



CHEMISTRY ONLINE
— **TUITION** —

Phone: +442081445350

www.chemistryonlinetuition.com

Email: asherrana@chemistryonlinetuition.com

CHEMISTRY

ORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	ALKANES
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	10
TOTAL MARKS	36

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Alkanes - 1

1. Bromine-containing and chlorine-containing organic compounds may have a role in the decomposition of ozone in the upper atmosphere.

(a) Draw an appropriate displayed formula in the space provided to complete the following equation to show how CBrF_3 may produce bromine atoms in the upper atmosphere.



(b) In the upper atmosphere, it is more likely for CBrF_3 to produce bromine atoms than it is for CClF_3 to produce chlorine atoms. Suggest one reason for this.

(1)

(c) Bromine atoms have a similar role to chlorine atoms in the decomposition of ozone.

The overall equation for the decomposition of ozone is



Write two equations to show how bromine atoms ($\text{Br}\cdot$) act as a catalyst in the decomposition of ozone.

Explain how these two decomposition equations show that bromine atoms behave as a catalyst.

(3)

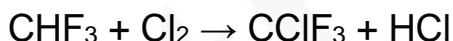
2. Which of these substances does not contribute to the greenhouse effect?

- A. Unburned hydrocarbons
- B. Carbon dioxide
- C. Water vapour
- D. Nitrogen

(1)

3. Trifluoromethane (CHF_3) can be used to make the refrigerant chlorotrifluoromethane(CClF_3).

(a) Chlorotrifluoromethane is formed when trifluoromethane reacts with chlorine.



The reaction is a free-radical substitution reaction similar to the reaction of methane with chlorine.

Write an equation for each of the following steps in the mechanism for the reaction of CHF_3 with Cl_2

Initiation step

First propagation step

Second propagation step

Termination step to form hexafluoroethane

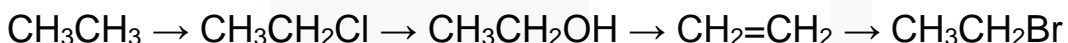
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(4)

(b) Give one essential condition for this reaction.

(1)

4. Which one of the following mechanisms is not involved in the reaction sequence below?



- A. electrophilic addition
- B. electrophilic substitution
- C. nucleophilic substitution
- D. free-radical substitution

(1)

5. Central heating fuel, obtained by the fractional distillation of crude oil, contains saturated hydrocarbons with the molecular formula $\text{C}_{16}\text{H}_{34}$

(a) Give the meaning of the terms saturated and hydrocarbon as applied to saturated hydrocarbons.

(2)

(b) If the boiler for a central heating system is faulty, a poisonous gas may be produced during the combustion of $\text{C}_{16}\text{H}_{34}$

Write an equation for the reaction that forms this poisonous gas and one other product only.

(1)

(c) Explain why the sulfur compounds found in crude oil should be removed from the fractions before they are used for central heating fuel.

(2)

6. An alkane contains 30 hydrogen atoms per molecule. Its empirical formula is

- A. C_6H_{15}
- B. C_7H_{15}
- C. $C_{14}H_{30}$
- D. $C_{15}H_{30}$

(1)

7. The hydrocarbon but-1-ene (C_4H_8) is a member of the homologous series of alkenes. But-1-ene has structural isomers.

(a) State the meaning of the term structural isomers.

(2)

(b) Give the IUPAC name of the position isomer of but-1-ene.

(1)

(c) Give the IUPAC name of the chain isomer of but-1-ene.

(1)

(d) Draw the displayed formula of a functional group isomer of but-1-ene.

(1)

8. The percentage by mass of carbon is 83.3% in

- A. propane
- B. butane
- C. pentane
- D. hexane

(1)

9. Pentane is a member of the alkane homologous series.

(a) Give the general formula for the homologous series of alkanes.

(1)

(b) One of the structural isomers of pentane is 2,2-dimethylpropane.

Draw the displayed formula of 2,2-dimethylpropane.

State the type of structural isomerism shown.

(2)

(c) A molecule of hydrocarbon Y can be thermally cracked to form one molecule of pentane and two molecules of ethene only.

Deduce the molecular formula of Y.

State why high temperatures are necessary for cracking reactions to occur.

Give one reason why thermal cracking reactions are carried out in industry.

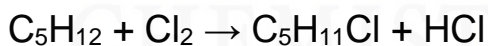
(3)

(d) Write an equation for the incomplete combustion of pentane to form a solid pollutant.

Suggest why this solid pollutant is an environmental problem.

(2)

(e) Pentane can react with chlorine as shown in the following equation.



Calculate the percentage atom economy for the formation of $\text{C}_5\text{H}_{11}\text{Cl}$

Deduce how many straight-chain isomers of $\text{C}_5\text{H}_{11}\text{Cl}$ could be formed.

(3)

10. Which molecule is not produced when ethane reacts with bromine in the presence of ultraviolet light?

- A. $C_2H_4Br_2$
- B. HBr
- C. H_2
- D. C_4H_{10}

(1)



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DR. ASHAR RANA
M.B.B.S / MS. CHEMISTRY



- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students in UK and worldwide since 2008
- CIE & EDEXCEL Examiner since 2015
- Chemistry, Physics, Math's and Biology Tutor

CONTACT INFORMATION FOR CHEMISTRY ONLINE TUITION

- UK Contact: 02081445350
 - International Phone/WhatsApp: 00442081445350
 - Website: www.chemistryonlinetuition.com
 - Email: asherrana@chemistryonlinetuition.com
- Address: 210-Old Brompton Road, London SW5 OBS, UK