

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

Advanced GCE

**CHEMISTRY****2815/03**

Environmental Chemistry

Wednesday

**30 JANUARY 2002**

Afternoon

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 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		
Question Number	Max.	Mark
1	7	
2	12	
3	14	
4	12	
<b>TOTAL</b>	<b>45</b>	

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**This question paper consists of 8 printed pages.**

Answer **all** questions.

1 Under the EC Landfill Directive of 1999 the amount of biodegradable waste going to landfill is to be reduced by 50% by 2009.

(a) Explain the meaning of the term *biodegradable*.

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

(b) State **two** advantages of the decomposition of biodegradable waste.

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

(c) One advantage of waste incineration is the recovery of energy.

(i) How may the recovered energy be used?

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

(ii) Explain the need for temperature control during the incineration of some wastes.

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

[Total : 7]

2 The solubility of oxygen in water is  $2.58 \times 10^{-4} \text{ mol dm}^{-3}$  at atmospheric pressure and 298 K. Under these conditions 1.00 mol of gas molecules occupies  $24.0 \text{ dm}^3$ .

(a) Calculate the volume of oxygen dissolved in  $1.00 \text{ dm}^3$  of water at atmospheric pressure and 298 K. Include units in your answer.

Answer ..... [2]

(b) What effect does increased pressure have on the solubility of oxygen in water?

.....[1]

(c) A power station discharges warm water into a river. Describe and explain the possible effects of this on plant and animal life in the river.

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

(d) (i) The carbon dioxide dissolved in river water is present partly as the hydrogencarbonate ion,  $\text{HCO}_3^-$ . Explain, with equations, how this ion can act both as an acid and as a base in its reactions with water.

[4]

(ii) Write an equation for the thermal decomposition of calcium hydrogen carbonate,  $\text{Ca}(\text{HCO}_3)_2$ .

[1]

[Total : 12]

[Turn over



(d) Nitrogen monoxide is also produced by jet aircraft flying in the stratosphere. Write an equation for the reaction of nitrogen monoxide with ozone.

.....[1]

(e) In the stratosphere there are droplets of sulphuric acid.

(i) Explain how this sulphuric acid is made from sulphur dioxide.

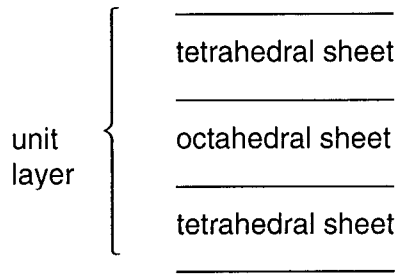
.....  
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.....[2]

(ii) The stratospheric sulphur dioxide probably comes from volcanoes rather than from the burning of fossil fuels. Explain why the sulphur dioxide is unlikely to have come from the burning of fossil fuels.

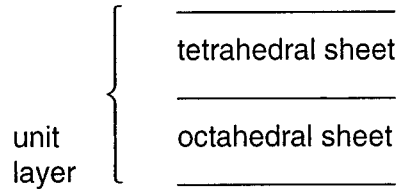
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.....[1]

[Total : 14]

4 The diagrams below show a unit layer of a 2:1 and a 1:1 clay.



**2:1 clay**



**1:1 clay**

(a) Explain what holds adjacent **unit layers** together in the clay in each case. You may find it helpful to include diagrams in your answer.

2:1 clay

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.....

.....

1:1 clay

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.....

.....

.....[4]

(b) Explain why soils containing the 2:1 clay crack easily when they dry out.

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

(c) (i) Why are the surfaces of 2:1 clays negatively charged?

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

(ii) State and explain **two** reasons why 2:1 clays, such as vermiculite, have a higher cation exchange capacity than 1:1 clays such as kaolinite.

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

[Total : 12]