OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY 2815/05

Gases, Liquids and Solids

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	12	
2	10	
3	10	
4	13	
TOTAL	45	

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

Registered Charity Number 1066969
[Turn over

For Examiner's Use

Answer **all** the questions.

1 This question is about the behaviour of solids, liquids and gases.

(a) Describe, using a kinetic-molecular model, what happens when a molecular solid is heated until it becomes molten. Your answer should include a description of both solid and liquid states.

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..... [3]

(b) Continued heating of the liquid from **(a)** will eventually produce a gas, but such a gas is **not** ideal.

(i) Name an example of a gas which **does** approach ideal behaviour.

..... [1]

(ii) Under certain conditions, all gases approach ideality. State these conditions. Explain why the gas approaches ideality under these conditions.

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..... [4]

(c) The relative molecular mass of a volatile liquid can be determined by vaporising a known mass of the liquid. The volume and temperature of the vapour produced are then measured. The relative molecular mass is calculated using the Ideal Gas Equation.

(i) State the Ideal Gas Equation. ..... [1]

(ii) In an experiment, 0.180 g of a liquid **L** produce a vapour of volume 77.0 cm^3 at a pressure of 100 kPa and a temperature of 373 K.

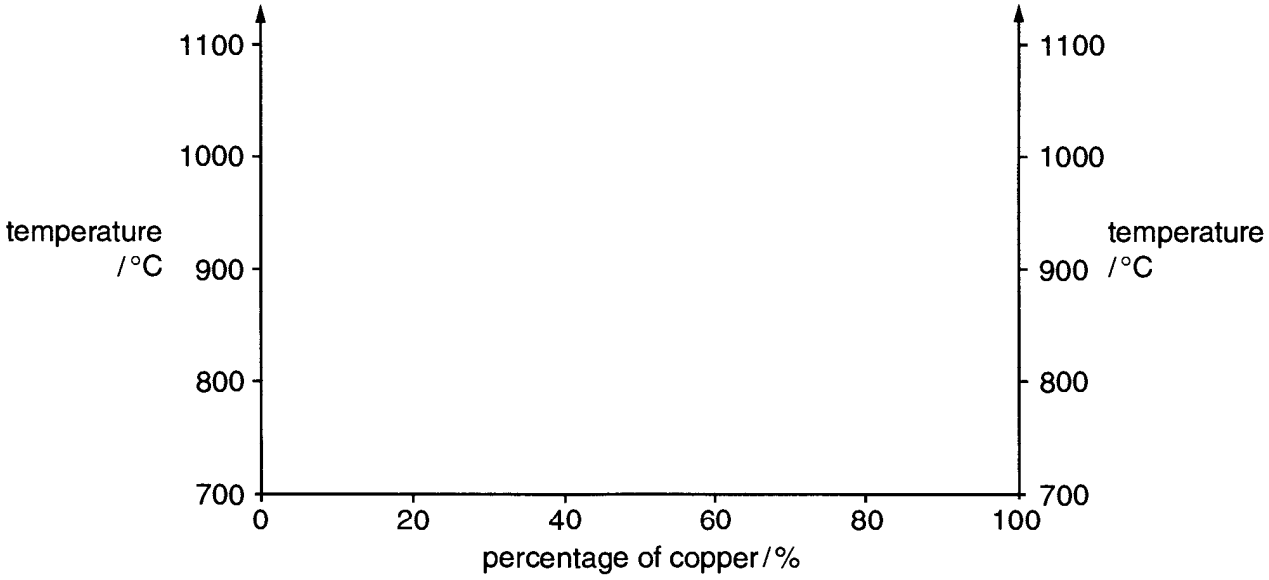
Use the Ideal Gas Equation to calculate the relative molecular mass of **L**.
$R = 8.31\ J\ K^{-1}\ mol^{-1}$

molecular mass = ... [3]

[Total: 12]

2 Pure copper melts at 1081 °C, and pure silver melts at 960 °C. Mixtures of copper and silver melt at lower temperatures than either pure metal. The mixture with the lowest melting point consists of 40% copper and 60% silver and melts at 778 °C.

(a) (i) Using the data above, sketch the phase diagram for mixtures of copper and silver on the axes provided, indicating the composition of the different areas.



[3]

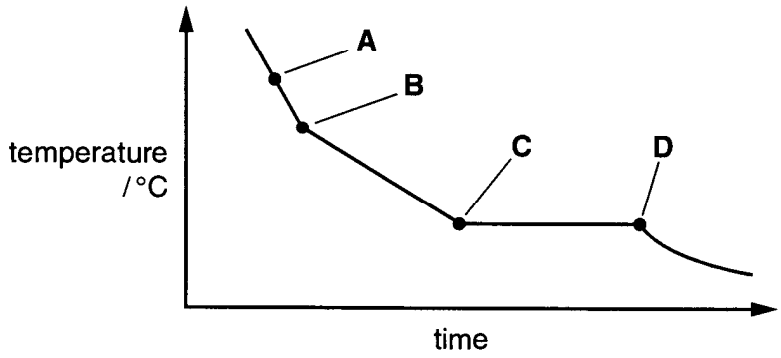
(ii) What name is given to the mixture which melts at 778 °C?

.....

[1]

For Examiner's Use

(b) (i) The cooling curve below is for a mixture containing 30% copper.
State what is happening at each of the points indicated.



A .....

B .....

C .....

D .....

[4]

(ii) Explain how the cooling curve of the mixture containing 40% copper in **(a)**, differs from the one containing 30% copper shown in **(b)(i)**.

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..... [2]

[Total: 10]

[Turn over

For Examiner's Use

3 This question is about the solubility of substances in different solvents.

(a) Gases dissolve in water to varying extents depending on their nature, the temperature and pressure.

(i) A glass of cold water from the tap develops bubbles of gas when left to stand at room temperature. Why?

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..... [1]

(ii) Explain why ammonia dissolves readily in water.

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..... [2]

(iii) Explain why a bottle of cola produces lots of bubbles of gas when the top is removed.

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..... [1]

(b) One of the important techniques in separating substances is solvent extraction. This relies on a process called partition.

(i) State what is meant by the term *partition*.

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..... [1]

For Examiner's Use

(ii) In a laboratory preparation, a solution of the organic product in water was shaken with the solvent ethoxyethane.

50.0 cm^3 of the aqueous solution was shaken with 50.0 cm^3 of ethoxyethane.

0.250 g of the product remained in the aqueous solution.

1.25 g had dissolved in the ethoxyethane.

Calculate the partition coefficient for the product under these conditions.

[1]

(iii) Instead of using one 50 cm^3 portion of ethoxyethane as in **(b)(ii)**, two 25 cm^3 portions were used.
Calculate the total mass of product that was extracted.

[4]

[Total: 10]

[Turn over

For Examiner's Use

4 This question concerns mixtures of liquids and their separation.

(a) (i) What law may be represented by the expression: $p_A = n_A \times p_A^o$?

p_A represents the partial pressure due to **A**
n_A is the mole fraction of **A** present in a mixture
p_A^o is the vapour pressure of pure **A**.

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..... [1]

(ii) What types of liquids form **ideal** solutions?

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..... [1]

(iii) Under what circumstances does a mixture of liquids show a **positive** deviation from ideal behaviour?

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(iv) On the axes below, sketch a graph showing a positive deviation. Label the axes.

[2]

For Examiner's Use

(b) (i) State what is meant by an *azeotropic mixture*.

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..... [1]

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

A fractionating column enables mixtures of liquids to be separated.

Explain the separation process in terms of

- the principles involved
- the packing of the column
- the concept of theoretical plates.

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..... [6]

Quality of Written Communication [1]

[Total: 13]

END OF QUESTION PAPER