OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY 2815/04

Methods of Analysis and Detection

Tuesday **29 JUNE 2004** Morning 50 minutes

Candidates answer on the question paper.
Additional materials:
Data Sheet for Chemistry
Scientific calculator

Candidate Name	Centre Number	Candidate Number

TIME 50 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	13	
2	9	
3	10	
4	13	
TOTAL	45	

This question paper consists of 10 printed pages and 2 blank pages.

Registered Charity Number. 1066969
[Turn over

Answer **all** the questions.

1 We see the flower of a poppy as red.

(a) Explain why we see the poppy as a red colour.

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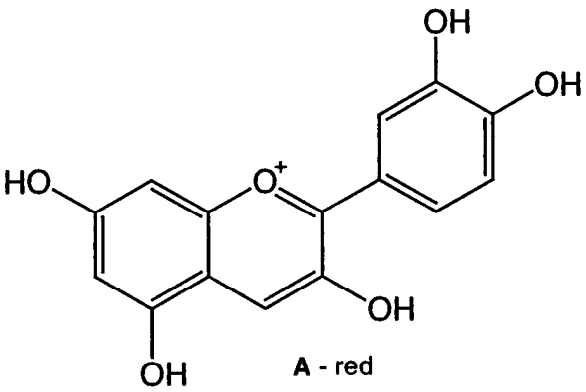
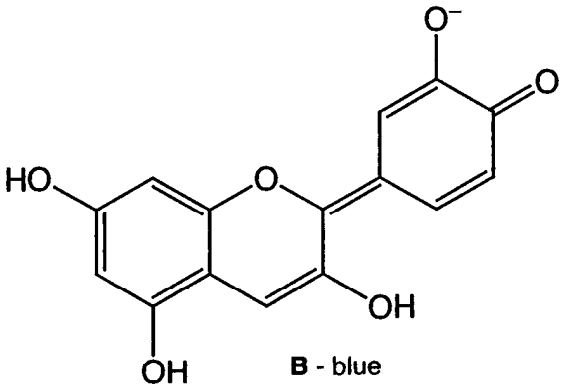
..... [1]

(b) Two related species, **A** and **B**, are responsible for the red colour of poppies and the blue colour of cornflowers.



A - red



B - blue

(i) Explain, in terms of energy levels, why **A** and **B** are coloured.

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..... [3]

(ii) Suggest why **A** is red whereas **B** is blue.

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..... [2]

(c) Explain how the ionisation energy of hydrogen may be determined from its atomic emission spectrum.

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..... [5]

(d) When an iron rod is heated in a flame, it eventually glows red.

Suggest why the very hot metal appears red.

.....

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..... [2]

[Total: 13]

2 This question concerns the analysis of organic compounds from their mass spectra.

(a) What is meant by the following terms used in mass spectrometry?

molecular ion peak ..... [1]

base peak ..... [1]

(b) In the mass spectra of organic compounds, a small peak exists at (M+1) that can help to determine the number of carbon atoms in the compound.

(i) What is responsible for this (M+1) peak?

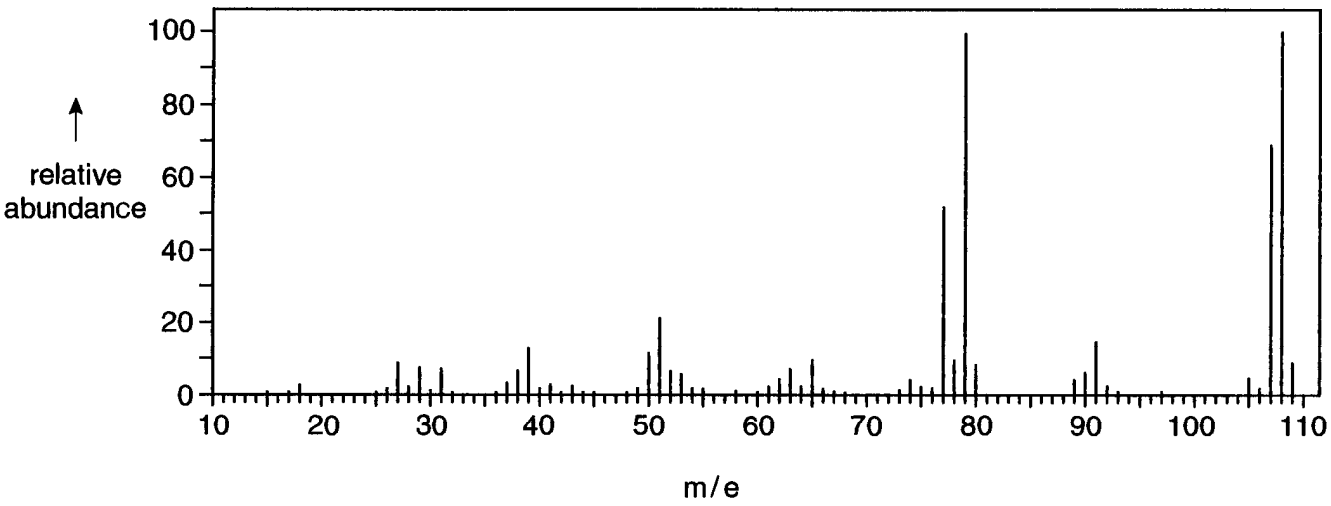
..... [1]

(ii) In a mass spectrum of compound **D**, this peak has a relative height of 0.7 compared with one of 10.4 for the molecular ion peak.

Calculate the number of carbon atoms in a molecule of compound **D**. Show your working.

[2]

(c) A different compound, **E**, has the molecular formula C_7H_8O. The mass spectrum of compound **E** is shown below.



(i) What is the m/e of the molecular ion of compound **E**? ..... [1]

(ii) What fragment ion is responsible for the peak at m/e 77? ..... [1]

(d) On reaction with a halogen, compound **E** forms compound **G**. The spectrum of compound **G** has an M and an (M+2) peak with the same relative abundance.

(i) Which halogen was used in the reaction? ..... [1]

(ii) What is the value of m/e for the molecular ion peak for compound **G**? ..... [1]

[Total: 9]

[Turn over

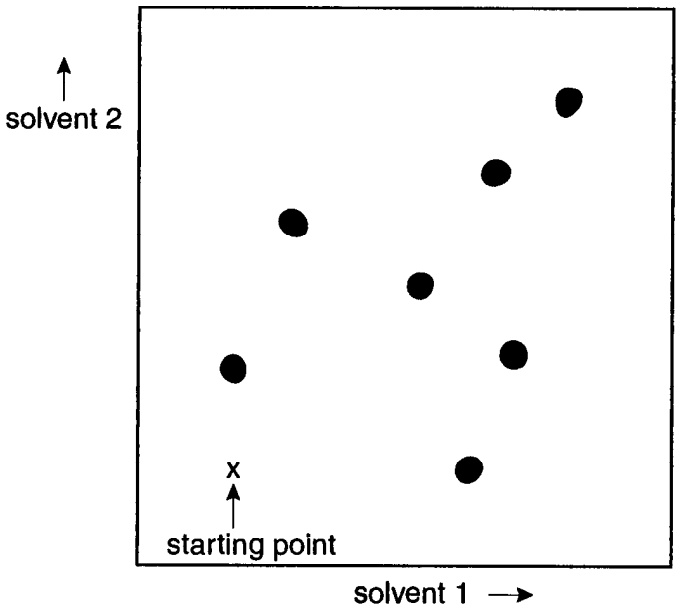
3 **(a)** Gas liquid chromatography and paper chromatography both use partition to separate the components of a mixture.

Identify the phases used for the partition in each method.

method	stationary phase	mobile phase
gas/liquid chromatography		
paper chromatography		

[2]

(b) The chromatogram below shows the results of two-way chromatography on a mixture of dyes.



(i) Label, with a **U**, any dye which did **not** move in solvent 1. [1]

(ii) Label, with an **S**, the dye which moved most in **both** solvents. [1]

For Examiner's Use

(c) In this question, one mark is available for the quality of written communication.

Describe the process by which DNA may be used to produce a genetic fingerprint.

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..... [5]

Quality of Written Communication [1]

[Total: 10]

[Turn over

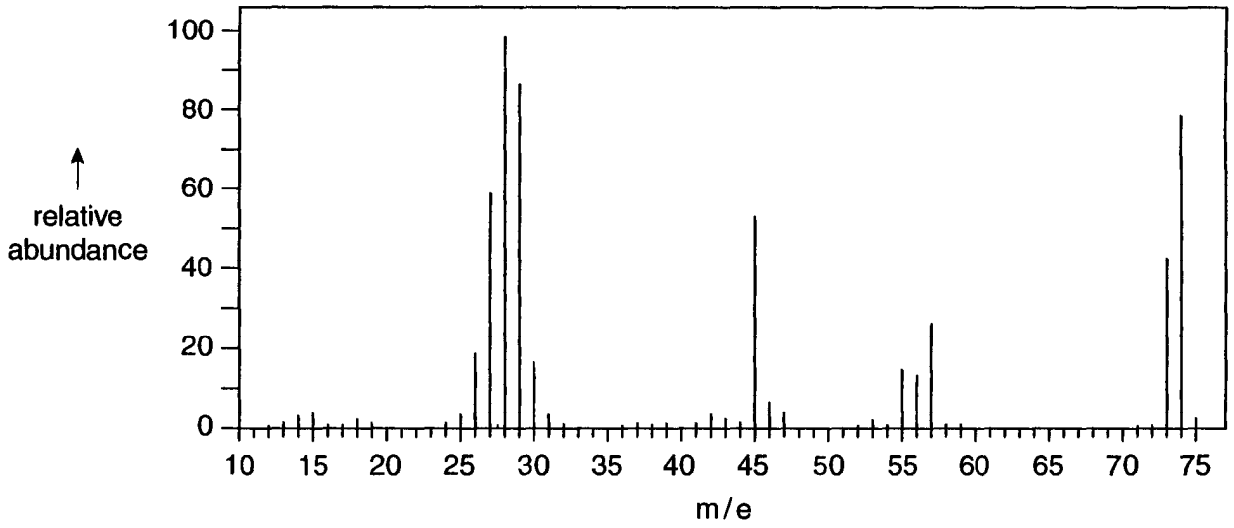
For Examiner's Use

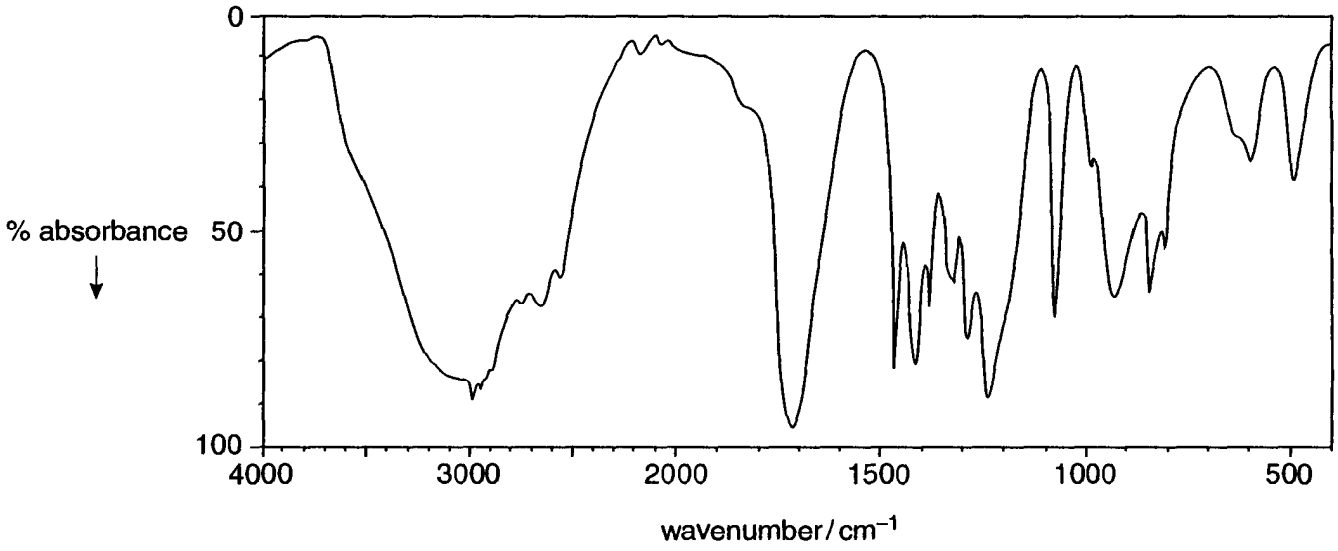
4 **(a)** State the regions of the electromagnetic spectrum that are used for

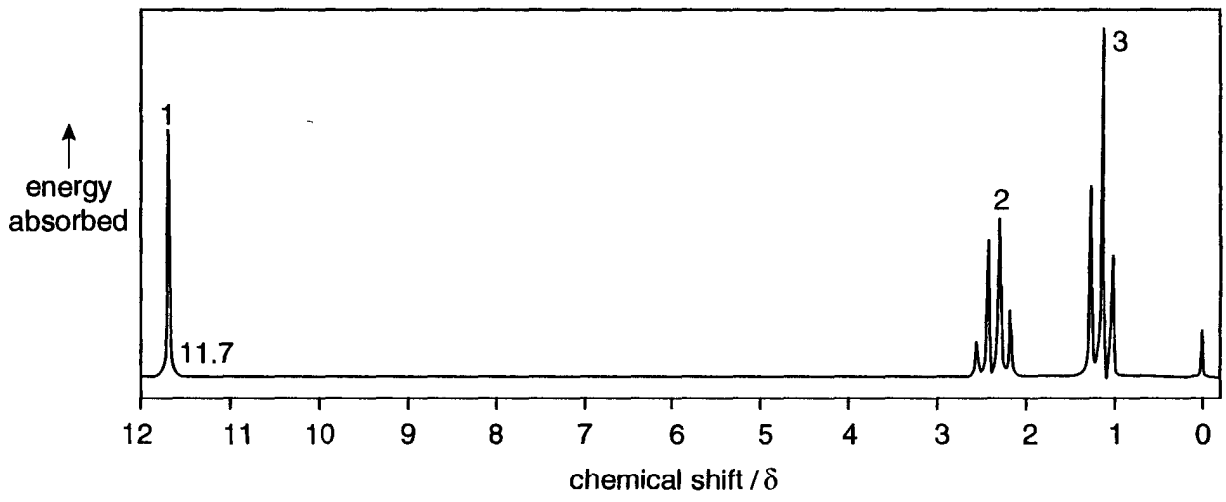
atomic emission spectroscopy .....

n.m.r. spectroscopy ..... [2]

(b) Compound **J** produced the three spectra given below.







(i) Compound **J** has the formula $C_xH_yO_2$, and is known to be saturated.

Use the mass spectrum to deduce the values of *x* and *y*, showing how you arrive at your answer.

[2]

(ii) Use the i.r. spectrum to identify **three** absorptions due to characteristic bonds. You should quote the bond and the wavenumber of the absorption **in the spectrum**.

1 ..... [1]

2 ..... [1]

3 ..... [1]

(iii) Study the n.m.r. spectrum and use the *Data Sheet* to identify the proton environments that exist in compound **J**.

[3]

(iv) What extra information is provided by the splitting patterns?

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..... [2]

(v) Use the data from the three spectra to suggest a structure for **J**.

[1]

[Total: 13]

END OF QUESTION PAPER