# 11.2 Alkanes

**Set B** Exam practice

| Name | Time 1 hour | Total 21 marks | Score ____ / 21 |
|---|---|---|---|

A Data Booklet may be used.

**Marks by notes section** For the marker: total each row. A score below the target means that section of the notes needs revising.

| Notes section | Questions | Marks | Target | Score |
|---|---|---|---|---|
| **2** Physical Properties | 5(b)(iii) | 3 | 2 | |
| **4** Reactivity and Combustion | 5(a) | 1 | 1 | |
| **5** Free Radical Substitution | 1, 3, 4, 5(b)(i) | 6 | 4 | |
| **6** Ratio of Products | 2, 5(b)(ii), 6, 8 | 9 | 6 | |
| **7** Pollution from Combustion | 7 | 2 | 2 | |

## A Multiple choice

4 MARKS

**1** COMMON $CH_4$ and $Cl_2$ react together in the presence of ultraviolet light. Which statements are correct?

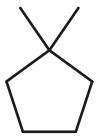
1 Hydrogen gas is produced.
2 Bond breaking occurs only in the initiation step.
3 $CH_3Cl$ is formed in the propagation and termination steps.

**A** 3 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

Answer ☐ [1]

/1

*Source: 2022 HCI J1 Promo P1 Q18*

**2** 1,1-dimethylcyclopentane  undergoes free-radical substitution with limited bromine in the presence of ultraviolet light. A mixture of mono-brominated products is obtained.

Assuming that the reaction occurs at the same rate at every carbon atom, what is the total number of mono-brominated products (ignore stereoisomers) obtained?

**A** 2 **B** 3 **C** 4 **D** 6

Answer ☐ [1]

/1

*Source: 2022 HCI J1 Promo P1 Q19*

**3** Use of the Data Booklet is relevant to this question. Chlorofluorocarbons (CFCs) were widely used as refrigerants, solvents and propellants. However, the manufacture of CFCs has been phased out, as they undergo homolytic fission by ultraviolet radiation in the stratosphere, which contributes to ozone depletion. Which radical could result from the irradiation of $CHFClCF_2Cl$?

**A** $\bullet CHFCF_2Cl$ **B** $\bullet CHClCF_2Cl$ **C** $CHFCl\dot{C}FCl$ **D** $\bullet CFClCF_2Cl$

Answer [ ] [1]

/1

*Source: VJC 2012 Prelim P1 Q17, via EJC Alkanes Topical Revision, Q2*

**4** What are the products from the following reaction? $\dot{C}H_3 + CH_3CH_2Cl \rightarrow ?$

**A** $CH_4 + CH_3\dot{C}HCl$ **B** $CH_3CH_2\dot{C}H_2 + HCl$

**C** $CH_3CH_2CH_3 + Cl\bullet$ **D** $CH_3CH_2CH_2Cl + H\bullet$

Answer [ ] [1]

/1

*Source: DHS 2013 Prelim P1 Q13, via EJC Alkanes Topical Revision, Q6*

## B Structured questions

17 MARKS

**5** COMMON Crude oil consists of a mixture of hydrocarbons, namely alkanes, cycloalkanes and various aromatic hydrocarbons.

**(a)** Alkanes are generally unreactive. Suggest a possible reason why this is so.

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..... [1]

**(b)(i)** Butane, $CH_3CH_2CH_2CH_3$, can react with bromine gas to form 2-bromobutane under suitable conditions. Name and outline the mechanism for the formation of 2-bromobutane from butane.

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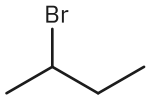
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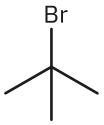
..... [3]

**(ii)** Suggest the ratio of 1-bromobutane to 2-bromobutane formed from the reaction between butane and bromine.

..... [1]

**(iii)** 2-bromobutane, 

, is a constitutional isomer of 2-bromo-2-methylpropane,



. Using structure and bonding, predict and explain the relative boiling point of 2-bromo-2-methylpropane compared with 2-bromobutane.

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..... **[3]**

/8

*Source: MJC 2018 Promo Section B Q1(a) and (b), via EJC Alkanes Topical Revision, Section B Q6*

**6** Octane has a total of 18 isomers. Isomers of octane may be distinguished by the number of mono-brominated products formed upon reaction with bromine under ultraviolet light. Draw an isomer of octane which reacts with limiting bromine to give

**(a)** only one mono-brominated product

**[1]**

**(b)** three mono-brominated products (ignore stereoisomers)

**[1]**

/2

*Source: RJC H2 Chemistry Tutorial 11 (Alkanes), Q7(b)(i)*

**7** COMMON Catalytic converters containing solid platinum convert over 90% of carbon monoxide and gaseous nitrogen oxides into harmless gases such as $CO_2$ and $N_2$. Outline the mode of action of the platinum catalyst.

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**[2]**

/2

*Source: 2024 JPJC J2 Prelim P2 Q2(a)*

**8** CHALLENGE In the chlorination of propane, four products, A, B, C and D, of molecular formula $C_3H_6Cl_2$ were isolated. Each underwent further chlorination, and the number of trichloro-products ($C_3H_5Cl_3$) obtained from each was determined by gas chromatography. A gave one trichloro product, B gave two, and C and D each gave three. When optically active C was chlorinated, one of the trichloropropanes, E, obtained was optically active while the other two were inactive. Give the structural formulae of A, B, C, D and E.

**[5]**

/5

*Source: RJC H2 Chemistry Tutorial 11 (Alkanes), Q3*