Rewarding Learning

FACTFILE:
GCE ENVIRONMENTAL TECHNOLOGY

THE DEVELOPMENT OF PLASTICS FOR THE FUTURE

The development of plastics for the future

Learning outcomes

Students should be able to:

- understand the significance of global reliance on crude oil as both a fuel source and an industrial feedstock;
- understand that global production of plastic continues to increase each year and that plastic production is the largest single user of crude oil outside the energy and transport sectors; and
- explain that the gases formed by fractional distillation are cooled, liquefied and stored for use as feedstocks in the plastics industry.

Course Content

Crude oil is the name given to oil in its rawest form when it is being extracted from the ground. This is before the oil is processed for use in a refinery. At this stage in its use it can be thick black in colour or almost clear and thin like water. Oil, like coal and gas, was formed millions of years ago in shallow water around land masses.

Dead remains of sea life and plants littered the sea bed and gradually became covered with sand and rock as the land mass gradually eroded. The plant and animal matter became compacted and decomposed creating gas and oil.
The oil then bubbled through the porous rock or became trapped in large volumes by more non-porous rock.

Once processed it is then used for a wide variety of uses e.g.:

- a range of fuels such as petrol, diesel and kerosene;
- fertilizers and pesticides;
- plastics for use in products packaging and casings;
- synthetic rubber;
- some cosmetics and perfumes;
- fuels for home use such as butane and propane; and
- industrial solvents such as those used to clean machinery.

It is generally accepted that 8% of oil sourced and refined in the world is actually used to produce plastic either directly as plastic or as energy used to produce plastic. This makes the plastic industry the largest user of crude oil stocks outside the transport industry. Industrial nations, developed or

developing, are heavily reliant on crude oil as a fuel source and as a base material for the production of plastic, known as a feedstock.

Activity 1:

Use the links below, or any others of your choice, to research the issue of global reliance on crude oil as the base material for a wide range of applications and uses.

http://www.wintershall.com/en/company/oil-and-gas/oil-can-do-more.html

http://www.plasticoceans.net/the-facts/energy-consumption/

https://circulareconomy.europa.eu/platform/sites/default/files/euric_-_plastic_recycling_fact_sheet.pdf

In your research identify:

a) The scale of use of oil on an annual global basis and provide suggestions for the increase/ decrease in consumption.

b) The increase in the production of plastic and provide an overview of the range of products and applications derived from crude oil.

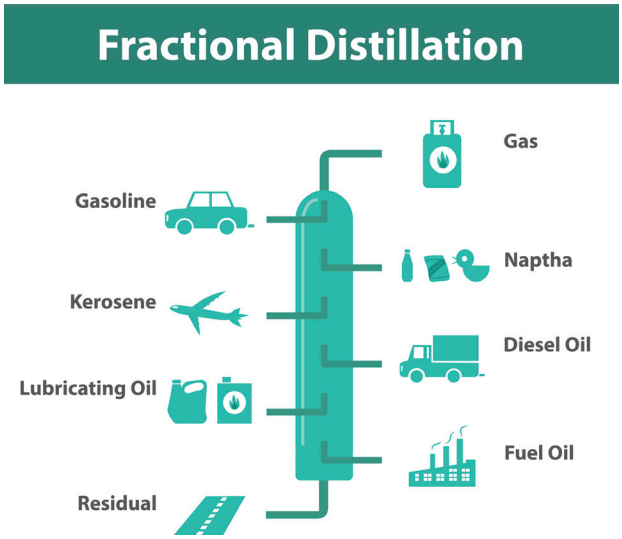
Fractional distillation and the refining of oil

Fractional distillation is the name given to the process of separating a mixture into a number of parts or fractions. If a mixture is made up of different materials each with their own boiling point, this fact can be used when trying to separate the various constituent parts. Because crude oil is made up of a number of different substances, each with different boiling points, these constituent parts can be separated by heating the oil and allowing the different fractions to condense in a tall column which has been placed over the crude oil mixture. The column is hot at the bottom and cool at the top. As the oil vapour rises, when it reaches a part of the column which has the same temperature as its boiling point, it condenses.

Those parts of the crude oil which have high boiling points can be drawn off at the bottom while those with lower boiling points are available at different heights in the column. The condensing vapour is further cooled at each height to produce a liquid and is removed for further processing to allow its use in applications such as production of plastic. A typical oil refinery will contain large industrial scale distillation columns with associated processing equipment to provide industry and commerce with the by-products of crude oil which are required for the range of uses named above.

Activity 2:

Describe using block diagrams and notes, the journey of crude oil from land to the refined fractions (after undergoing fractional distillation).



SOURCES

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