

Option C.2 Fossil fuels

Understandings:

- Fossil fuels were formed by the reduction of biological compounds that contain carbon, hydrogen, nitrogen, sulfur and oxygen.
- Petroleum is a complex mixture of hydrocarbons that can be split into different component parts called fractions by fractional distillation.
- Crude oil needs to be refined before use. The different fractions are separated by a physical process in fractional distillation.
- The tendency of a fuel to auto-ignite, which leads to “knocking” in a car engine, is related to molecular structure and measured by the octane number.
- The performance of hydrocarbons as fuels is improved by the cracking and catalytic reforming reactions.
- Coal gasification and liquefaction are chemical processes that convert coal to gaseous and liquid hydrocarbons.
- A carbon footprint is the total amount of greenhouse gases produced during human activities. It is generally expressed in equivalent tons of carbon dioxide.

Applications and skills:

- Discussion of the effect of chain length and chain branching on the octane number.
- Discussion of the reforming and cracking reactions of hydrocarbons and explanation how these processes improve the octane number.
- Deduction of equations for cracking and reforming reactions, coal gasification and liquefaction.
- Discussion of the advantages and disadvantages of the different fossil fuels.
- Identification of the various fractions of petroleum, their relative volatility and their uses.
- Calculations of the carbon dioxide added to the atmosphere, when different fuels burn and determination of carbon footprints for different activities.