



GCE A LEVEL CHEMISTRY

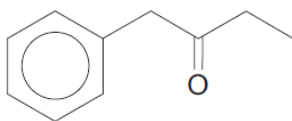
S21-A410

Assessment Resource B

Organic Chemistry and Analysis

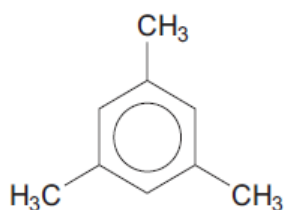
1. The compound below is reduced by sodium tetrahydridoborate(III).

State, giving a reason, whether a primary, secondary or tertiary alcohol is produced. [1]

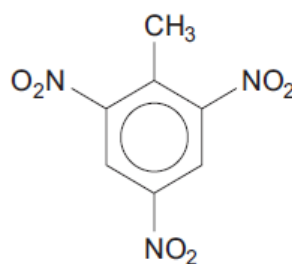


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2. The formulae for two aromatic compounds are given below.



mesitylene



TNT

Complete the table which describes the ^1H NMR signals for these two compounds. [2]

Compound	Number of peaks	Relative peak area ratio
mesitylene		
TNT		

3. Benzene-1,2-dicarboxylic acid (or its sodium salt) is heated with sodalime.

State the type of reaction that occurs and give the name of the product.

[2]

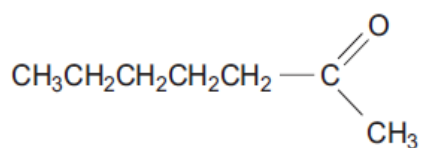
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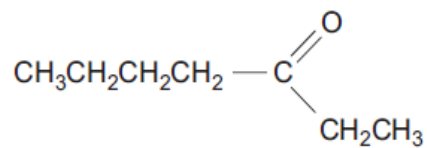
4. Draw the structure of a compound that has an empirical formula CH_4N .

[1]

5. (a) The characteristic smell of some varieties of blue cheese is due mainly to heptan-2-one.



heptan-2-one



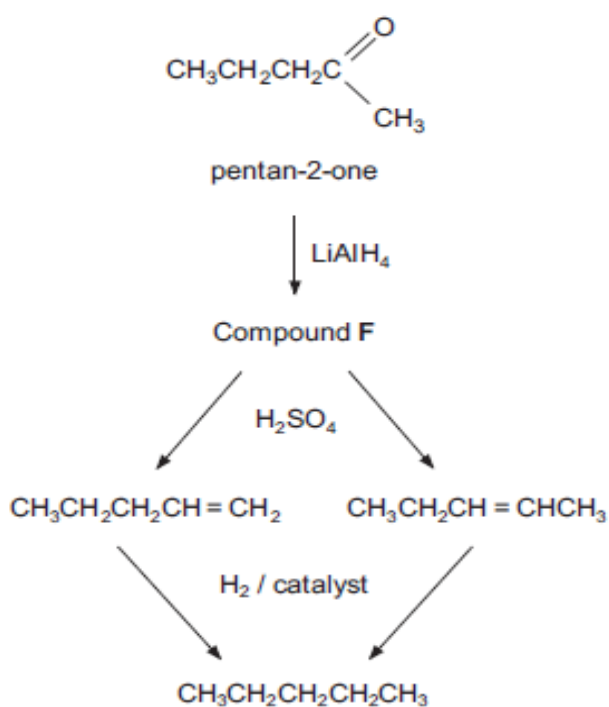
heptan-3-one

A teacher was asked whether heptan-2-one could be clearly distinguished from heptan-3-one by some suggested methods. His responses are shown in the table.

Method	Clearly identified?
mass spectroscopy	yes
gas-liquid chromatography	no
boiling temperature	yes
chemical analysis for C, H and O	no
reaction with alkaline iodine	yes
reaction with 2,4-dinitrophenylhydrazine	no
reaction with Tollens' reagent	no

(b) Pentan-2-one contributes to the smell of other blue cheese varieties.

A reaction sequence for obtaining pentane from pentan-2-one is shown below.



(i) Give the skeletal formula of compound F.

[1]

(ii) State the role of sulfuric acid when it reacts with compound F and explain why two products are formed. [2]

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- (iii) The final stage involves catalytic hydrogenation. One method of carrying this out is to dissolve the alkene in a suitable solvent and react it with hydrogen at room temperature in the presence of a heterogeneous catalyst.

State a catalyst that can be used and why this is described as a *heterogeneous* catalyst. [2]

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- (iv) One solvent that can be used for the hydrogenation described in (iii) above is hexane. The boiling temperatures of pentane and hexane are 35 °C and 69 °C respectively.

State the name of a method that can be used to separate these two compounds. [1]

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(v) The boiling temperatures of some alkanes are shown in the table.

Alkane	Boiling temperature / °C
2,2-dimethylpropane	9
2-methylbutane	28
pentane	35
2,2-dimethylbutane	50
2-methylpentane	60
hexane	69
heptane	98

State **two** factors that affect the boiling temperature of an alkane that can be deduced from the formulae of these alkanes. Suggest reasons for these variations in boiling temperatures. [4]

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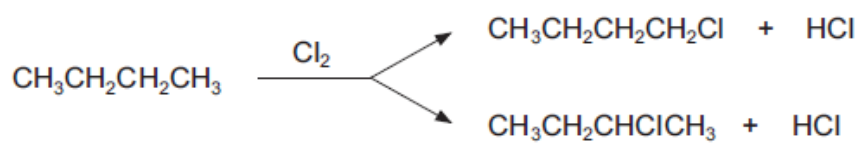
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- (vi) A radical reaction occurs when alkanes are reacted with chlorine in the presence of ultraviolet light. For example in the chlorination of butane.

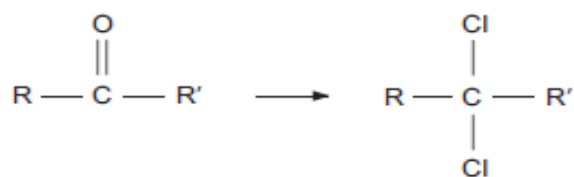


- I. Give the **displayed** formula of the carbon-containing radical that leads to 2-chlorobutane. [1]

- II. State the name of an alkane that can be made as a side product during the chlorination of butane. [1]

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6. (a) Ketone **W** reacted with phosphorus(V) chloride to give the corresponding dichloro compound.



ketone **W**

- (i) Describe how to show the presence of chlorine in this compound. [4]

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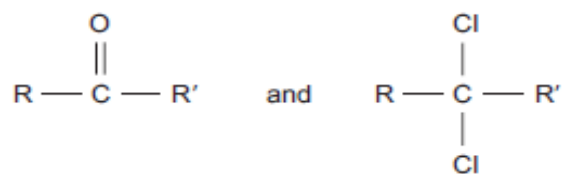
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- (ii) 6.35g of the dichloro compound formed from ketone **W** contained 50.3% of chlorine by mass, the remainder being carbon and hydrogen.

Calculate the relative molecular mass of the dichloro compound. [2]

$M_r =$

- (iii) Explain why both the molecules shown below have the same splitting pattern in their ^1H NMR high resolution spectra. [1]

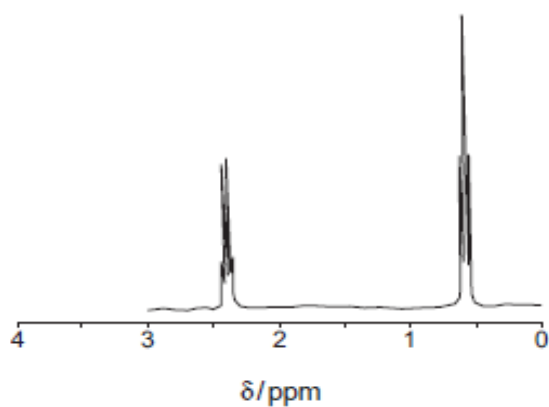


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- (iv) The ^1H NMR spectrum of ketone W is shown below.



Assuming that the alkyl groups R and R' are the same, use the information from the NMR spectrum to deduce the structure of ketone W. [3]

(b) The relative molecular mass of a volatile compound L can be found by weighing a sample and measuring the volume of its vapour at a known temperature and pressure.

(i) In an experiment the following results were obtained.

Mass of liquid L = 0.222 g
Volume of vapour produced = 111 cm³
Temperature = 423 K
Pressure = 9.50×10^4 Pa

Use this data to calculate the relative molecular mass of compound L. [2]

$M_r = \dots\dots\dots$

(ii) Tests on liquid L showed that

- it did not liberate carbon dioxide with sodium hydrogencarbonate solution.
- it contained 2 oxygen atoms in each molecule
- when it was heated with aqueous sodium hydroxide it did not produce ethanol as one of the products

Discuss these results and then suggest a structure for liquid L. [4]

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