

14. Hydrocarbons

14.1 Alkanes

Paper 1

Question Paper

1 The hydrocarbon $C_{17}H_{36}$ can be cracked.

Which compound is the **least** likely to be produced in this reaction?

- A C_3H_8 B C_4H_8 C C_8H_{16} D $C_{16}H_{34}$

2 Which list contains a compound that is **not** made during the free radical substitution of methane with chlorine?

- A CH_3Cl , CCl_4 , C_2H_6
B Cl_2 , CH_2Cl_2 , CCl_4
C CH_3Cl , CH_2Cl_2 , $CHCl_3$
D CH_3Cl , $CHCl_3$, $C_2H_2Cl_2$

3 Which equation represents a reaction that proceeds through initiation, propagation and termination steps?

- A $C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$
B $C_5H_{11}Br + NaOH \rightarrow C_5H_{11}OH + NaBr$
C $C_6H_{12} + H_2O \rightarrow C_6H_{13}OH$
D $C_6H_{13}CHO + HCN \rightarrow C_6H_{13}CH(OH)CN$

4 Ethane reacts with an excess of chlorine in the presence of ultraviolet light to form a mixture of products.

How many of these products contain two carbon atoms and one or more chlorine atoms?

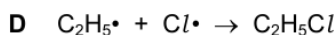
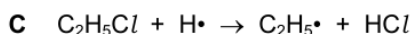
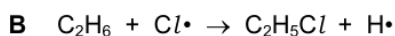
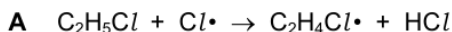
- A 6 B 7 C 8 D 9

- 5 The molecular formula CH_3 can represent an anion, a cation or a free radical. Species with the molecular formula CH_3 can act as an electrophile, a free radical or a nucleophile depending on the number of outer shell electrons on the central carbon atom.

How many outer shell electrons on the central carbon atom must be present for CH_3 to act in these different ways?

	CH_3 as an electrophile	CH_3 as a free radical	CH_3 as a nucleophile
A	6	7	8
B	6	8	7
C	7	6	8
D	8	7	6

- 6 Which equation represents a valid propagation step in the chlorination of ethane?



- 7 Methane and bromine react by free radical substitution.

P and Q are involved in the reaction mechanism.

P and Q:

- are **both** involved in propagation steps as reactants
- are **both** involved in termination steps as reactants.

What could be P and Q?

- A** Br and H **B** Br and CH_3 **C** Br and C_2H_6 **D** CH_3 and CH_3Br

- 8 Which statement about the use of alkane fuels in internal combustion engines is correct?

A C_8H_{18} is used as fuel in internal combustion engines and reacts with oxygen and nitrogen from the air.

B In limited oxygen, CO is produced which oxidises SO_2 to SO_3 in the atmosphere.

C The catalytic converter removes polluting gases including NO_2 and CO_2 .

D Unburnt hydrocarbons and NO_2 can react in sunlight to produce photochemical smog.

9 Alkanes are saturated hydrocarbons.

Which type of reaction are alkanes most likely to undergo?

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

10 Which equation represents a valid propagation step in the chlorination of ethane?

- A** $\text{C}_2\text{H}_6 + \text{Cl}\cdot \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{H}\cdot$
- B** $\text{C}_2\text{H}_5\text{Cl} + \text{Cl}\cdot \rightarrow \text{C}_2\text{H}_4\text{Cl}\cdot + \text{HCl}$
- C** $\text{C}_2\text{H}_5\text{Cl} + \text{H}\cdot \rightarrow \text{C}_2\text{H}_5\cdot + \text{HCl}$
- D** $\text{C}_2\text{H}_5\cdot + \text{Cl}\cdot \rightarrow \text{C}_2\text{H}_5\text{Cl}$