

Name:

Target grade:

Mark: / 35

Actual grade:

Percentage:

Homework 9 – Chromatography and spectroscopy

1. It is thought that using virgin olive oil in cooking reduces the risk of cancer from free radicals.

Chemists have shown that the oil contains tyrosol and hydroxytyrosol, which are strong scavengers of free radicals.

A mixture of these two liquid compounds, tyrosol and hydroxytyrosol, is extracted from olive oil.

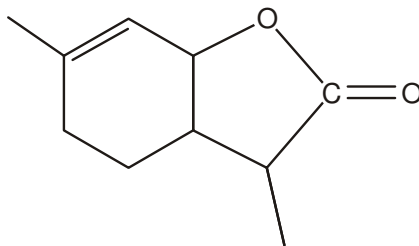
Describe how you would carry out thin layer chromatography to show that there are two compounds in a mixture.

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[Total 5 marks]

2. The smell and flavour of many white wines are due to the presence of an ester called a lactone.

The lactone shown below has a sweet coconut odour.



molecular formula $C_{10}H_{14}O_2$

- (a) Ring the part of the molecule that shows you that this lactone is an ester.

[1]

Name:

- (b) How many chiral carbons are present in the lactone molecule?

number of chiral carbons =

[1]

- (c) Thin layer chromatography (t.l.c.) can be used to show that this lactone is present in white wine.

However, the lactone is colourless.

Suggest one method of treating the t.l.c. plate to make the spot visible.

.....

[1]

- (d) The structure of the lactone can be identified by using mass spectrometry and nuclear magnetic resonance spectroscopy.

- (i) In the mass spectrum of the lactone, at what mass value would you expect to see the molecular ion peak?

mass value =

[1]

- (ii) Also in the mass spectrum there is a peak at a mass value of 15.

Give the formula of the ion responsible for this peak.

.....

[2]

[Total 6 marks]

Name:

3. In this question, one mark is available for the quality of spelling, punctuation and grammar.

A solid sample is thought to be impure acetanilide. The sample is soluble in ethanol.

Describe how thin-layer chromatography would be carried out to show that acetanilide is present in the sample.

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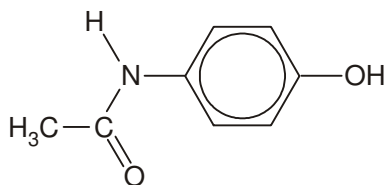
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[6]

Quality of Written Communication [1]

[Total 7 marks]

4. Acetaminophen is a medicine that reduces the symptoms of a fever. It is sometimes used as a substitute for aspirin for people who suffer from stomach disorders. Like aspirin, it is a solid.



acetaminophen

Name:

- (i) In this question, one mark is available for the quality of spelling, punctuation and grammar.

A sample of acetaminophen has been stored for some time and is found to be contaminated with impurities. It can be purified by recrystallisation, using ethanol as the solvent.

Describe how you would carry out the recrystallisation in the laboratory to obtain a pure sample of acetaminophen.

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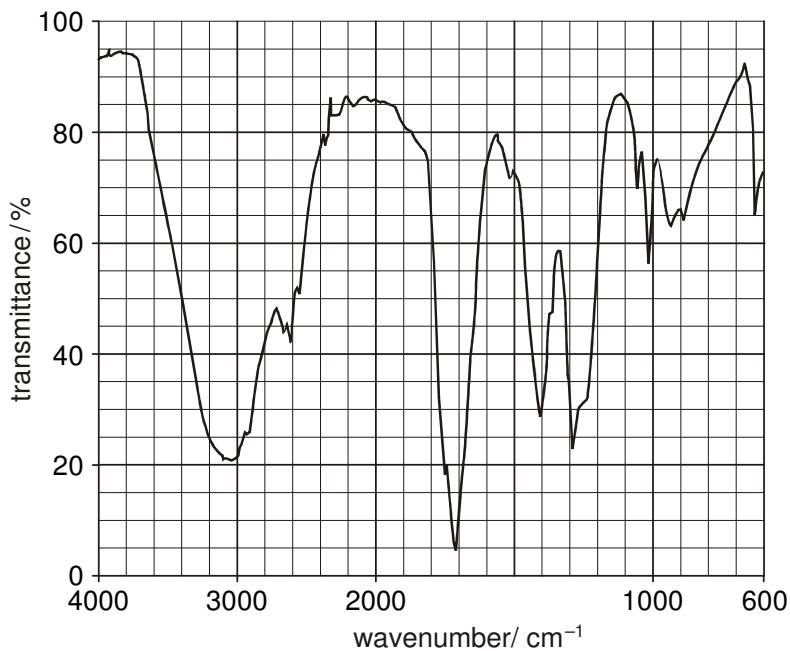
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[5]

Quality of Written Communication [1]

Name:

- (ii) The stored sample of acetaminophen is damp and some hydrolysis has taken place to give the impurities. The infrared spectrum of **one** of the impurities, **X**, is shown below.



Use the *Data Sheet*, together with the information above, to identify the functional group in **X**. Give your reasoning by identifying the key peaks in the spectrum and the bond to which each corresponds.

reasoning:

.....

.....

functional group:

[3]

- (iii) The M_r of **X** is 60. Draw the **full structural formula** of **X**.

[2]

Name:

- (iv) 2.00 g of **impure** acetaminophen contains 0.010 mol acetaminophen. Calculate the percentage by mass of acetaminophen in the impure sample.

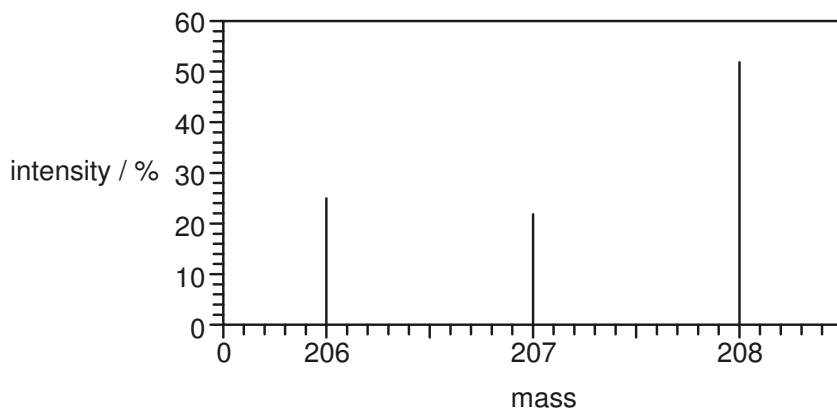
A_r : H,1.00; C,12.0; N,14.0; O,16.0

percentage purity = %

[3]

[Total 14 marks]

5. Another possible instrumental technique to detect the presence of lead compounds is mass spectrometry. A simplified mass spectrum for lead is shown below.



- (i) Explain why there is more than one peak in the mass spectrum of lead.

.....
.....

[2]

Name:

(ii) What information is given by the relative heights of the peaks?

.....

[1]
[Total 3 marks]