



CHEMISTRY ONLINE
— **TUITION** —

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CHEMISTRY

ORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	ALKANES
PAPER TYPE:	SOLUTION - 4
TOTAL QUESTIONS	10
TOTAL MARKS	39

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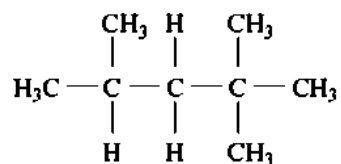
Alkanes - 4

1.

Structural isomers:

Structural isomers are compounds with the same molecular formula (same number and types of atoms) but different structural arrangements, represented by distinct structural formulas.

Name: 2,2,4-trimethylpentane



(3)

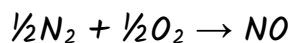
2. D

(1)

3.

(a)

Equation for the reaction between nitrogen and oxygen to form nitrogen monoxide can be represented as.



(1)

(b)

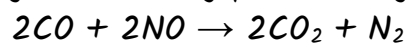
Catalyst used in a catalytic converter:

Platinum or palladium or rhodium

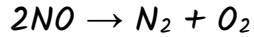
(2)

(c)

Equation showing how nitrogen monoxide is removed from the exhaust gases as they pass through a catalytic converter.



Or



Or

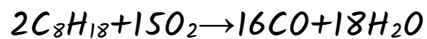


(2)

4.

(a)

The incomplete combustion of octane (C_8H_{18}) can be represented by the following chemical equation:



(1)

(b)

Incomplete combustion occurs when there's insufficient oxygen. Factors include low oxygen supply, poor air-fuel mixing, limited time, and low combustion temperatures. This incomplete process leads to the formation of carbon monoxide instead of complete oxidation to carbon dioxide and water.

(1)

5.

Hydrocarbons from heavy fractions are cracked due to following reasons:
Demand and Supply:

- Demand for heavy fractions is low, while demand for petrol is high.
- Supply of heavy fractions is high, prompting the need for conversion into more valuable products like petrol.

Molecular Size and Volatility:

- Hydrocarbons in heavy fractions have larger molecular sizes.
- Larger molecules are less volatile, making them less suitable for use as petrol.

Boiling Points and Intermolecular Forces:

- Larger molecules have higher boiling points.
- Higher boiling points are attributed to stronger intermolecular forces.
- Stronger intermolecular forces make ignition more challenging.

(4)

6.

(a)

The susceptibility of chloromethane (CH_3Cl) to attack by an ammonia molecule (NH_3) is attributed to the presence of a polarized C-Cl bond. The chlorine atom is more electronegative than carbon, creating a partial negative charge on the chlorine atom and a partial positive charge on the carbon atom. This polarity makes the carbon atom in chloromethane electrophilic (electron-deficient), and it can attract a nucleophile, such as the lone pair of electrons on the nitrogen atom in ammonia.

(2)

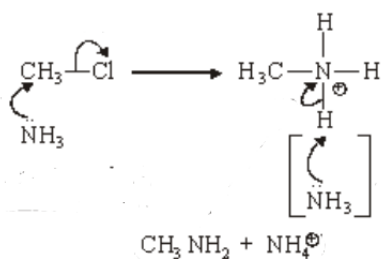
(b)

Name of the amine produced: methylamine

(2)

(c)

Mechanism: $\text{S}_{\text{N}}1$

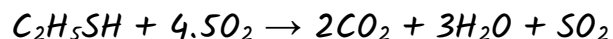


(3)

7.

(a)

Equation for the combustion of ethanethiol



(1)

(b)

Calcium oxide or calcium carbonate is a compound that is used to react with the sulfur dioxide in the products of combustion before they enter the atmosphere.

(2)

(c)

It neutralises the SO_2 by acid base reaction that is why this compound reacts with sulfur dioxide.

(1)

(d)

Ethanol contains hydrogen bonding which is stronger than intermolecular forces (VDW / dipole-dipole forces) in ethanethiol that is why ethanol has the higher boiling point. As greater amount of heat is required to break these forces in ethanol

(2)

8.

Some of the essential features of the fractional distillation are as:

Boiling Point Variation:

- Different fractions or hydrocarbons are separated based on distinct boiling points.

Factors Influencing Boiling Point:

- Boiling points depend on size (molecular mass), structure, and chain length of hydrocarbons.

Temperature Gradient in Column:

- The fractional distillation column has a temperature gradient, with cooler conditions at the top and hotter conditions at the bottom.

Positional Separation:

- Higher boiling point or larger molecules collect at the bottom, while lower boiling point fractions gather at the top of the column.

(4)

9.

Catalyst used in catalytic cracking: Zeolite / aluminosilicate

Type of mechanism: Carbocation / heterolytic fission

Conditions:

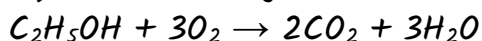
- *Temperature: High temperature around 450 °C (300 – 600) °C*
- *Pressure: Slight pressure (> 1 atm ≤ 10 atm)*

(4)

10.

(a)

Equation showing how ethanol burns completely in air is as:



(1)

(b)

Incomplete combustion of ethanol in a car engine may produce toxic carbon monoxide (CO), a respiratory irritant. CO contributes to smog, exacerbates asthma, and its particles can cause global dimming, affecting both human health and the environment.

(1)

(c)

Economic problems for the car user caused by incomplete combustion of ethanol can be

- *More fuel needed which costs more*
- *Wastes fuel*
- *Have to fit catalytic converter*

(1)



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- Tutoring students in UK and worldwide since 2008
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