

**ADVANCED SUBSIDIARY GCE****CHEMISTRY**

Chains and Rings

2812/01

Candidates answer on the question paper

OCR Supplied Materials:

- *Data Sheet for Chemistry* (Inserted)

Other Materials Required:

- Scientific calculator

Wednesday 3 June 2009**Morning****Duration: 1 hour**

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

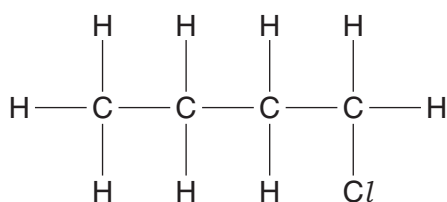
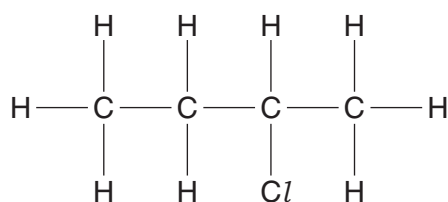
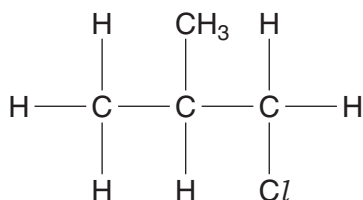
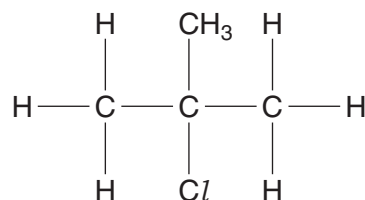
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- You may use the *Data Sheet for Chemistry*.
- You are advised to show all the steps in any calculations.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE

Qu.	Max.	Mark
1	10	
2	9	
3	11	
4	10	
5	20	
TOTAL	60	

Answer **all** the questions.

- 1 This question is about halogenoalkanes **A** to **D**, shown below.

**A****B****C****D**

- (a) Answer the questions that follow by using the appropriate letter **A**, **B**, **C** or **D**.

Each letter may be used once, more than once or not at all.

- (i) Which is 2-chloro-2-methylpropane? [1]
- (ii) Which could react with hot aqueous sodium hydroxide to produce butan-2-ol? [1]
- (iii) Which could react with hot aqueous sodium hydroxide to produce a tertiary alcohol? [1]
- (iv) Which **two** could react with hot ethanolic sodium hydroxide to produce but-1-ene? and [1]

- (b) Compound **C** can react with ammonia to produce an amine.

- (i) Draw the organic product.

[1]

(ii) State a solvent for this reaction.

..... [1]

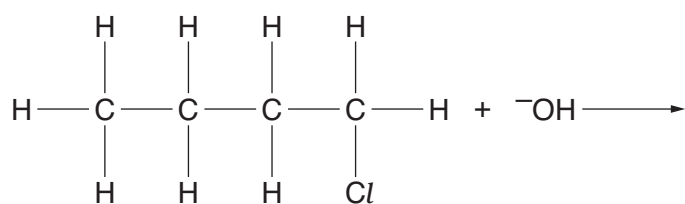
(c) Compound **A** can react with aqueous hydroxide ions, OH^- . The hydroxide ion is a nucleophile.

(i) Define the term *nucleophile*.

.....

..... [1]

(ii) Complete, with the aid of curly arrows, the mechanism involved in this reaction. Show any relevant dipoles and charges.



compound **A**

[3]

[Total: 10]

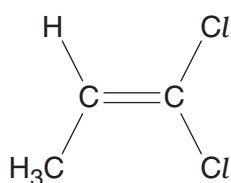
- 2 The chlorinated alkene, $C_3H_4Cl_2$, has five structural isomers that are alkenes and two other structural isomers that are not alkenes.

(a) (i) What is meant by the term *structural isomer*?

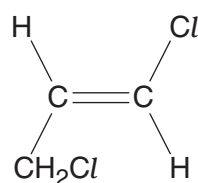
.....

 [2]

(ii) Two of the structural isomers of $C_3H_4Cl_2$ are drawn below.



isomer 1



isomer 2

Draw the other three **structural** isomers, **3–5**, of $C_3H_4Cl_2$ that are alkenes.

isomer 3	isomer 4	isomer 5

[3]

(iii) Name isomer 1 [1]

(iv) Draw one structural isomer of $C_3H_4Cl_2$ that is **not** an alkene.

[1]

(b) Another type of isomerism is *cis-trans* isomerism.

Why can some alkenes have *cis* and *trans* isomers?

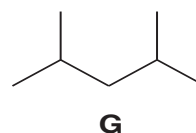
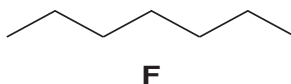
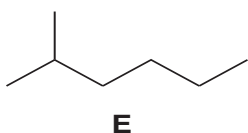
.....

.....

..... [2]

[Total: 9]

- 3 Each of the compounds, **E**, **F** and **G**, has the formula C_7H_{16} .



- (a) (i) Which of **E**, **F** or **G** has the highest boiling point? [1]

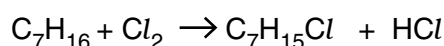
- (ii) State the type of intermolecular forces present in all three compounds.

..... [1]

- (iii) Identify another isomer of C_7H_{16} that is likely to have a boiling point lower than the boiling points of **E**, **F** or **G**.

[1]

- (b) **E**, **F** and **G** all react with chlorine as shown below.



The reaction is initiated by the formation of chlorine free-radicals.

- (i) What is meant by the term *free-radical*?

..... [1]

- (ii) Write an equation to show the formation of chlorine free-radicals.

..... [1]

- (iii) State the type of bond breaking involved in the formation of chlorine free-radicals.

..... [1]

- (iv) Write equations to show the **two** propagation steps that lead to the formation of $C_7H_{15}Cl$.

.....

..... [2]

- (v) Explain, with the aid of an equation, how $C_{14}H_{30}$ could be formed in this reaction.

..... [1]

- (c) Compounds **E** and **G** can react with chlorine to form a mono-chloro compound, $C_7H_{15}Cl$.

Deduce the number of possible structural isomers, each with formula $C_7H_{15}Cl$, that could be made by the reaction of chlorine with

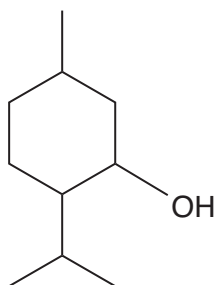
(i) compound **E**, [1]

(ii) compound **G**. [1]

[Total: 11]

- 4 Menthol is a naturally occurring cyclic alcohol found in peppermint oil. It has been used in throat sprays and cough drops for many years.

The skeletal formula of menthol is shown below.



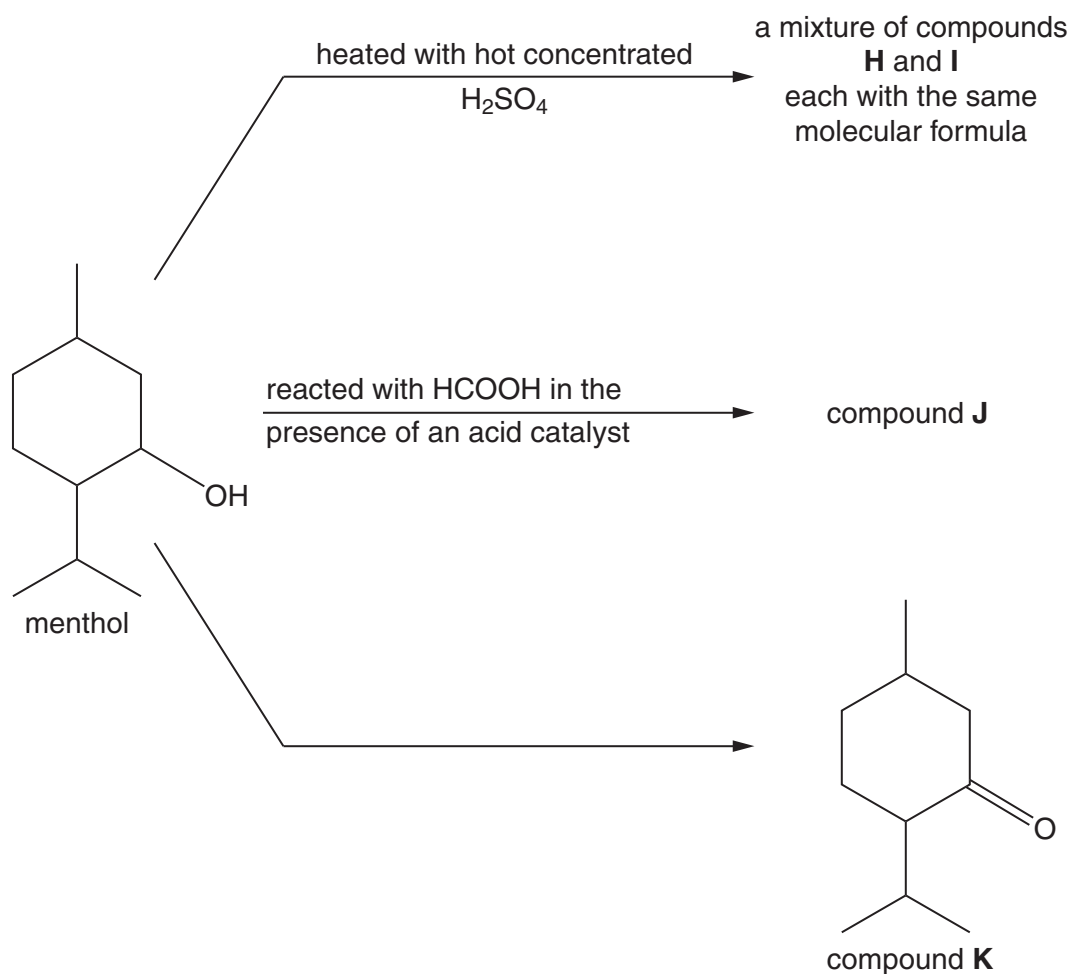
- (a) (i) What is the molecular formula of menthol?

..... [1]

- (ii) Classify menthol as a primary, secondary or tertiary alcohol.

..... [1]

- (b) The reaction scheme below shows some of the reagents and conditions needed to convert menthol into four **organic** compounds **H**, **I**, **J** and **K**.



(i) Draw compounds **H** and **I**.

(ii) State the functional group in compound **J**. [2]

..... [1]

(c) Menthol can be oxidised to form compound **K**.

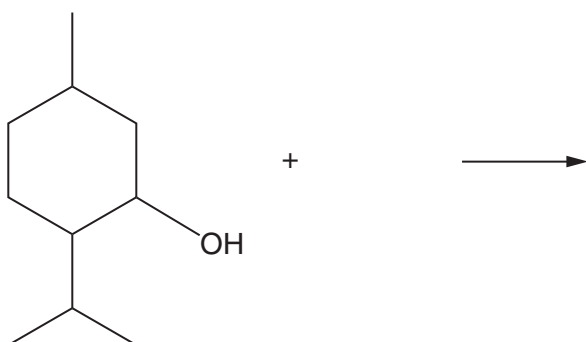
(i) State the reagents and conditions.

..... [2]

(ii) State what you would see during the oxidation.

..... [1]

(iii) Write a balanced equation for the oxidation.
Use **[O]** to represent the oxidising agent.



[1]

(iv) Explain how you could use infra-red spectroscopy to confirm that no menthol remains.

..... [1]

[Total: 10]

- Explain why the crude oil can be separated into fractions by using fractional distillation. Outline, with the aid of equations, the three processes in the refining of the fractions. Explain why the three processes are necessary in the production of fuels.
- Explain why, in the long term, ethanol could supplement the use of oil-based fuels.
- Write an equation for the combustion of ethanol.

[13]

Quality of Written Communication [1]

- (b) Propene is a by-product of the refining of oil fractions.

Propene undergoes addition polymerisation to form poly(propene).

- (i) Write an equation for the formation of poly(propene).

..... [1]

- (ii) Draw a section of the polymer formed from propene. Show **two** repeat units.

[1]

- (c) Propene can also be converted into alcohols.

State the reagents and conditions for this conversion and identify the organic products.

- (i) reagents and conditions,

.....

..... [2]

- (ii) organic products.

[2]

[Total: 20]

END OF QUESTION PAPER

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