

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS****Advanced GCE****CHEMISTRY****2815/03**

Environmental Chemistry

Tuesday

**24 JUNE 2003**

Morning

50 minutes

Candidates answer on the question paper.

Additional materials:

*Data Sheet for Chemistry*

Scientific calculator

Candidate Name	Centre Number	Candidate Number										
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**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	7	
2	8	
3	10	
4	12	
5	8	
<b>TOTAL</b>	<b>45</b>	

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**This question paper consists of 7 printed pages and 1 blank page.**

Answer **all** the questions.

1 This question is concerned with domestic and industrial waste.

(a) (i) Describe **one** way in which the composition of domestic waste has changed over the last 25 years.

.....  
.....[1]

(ii) Suggest a consequence of the change you describe for waste disposal by landfill.

.....  
.....  
.....[1]

(b) Certain toxic chemicals such as benzene,  $C_6H_6$ , can linger in soils under old petrol stations and in landfill sites. Some bacteria, *Dechloromonas*, have been discovered which will oxidise benzene to carbon dioxide under anaerobic conditions.

(i) What is the meaning of the term *anaerobic*?

.....[1]

(ii) In car engines, the benzene in petrol burns aerobically. Write a balanced equation for the **complete** oxidation of benzene in air.

.....[1]

(iii) Work out the volume of carbon dioxide, at room temperature and pressure, produced by the complete oxidation of 1.00 kg of benzene.

The volume of 1 mol of molecules of a gas at room temperature and pressure is  $24.0 \text{ dm}^3$ .

[3]

[Total: 7]



- 3 This question is about the greenhouse effect and carbon dioxide. The table shows the greenhouse factors (relative effects) of various gases in the Earth's atmosphere.

gas	greenhouse factor
CO <sub>2</sub>	1
CH <sub>4</sub>	30
N <sub>2</sub> O	150
O <sub>3</sub>	2 000
CFCs	10 000–25 000

- (a) (i) Explain what is meant by the term *greenhouse gas*.

.....  
 .....  
 .....[2]

- (ii) Name the compound, not included in the table, which makes the largest contribution to the overall greenhouse effect.

.....[1]

- (iii) Suggest a reason why nitrogen is **not** a greenhouse gas.

.....  
 .....[1]

- (iv) In addition to the greenhouse factor, what else affects the contribution of a particular substance to the overall greenhouse effect?

1 .....  
 2 .....[2]

- (b) Some scientists have suggested that carbon dioxide could be absorbed from the atmosphere into huge lakes of calcium hydroxide solution.

Write an equation for the process and state what type of reaction is involved.

.....  
 .....[2]

- (c) Explain why carbonated water fizzes when the cap is removed from the bottle.

.....  
 .....  
 .....[2]

[Total: 10]

4 This question is about ion exchange in 2:1 clays.

(a) Explain the presence of high negative charge on the surface of the layers in a 2:1 clay.

.....  
.....  
.....  
.....  
.....  
.....  
.....[3]

(b) (i) Explain how 2:1 clays can act as ion exchangers.

.....  
.....  
.....  
.....[3]

(ii) Suggest why using clay as the ion exchanger might not be a practical method for softening hard water.

.....  
.....[1]

(c) What is the importance of ion exchange by clays to plant life?

.....  
.....  
.....[2]

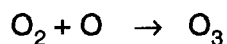
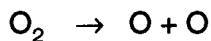
(d) Explain why clay used in pottery is more likely to be a 1:1 clay than a 2:1 clay.

.....  
.....  
.....  
.....  
.....  
.....  
.....[3]

[Total: 12]

- 5 Under unpolluted conditions, the concentration of ozone in the stratosphere remains fairly constant. Ozone is constantly being formed and broken down, but the two processes occur at the same rate.

The formation of ozone in the stratosphere occurs by the two step process shown below.



- (a) (i) What is the source of energy for this process?

.....[1]

- (ii) What is the importance of the ozone layer to life on Earth?

.....  
.....[1]

- (b) Explain how the release of CFCs into the lower atmosphere affects the concentration of ozone in the stratosphere.

.....  
.....  
.....  
.....  
.....[4]

- (c) HFCs, such as  $\text{CF}_3\text{CH}_2\text{F}$ , can be used as alternatives to CFCs.

Outline the chemical properties of HFCs which can make them less damaging than CFCs to the ozone layer.

.....  
.....  
.....[2]

[Total: 8]