# Past-paper walk-through

Alkanes ▪ 11.4

eXercise

# Questions in this set

- 0620/21 N25 Q34 ▪ 1 mark
- 0620/23 N25 Q31 ▪ 1 mark
- 0620/42 N25 Q5 ▪ 12 marks
- 0620/21 J25 Q34 ▪ 1 mark
- 0620/22 J25 Q35 ▪ 1 mark
- 0620/23 J25 Q35 ▪ 1 mark
- 0620/23 J25 Q36 ▪ 1 mark
- 0620/22 M25 Q36 ▪ 1 mark

# Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

# Question 34

0620/21 N25 ▪ Q34 ▪ 1 mark

**34** Ethane reacts with chlorine.

Which row identifies the type of reaction and the formulae of the products formed?

| | reaction | products |
|---|---|---|
| **A** | addition | $CH_3CH_2Cl + H_2$ |
| **B** | addition | $CH_3CH_2Cl + HCl$ |
| **C** | substitution | $CH_3CH_2Cl + HCl$ |
| **D** | substitution | $CH_3CH_2Cl + H_2$ |

# Solution 34

Answer: **C**

**Why**

- Ethane is saturated, so it cannot add anything – it can only substitute.
- One hydrogen is replaced by one chlorine atom.
- So the products are chloroethane and hydrogen chloride.

# Question 31

0620/23 N25 ▪ Q31 ▪ 1 mark

**31** Which type of reaction takes place when methane reacts with chlorine in the presence of ultraviolet light?

**A** addition

**B** cracking

**C** polymerisation

**D** substitution

# Solution 31

Answer: **D**

**Why**

- Ultraviolet light starts a free-radical reaction.
- Methane is saturated, so nothing can be added to it.
- One hydrogen is replaced by one chlorine, which makes it a substitution.

# Question 5

0620/42 N25 ▪ Q5 ▪ 12 marks

**5** This question is about the homologous series of alkanes.

Three general characteristics of alkanes are:

- they are generally unreactive because they do **not** have a functional group
- they show trends in their physical properties, such as melting points and boiling points
- they have similar chemical properties.

**(a)** Describe **two other** general characteristics of the homologous series of alkanes.

# Question 5

# Question 5

[2]

**(b) (i)** State the trend in the boiling points of the alkanes as the carbon chain length increases.

# Question 5

**(ii)** Name **one other** physical property of alkanes that shows a trend, other than melting points and boiling points.

Describe this trend as the carbon chain length of alkanes increases.

# Question 5

# Question 5

[2]

**(c)** State why alkanes are described as saturated.

# Question 5

**(d)** Propane has the structural formula $CH_3CH_2CH_3$.

When propane undergoes a monosubstitution reaction with chlorine at room temperature, **two** organic products can be formed.

**(i)** State **one** condition needed for this substitution reaction to take place.

# Question 5

**(ii)** Give the structural formula and state the name of each organic product formed.

- structural formula of product 1

# Question 5

- structural formula of product 2

# Question 5

[4]

**(iii)** The two products formed are structural isomers of each other.

Define the term structural isomers.

# Question 5

[Total: 12]

# Solution 5

**(a)**

**Mark scheme**

- M1 (have a) general formula of CnH2n+2 M2
- differ from one member to the next by a –CH2– unit
- 2

# Solution 5

**(b)(i)**

**Mark scheme**

- increases
- 1
- 0620/42
- October/November 2025

# Solution 5

**(b)(ii)**

**Mark scheme**

- M1 physical property M2
- change as chain length increases
- 2

# Solution 5

**(c)**

**Mark scheme**

- all carbon–carbon bonds are single (bonds)
- 1

# Solution 5

**(d)(i)**

**Mark scheme**

- ultraviolet light
- 1

# Solution 5

**(d)(ii)**

**Mark scheme**

- M1 CH3CH2CH2Cl M3
- 1-chloropropane M2
- CH3CHClCH3 M4
- 2-chloropropane
- 4

# Solution 5

**(d)(iii)**

**Mark scheme**

- (compounds with) the same molecular formula but different structural formulae or structure
- 1

# Question 34

0620/21 J25 ▪ Q34 ▪ 1 mark

**34** What is the **total** number of covalent bonds in one molecule of propane?

**A** 8 **B** 9 **C** 10 **D** 11

# Solution 34

Answer: **C**

**Why**

- Propane is $CH_3CH_2CH_3$.
- There are $2$ carbon–carbon bonds and $8$ carbon–hydrogen bonds.
- Total $= 10$ covalent bonds.

# Question 35

0620/22 J25 ▪ Q35 ▪ 1 mark

**35** Ethane reacts with chlorine in the presence of ultraviolet light.

Which products are formed?

**A** $C\mathit{l}CH_2CH_2C\mathit{l}$ and $H_2$

**B** $2CH_3C\mathit{l}$ and $H_2$

**C** $C_2H_5C\mathit{l}$ and $HC\mathit{l}$

**D** $CH_2{=}CH_2$ and $2HC\mathit{l}$

# Solution 35

Answer: **C**

**Why**

- Ultraviolet light starts a free-radical *substitution*, not an addition.
- One hydrogen of the ethane is replaced by one chlorine atom.
- The displaced hydrogen leaves with the other chlorine as HCl: $C_2H_5Cl + HCl$.

# Question 35

0620/23 J25 ▪ Q35 ▪ 1 mark

**35** Compound W is a hydrocarbon that contains single bonds only.

Which homologous series contains W?

**A** alkenes

**B** alkanes

**C** carboxylic acids

**D** alcohols

# Solution 35

Answer: **B**

**Why**

- A hydrocarbon contains only carbon and hydrogen, which rules out carboxylic acids and alcohols.
- Single bonds only means it is saturated.
- Saturated hydrocarbons are the alkanes.

# Question 36

0620/23 J25 ▪ Q36 ▪ 1 mark

**36** Methane forms chloromethane in a photochemical reaction using ultraviolet light.

Which statement about this reaction is correct?

**A** Methane is mixed with hydrogen chloride gas, and ultraviolet light prevents a combustion reaction.

**B** Methane is mixed with hydrogen chloride gas, and ultraviolet light provides the activation energy for the reaction.

**C** Methane is mixed with chlorine gas, and ultraviolet light prevents a combustion reaction.

**D** Methane is mixed with chlorine gas, and ultraviolet light provides the activation energy for the reaction.

# Solution 36

Answer: **D**

**Why**

- Ultraviolet light provides the energy to start a free-radical substitution.
- A chlorine atom replaces one hydrogen of the methane.
- The products are chloromethane and hydrogen chloride – methane reacts with chlorine, not with HCl.

# Question 36

0620/22 M25 ▪ Q36 ▪ 1 mark

**36** The structural formula of methyl propane is $CH_3CH(CH_3)CH_3$.

The equation represents the reaction of methyl propane with chlorine.

$$C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$$

How many structural isomers with the molecular formula $C_4H_9Cl$ can be formed from this reaction?

**A** 1 **B** 2 **C** 3 **D** 4

# Solution 36

Answer: **B**

**Why**

- Methylpropane has only two *kinds* of hydrogen: the nine on the methyl groups and the one on the central carbon.
- Replacing a methyl hydrogen gives 1-chloro-2-methylpropane.
- Replacing the central hydrogen gives 2-chloro-2-methylpropane – so two isomers.