydrogen as a fuel in cars?

What are the disadvantages of using hydrogen as a fuel in cars?

- It is expensive to produce and a lot of energy is required for the electrolysis of water to acquire the hydrogen.
- Difficult and dangerous to store hydrogen because it is very volatile and easily ignites.

Name the non-renewable fossil fuel found in natural gas

Name the non-renewable fossil fuel found in natural gas

Methane

Are petrol, kerosene and diesel renewable fuels?

Are petrol, kerosene and diesel renewable fuels?

No, they are non-renewable.

They are finite resources which are not being readily replaced.

What is cracking?

What is cracking?

Breaking down large hydrocarbons into smaller more useful ones.

Saturated alkanes are cracked into shorter chain alkanes and short chain unsaturated alkenes.

What do the terms saturated and unsaturated mean?

What do the terms saturated and unsaturated mean?

Saturated - only contains single bonds.

Unsaturated - contains some C=C double bonds.

What type of reaction is cracking?

What type of reaction is cracking?

Thermal decomposition.

Why is cracking necessary?

Why is cracking necessary?

The demand for shorter chain alkenes and alkanes is much greater than the demand for long chain alkanes.

What produced the gases that formed Earth's early atmosphere?

What produced the gases that formed Earth's early atmosphere?

Volcanic activity

Describe how Earth's early atmosphere formed

Describe how Earth's early atmosphere formed

- Initially, the Earth's surface was molten with no atmosphere.
- Cooling caused land masses to solidify.
- Volcanoes formed on the land masses and released gases which formed the early atmosphere.

What was the Earth's early atmosphere thought to contain?

What was the Earth's early atmosphere thought to contain?

- Little or no oxygen.
- Large amount of carbon dioxide.
- Water vapour.
- Small amounts of other gases.

How did oceans initially form?

How did oceans initially form?

Condensation of water vapour.

How did the amount of carbon dioxide in the atmosphere decrease after oceans formed?

How did the amount of carbon dioxide in the atmosphere decrease after oceans formed?

Carbon dioxide dissolved into the oceans so the amount of carbon dioxide in the atmosphere decreased.

How did the amount of oxygen in the early Earth's atmosphere increase?

How did the amount of oxygen in the early Earth's atmosphere increase?

The growth of early plants used carbon dioxide for photosynthesis and released oxygen. This increased the amount of oxygen and decreased the amount of carbon dioxide in the atmosphere.

What is the chemical test for oxygen?

What is the chemical test for oxygen?

Insert a glowing splint into a test tube of gas. If oxygen is present, the splint will ignite.

What are greenhouse gases?

What are greenhouse gases?

Various gases in the atmosphere (such as carbon dioxide, methane and water vapour) that absorb the heat radiated from Earth.

What is the greenhouse effect?

What is the greenhouse effect?

- Electromagnetic radiation from the sun passes through the Earth's atmosphere.
- The Earth absorbs some radiation and warms up.
- Heat is radiated from the Earth as infrared radiation.
- Some of the infrared radiation is absorbed by greenhouse gases in the atmosphere which warms the atmosphere.

How has human activity increased atmospheric carbon dioxide concentration?

How has human activity increased atmospheric carbon dioxide concentration?

- Burning fossil fuels for energy releases carbon dioxide.
- Deforestation reduces the amount of photosynthesis occurring so less carbon dioxide is converted to oxygen.

Evaluate the evidence that human activity is causing climate change

Evaluate the evidence that human activity is causing climate change

- There is a correlation between carbon dioxide concentration in the atmosphere, fossil fuel consumption and temperature change.
- Correlation doesn't mean causation.
- There may be uncertainties in the data (e.g. location of the measurements and historical accuracy).

What is the current composition of Earth's atmosphere?

What is the current composition of Earth's atmosphere?

Nitrogen - 78%

Oxygen - 21%

Argon - 0.93%

Carbon - 0.04%

What are the effects of global warming?

What are the effects of global warming?

- Melting of polar ice caps.
- Difficulties acquiring drinking water.
- Flooding.
- Forest fires.
- Destruction of ecosystems.

How has human activity increased the amount of methane in the atmosphere?

How has human activity increased the amount of methane in the atmosphere?

- Raising livestock such as cows.
- Decay of organic waste in landfill sites.

How can the effects of global warming be mitigated?

How can the effects of global warming be mitigated?

- Construct flood defences in areas of low lying land.
- Use of irrigation systems to provide water in drought.
- Produce alternative crops which are better adapted to the new environment.