OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

CHEMISTRY 2815/05

Gases, Liquids and Solids

Monday **26 JUNE 2006** 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 that 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 quality of written communication where this is indicated in the question.
- Your may use a scientific calculator.
- You may use the *Data Sheet for Chemistry*.
- You are advised to show all the steps in calculations.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**9**	
2	**9**	
3	**10**	
4	**17**	
TOTAL	**45**	

This question paper consists of 12 printed pages.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 The kinetic theory of gases is an explanation about how gaseous particles move. It was developed largely by the scientists Clausius and Maxwell.

The theory has several basic assumptions.

(a) State **three** basic assumptions that scientists make about the particles in an ideal gas.

1. .....

2. .....

3. ..... [3]

(b) Gases in a container exert pressure.

(i) What causes this pressure?

.....

..... [1]

(ii) The ideal gas equation is:

$$pV = nRT.$$

What pressure would be exerted by 10.5 g of propene, C_3H_6, in a container of volume 3.50 dm^3 at 80 °C? State the units.

$R = 8.314\ J\ K^{-1}\ mol^{-1}$

pressure = ...

units = ... [3]

(c) Gases do not show ideal behaviour at very low temperatures or very high pressures.

Explain why.

.....

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.....

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..... [2]

[Total: 9]

2 Carbon dioxide gas is dissolved in water to produce the 'fizz' in fizzy drinks such as lemonade.

(a) Explain why a large number of bubbles are seen escaping from a bottle of lemonade when the top is first released.

.....

.....

.....

..... [2]

(b) State *Henry's law*.

.....

.....

..... [2]

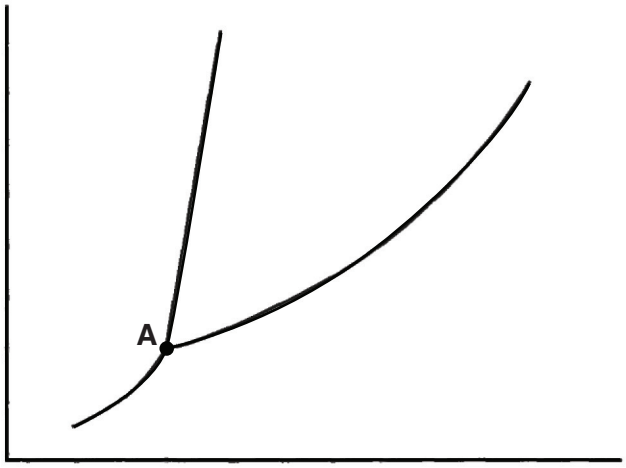
(c) The Henry's law constant, K_h, for carbon dioxide in water is 3.37×10^{-4} mol dm^{-3} kPa^{-1} at 25 °C.

Calculate the amount in moles of $CO_2(g)$ that will dissolve in a 2.00 dm^3 bottle of water at 100 kPa and 25 °C.

answer = ... mol [2]

(d) Carbon dioxide exists as a gas at room temperature and pressure, but it is used as a solid in 'dry ice' to create dramatic effects in the theatre.

The phase diagram for carbon dioxide is shown below.



(i) Label the axes of the graph. [1]

(ii) Label the areas of the graph. [1]

(iii) Point **A** is the *triple point*. What is the significance of point **A**?

.....

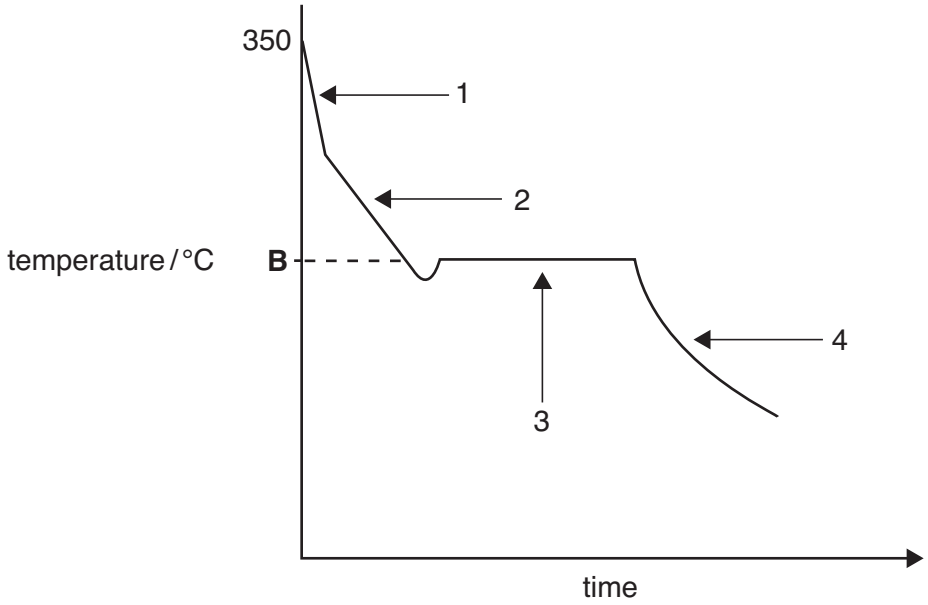
..... [1]

[Total: 9]

3 Tin and lead are mixed together to use as a solder in the manufacture of circuit boards for the electronics industry.

Pure tin melts at 232 °C. Pure lead melts at 328 °C. A mixture containing 64% tin and 36% lead by mass has a melting point of 183 °C. This composition has the lowest temperature at which any liquid is present.

(a) The **cooling curve** for a mixture containing 50% Sn and 50% Pb by mass, cooled from 350 °C, is shown below.



(i) State what is happening at **each** of the parts of the graph numbered 1–4.

1. .....

2. .....

3. .....

4. ..... [4]

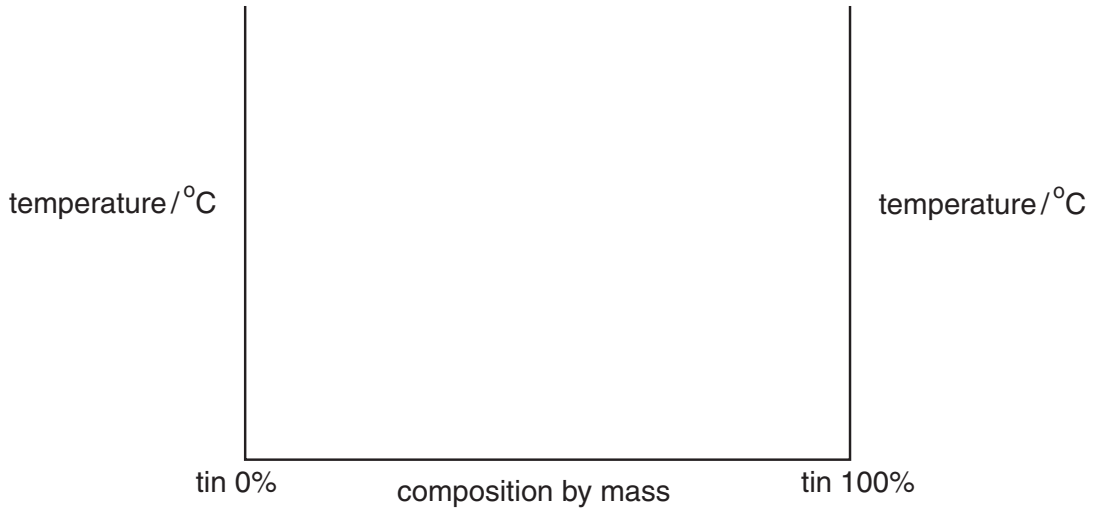
(ii) Deduce the temperature at **B**.

..... [1]

(b) **(i)** Draw a **phase diagram** for a mixture of tin and lead on the axes below.

Label areas of phases on the diagram.

Indicate significant temperatures on the temperature axis.



[4]

(ii) What term is given to the mixture with the composition 64% tin and 36% lead by mass?

..... [1]

[Total: 10]

4 This question is about distillation of different mixtures of liquids.

(a) Crude oil is a mixture of liquids which can be separated into fractions using fractional distillation.

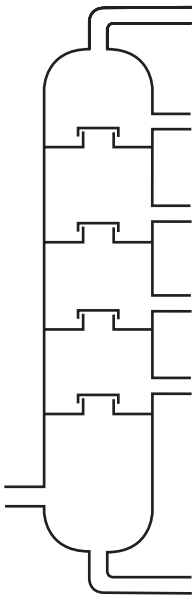
(i) What makes crude oil suitable for separation by fractional distillation?

.....

..... [1]

(ii) In this question, one mark is available for the quality of use and organisation of scientific terms.

Describe how the fractions in crude oil are separated in the industrial fractionating column shown below.



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Quality of Written Communication [1]

(b) Distillation uses scientific ideas that were researched by Francois-Marie Raoult.

(i) State *Raoult's law*.

.....

.....

..... [2]

(ii) A mixture containing equal amounts in moles of ethanol and water is distilled. In this mixture, the vapour pressure of ethanol is 180 kPa and that of water is 70 kPa.

What is the mole fraction of ethanol in the vapour that distils off?

[2]

(c) A mixture of ethanol and water has a positive deviation from Raoult's law.

(i) Sketch the shape of the vapour pressure-composition curve that you would expect for a mixture of ethanol and water. Label the axes.

[2]

(ii) Explain why a positive deviation is observed.

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..... [2]

(d) The table below shows the boiling points of two compounds.

compound	boiling point / °C
ethanol	78
pentane	36

Explain why the boiling points of ethanol and pentane are different.

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..... [2]

[Total: 17]

END OF QUESTION PAPER