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TOPIC 11.1: FUELS & CRUDE OIL

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THE ABOUT

CHAPTER ANALYSIS

MASTERY

- Straight forward topic
- Some memorising to be done

EXAM

- Tested in MCQ mainly
- Linked to ‘fractional distillation’ from Chapter 1.2 ‘Separation Techniques’

WEIGHTAGE

- Light overall weightage
- Constitute to around **1.5%** of marks for past 5 year papers

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KEY CONCEPT

FUELS & CRUDE OIL
METHANE & PETROLEUM
FRACTIONAL DISTILLATION OF PETROLEUM

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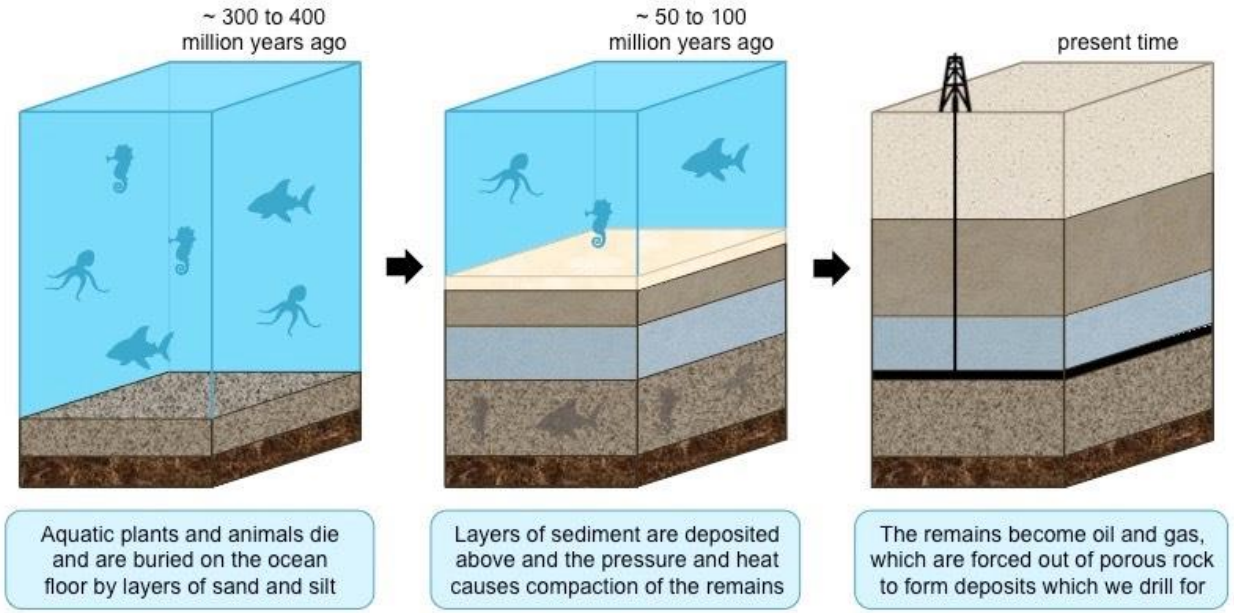
Fuels & Crude Oil



Fossil Fuels and Crude Oil

Fossil fuels are created due to compaction and heat from the remains of aquatic plants and animals.

Upon extraction, it is known as **crude oil or petroleum**, which is a thick black liquid. In order to be used as fuel for planes, cars and cooking, it has to undergo **fractional distillation** first.

Natural gas is a colourless gas found near fossil fuels in the earth's crust.

Hydrocarbons are compounds that contain **only hydrogen and carbon atoms**. Petroleum and natural gas are examples of the hydrocarbons.

Petroleum is a mixture of hydrocarbons that has differing numbers of carbon atoms while **natural gas** comprises mainly **methane CH_4** (up to 90%).

COMPETING USE

Petroleum, however, is a **non-renewable and limited resource**.

There is a **large demand from the petrochemical industry** as naphtha is used as a **chemical feedstock.**

Production of substances such as plastics and drugs will be affected when petroleum eventually runs out.

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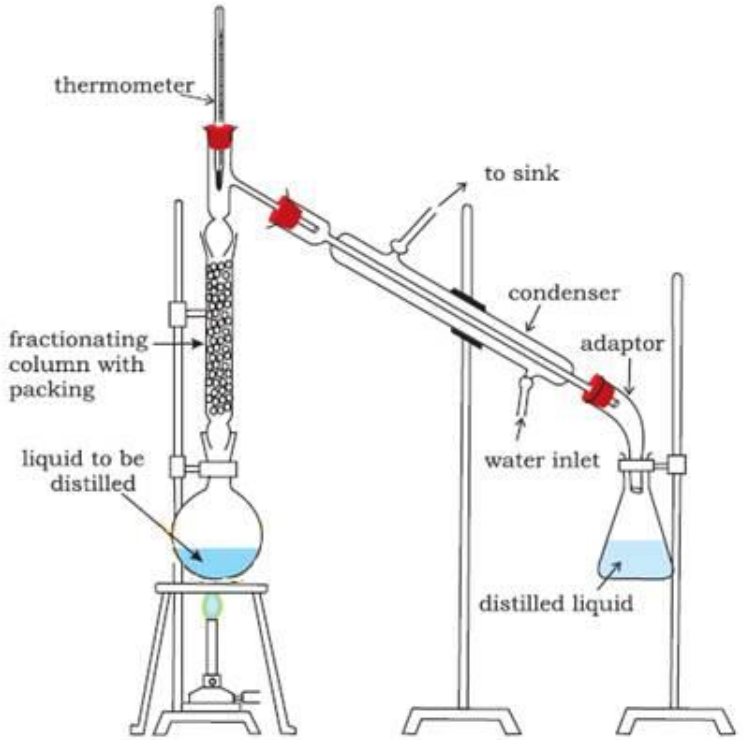
FRACTIONAL DISTILLATION DEPENDS ON DIFFERENT BOILING POINTS

Recall from 'Chapter 1.2 – Separation Techniques', **fractional distillation** is used to separation solutions with different boiling points.

A similar concept is used to separate the hydrocarbons into the different components!



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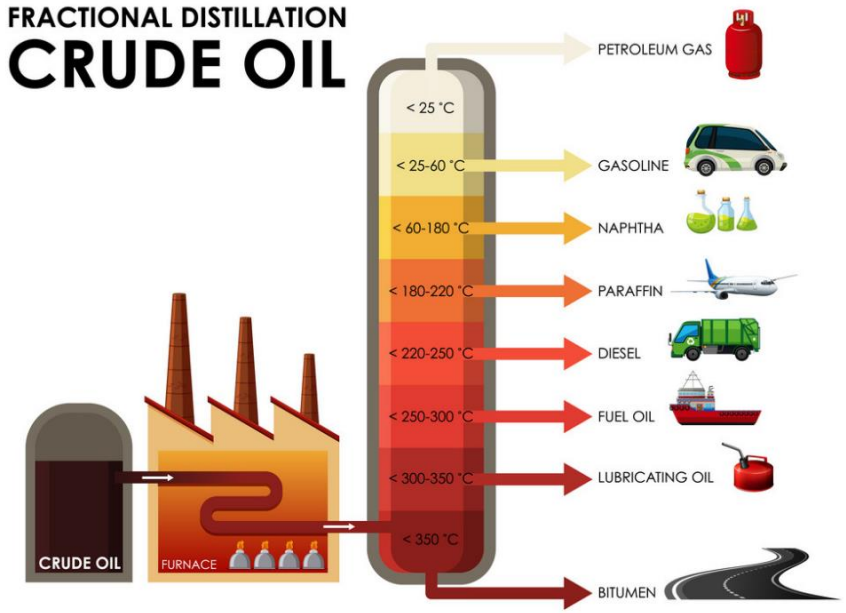
Fractional Distillation

Fraction	Boiling Point	Carbon atoms	Uses
Petroleum Gas	< 25°C	1- 4	Fuel for cooking
Petrol / Gasoline	25°C - 60°C	5 - 10	Fuel for car vehicles
Naphtha	60°C - 180°C	8 – 12	chemical feedstock
Paraffin	180°C - 220°C	10 – 16	Aircraft fuel, heating & cooking
Diesel	220°C - 250°C	15 – 25	Fuel for diesel engines like buses & lorries
Lubricating Oil	300°C - 350°C	19 - 35	Machine lubricants; polishes & waxes
Bitumen	>580°C	>70	Surfacing roads

FRACTIONAL DISTILLATION OF PETROLEUM

Petroleum is a **mixture of hydrocarbons** that has different number of carbon atoms. The **different no. of carbon atoms** result in them having d**ifferent boiling points**.

Petroleum needs to undergo **fractional distillation** to be separated into useful fractions.



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CLASSIFICATION OF ORGANIC COMPOUNDS

HOMOLOGOUS SERIES

A **homologous series** is defined as a family of organic compounds that has
:

- Same general formula
- Same functional group
- Similar chemical properties (undergo similar chemical reactions)
- Gradual change in physical properties
- Each member differs from the next by $-CH_2$

FUNCTIONAL GROUP

A **functional group** is an atom or a group of atoms that is responsible for the chemical properties of the molecule:

- C=C bond in alkenes
- -OH group in alcohols
- -COOH group in carboxylic acids
- -COO- group in esters

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NAMING OF ORGANIC COMPOUNDS

Prefix	Number
Meth-	1
Eth-	2
Prop-	3
But-	4
Pent-	5
Hex-	6
Hep-	7
Oct-	8
Non-	9
Dec-	10

Suffix	Homologous series	Example
-ane	Alkanes	Propane C_3H_8
-ene	Alkenes	Butene C_4H_8
-ol	Alcohol	Ethanol C_2H_5OH
-oic acid	Carboxylic Acid	Pentanoic acid C_4H_9COOH

Try it yourself! (TYS Question)

21. Petroleum can be separated into fractions by fractional distillation.
Which statement about this process is **not** correct? (N2015/P1/Q38)

A In a fractionating column, the bitumen fraction is obtained below the kerosene fraction.
B The fraction obtained at the top of the fractionating column has the highest boiling point.
C The lubricating oil fraction is a source of polishes and waxes.
D The relative molecular masses of the compounds obtained near the bottom of the fractionating column are higher than those of the compounds obtained near the top of the column.

( )

Answer:

21. **B**
The fraction obtained at the top of the fractionating column has the lowest boiling point.

Try it yourself! (TYS Question)

42. Petroleum can be separated into fractions using fractional distillation.
Which statements are correct? (N2019/P1/Q32)

1 Alkanes used in polishes and waxes have a higher boiling point than those used as diesel fuel.
2 Any of the fractions could be used as fuels because their enthalpy changes of combustion are negative.
3 The fraction used for petrol (gasoline) is extracted from higher up the fractionating column than the fraction used for paraffin (kerosene).
4 The fraction obtained at a particular point in the fractionating column always contains the same compounds in the same ratio.

A 1, 2 and 3 **B** 1 and 4
C 2 only **D** 3 and 4 ( )

Answer:

42. **A**
Fractions used as fuels produce energy when burnt and the fraction obtained at a particular point does not always contain the same compounds in the same ratio.

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