

Candidate Name	Centre Number	Candidate Number
		2



GCE A level

1094/01

CHEMISTRY CH4

P.M. THURSDAY, 17 June 2010

1³/₄ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a calculator;
- an 8 page answer book;
- a **Data Sheet** which contains a **Periodic Table** supplied by WJEC.
Refer to it for any **relative atomic masses** you require.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Section A Answer **all** questions in the spaces provided.

Section B Answer **both** questions in **Section B** in a separate answer book which should then be placed inside this question-and-answer book.

Candidates are advised to allocate their time appropriately between **Section A (40 marks)** and **Section B (40 marks)**.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The maximum mark for this paper is 80.

Your answers must be relevant and must make full use of the information given to be awarded full marks for a question.

You are reminded that marking will take into account the Quality of Written Communication in all written answers.

FOR EXAMINER'S USE ONLY		
Section	Question	Mark
A	1	
	2	
	3	
B	4	
	5	
TOTAL MARK		

- (iv) Another terpene, α -farnasene, is responsible for the characteristic odour of green apples.

A 0.100 mol sample of α -farnasene reacted with 8.96 dm³ of hydrogen to form a saturated hydrocarbon C₁₅H₃₂.

(1 mole of gas molecules occupy 22.4 dm³ under these conditions.)

Calculate how many double bonds there are in each molecule of α -farnasene. [2]

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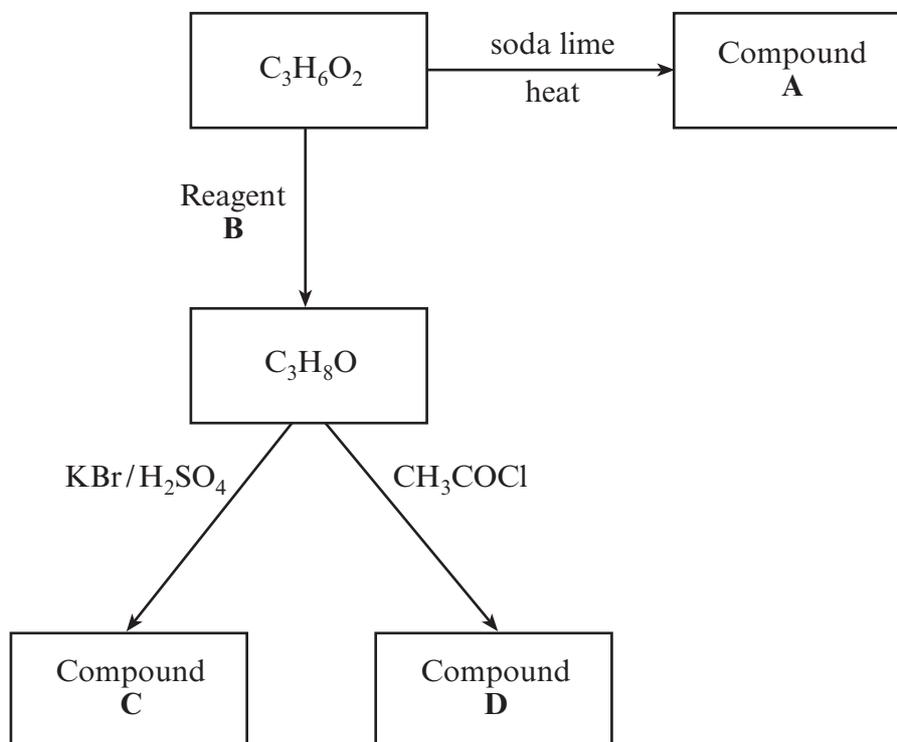
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Examiner
only

(b) Study the reaction scheme shown below:



(i) State the name of compound A. [1]

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(ii) Give the formula of reagent B. [1]

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(iii) Draw the displayed formula of compound C. [1]

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(iv) State the **name** of compound D. [1]

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Total [10]

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2. (a) Explain the difference in structure between *primary* and *secondary* alcohols. [1]

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- (b) Quantitative analysis of an alcohol shows that its percentage composition by mass is C 68.1%, H 13.7% and O 18.2%. It has a relative molecular mass of 88.1.

Calculate the empirical formula of the alcohol and show that its molecular formula is the same as the empirical formula. [3]

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- (c) The following compounds have the same molecular formula, C₅H₁₀O.



- (i) Draw the structure of an isomer of **B** that is also an aldehyde. [1]

- (ii) I. State which **one** of the compounds **A–D** exhibits E-Z (trans-cis) isomerism. [1]

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- II. Draw the structures of **both** isomers. [1]

- (iii) Give one test, including reagents and expected observations, which would distinguish between **A** and **B**. [2]

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- (iv) Give one test, including reagents and expected observations, which would distinguish between **C** and **D**. [2]

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(d) Ketones such as propanone react with hydrogen cyanide.

- (i) Classify the type of reaction taking place. [1]

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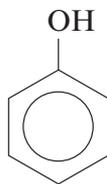
- (ii) Draw, with the aid of curly arrows, the mechanism for this reaction. [3]

Total [15]

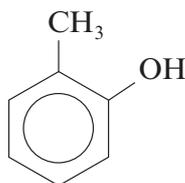
3. Read the passage below and then answer the questions in the spaces provided.

Phenol

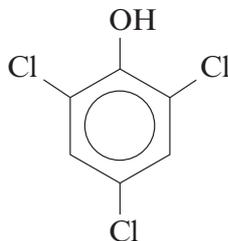
Phenol, formula C_6H_5OH , has an hydroxyl group joined directly to an aromatic ring.



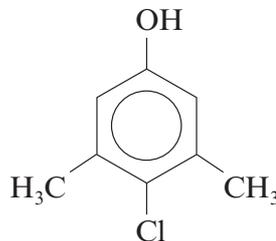
Phenol has many derivatives including 2-methylphenol.



- 5 Phenol was isolated from coal tar in 1835 and its original name was carbolic acid. It is a weak acid, between carboxylic acids and alcohols in strength. In 1865 the English surgeon Joseph Lister pioneered the use of phenol as the first surgical antiseptic and by the beginning of the 20th century phenol was commonly used as an antiseptic, but its use is not permitted today. Familiar pharmaceutical products such as TCP and Dettol are much more effective as antiseptics and disinfectants and do not have the toxicity of phenol itself.



TCP



Dettol

- 15 Nowadays most phenol is produced by the cumene process with less than 5% being made from coal tar. Recently a new process has been developed where phenol is made by the direct oxidation of benzene using nitrous oxide, N_2O , as the oxidising agent. This reaction could be of particular value since N_2O , a pollutant under strict control, is a by-product of the production of hexanedioic acid used to make nylon-6,6. The new process provides a very high yield of phenol and produces no significant aqueous waste products.

Phenol is very important since it is used in the production of

- 20
- epoxy and polycarbonate resins (e.g. as adhesives, in safety glasses and in drinking bottles),
 - nylon,
 - phenolic resins (e.g. as plywood adhesive, in fibreglass and in moulded electrical components),
 - derivatives of ethanoic anhydride.
- 25 You would be unwise to handle phenol, but it is a key chemical in the manufacture of many everyday materials you do handle.

– End of passage –

- (a) Describe a chemical test to show the presence of the –OH group in 2-methylphenol (line 4) by giving the reagent(s) and observation(s).

Reagent(s) [1]

Observation(s) [1]

- (b) Explain why phenol is more acidic than alcohols but less acidic than carboxylic acids (line 6). [4]

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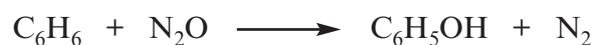
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- (c) Give the systematic name of Dettol (line 11). [1]

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- (d) The new process for the production of phenol (line 13) can be represented by the following equation.



Calculate the atom economy of the reaction. [2]

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(e) Draw the displayed formula of hexanedioic acid (line 16). [1]

(f) State the name of a compound that can react with hexanedioic acid to form nylon-6,6. [1]

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(g) Draw the repeating unit in nylon-6,6 (line 16). [1]

(h) Nylon-6,6 is a typical example of a condensation polymer. Explain the difference between condensation polymerisation and addition polymerisation. [2]

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(i) Give **one** important industrial use of ethanoic anhydride. [1]

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Total [15]

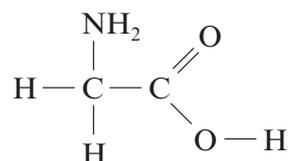
Total Section A [40]

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SECTION B

Answer **both** questions in the separate answer book provided.

4. (a) The reaction between but-1-ene and hydrogen bromide produces a mixture of **three** isomers.
- (i) Draw the displayed formula of each of the three isomers. [3]
- (ii) Outline how each of the isomers can be distinguished from one another. [3]
- (QWC) [1]
- (b) (i) Ethylamine can be produced by the reaction of ammonia with chloroethane.
- I. Write an equation for this reaction. [1]
- II. Classify the type of reaction taking place. [1]
- (ii) Phenylamine cannot be prepared in this way. Name the starting material and reagent(s) used to prepare phenylamine in a laboratory. [2]
- (iii) Give one chemical test, including reagent(s), condition(s) and expected observations, which would distinguish between ethylamine and phenylamine. [3]
- (c) Amino acids also contain an amine group. The simplest amino acid, aminoethanoic acid (glycine) has the formula



- (i) Draw the displayed formula of 2-aminopropanoic acid (alanine). [1]
- (ii) A dipeptide can be formed by reacting two amino acids. Draw the displayed formulae of the two different dipeptides which can be made by combining glycine and alanine. [2]
- (iii) Proteins are natural polypeptides. Explain briefly what is meant by primary, secondary and tertiary protein structure. [3]

Total [20]

