

**ADVANCED GCE****CHEMISTRY**

Environmental Chemistry

2815/03

Candidates answer on the Question Paper
A calculator may be used for this paper

OCR Supplied Materials:

- *Data Sheet for Chemistry* (inserted)

Other Materials Required:

- Scientific calculator

Monday 28 June 2010
Morning

Duration: 50 minutes



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **45**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculations.
- This document consists of **8** pages. Any blank pages are indicated.

Examiner's Use Only:			
1			
2			
3			
4			
Total			

Answer **all** the questions.

- 1 The oxygen-only reactions involved in the formation of ozone in the stratosphere may be summarised as follows.

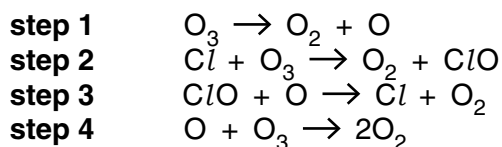


- (a) The values quoted above for ΔH refer to standard conditions.

Explain why these values will **not** apply to the reactions in the stratosphere.

.....
 [2]

- (b) The presence of CFCs in the stratosphere can lead to ozone depletion through the reaction sequence shown below.



- (i) In the reaction sequence above, give the number of the step that is the termination step.

..... [1]

- (ii) It is possible for one chlorine free-radical to destroy many molecules of ozone.

Use the reaction sequence above to explain how this may occur.

.....

 [2]

- (iii) Draw electron structures to show the difference between an oxygen free-radical and an oxide ion. You need only draw the outer electrons.

oxygen free-radical	oxide ion
----------------------------	------------------

[2]

- (c) (i) State **one** beneficial effect of the presence of ozone in the stratosphere.

..... [1]

- (ii) State **one** damaging result of ozone pollution in the troposphere.

..... [1]

- (iii) Emissions of CFCs have been significantly reduced over the last 20 years.

Suggest why this reduction has **not** yet fully restored the ozone layer.

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

- (iv) Environmentally safer alternatives to CFCs have now been developed which have less effect on the ozone layer.

Suggest **two** other properties that would be desirable for these alternatives.

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

[Total: 13]

2 Clays are aluminosilicate minerals with a layered structure.

(a) A basic building block of clays is the silicate ion, SiO_4^{4-} .

(i) Draw the three-dimensional structure of this ion, stating its shape.

[2]

(ii) The mineral, Rankinite, is a calcium salt. Its anion consists of two SiO_4^{4-} units linked by sharing one oxygen.

Suggest the formula and charge of the anion.

..... [2]

(iii) Deduce the formula of Rankinite.

..... [1]

(b) Clays may be described as 1:1 or 2:1.

Explain the meaning of 1:1 and 2:1 as a description of the structure of clays.

.....

.....

..... [2]

(c) The table shows the cation exchange capacity for two clays, **A** and **B**.

clay	cation exchange capacity / mol kg ⁻¹
A	0.1
B	1.0

(i) Use the table to deduce which of the clays is a 1:1 clay and which is a 2:1 clay.

Explain your answer, by referring to **A** and to **B**.

.....

 [3]

(ii) Explain the importance of cation exchange for the supply of some of the nutrient ions required by plants.

.....

 [2]

(iii) What is the effect of lowering the pH on the supply of nutrient cations to plants?

.....

 [2]

[Total: 14]

3 Organic waste in landfill sites is decomposed by aerobic and anaerobic bacteria.

(a) What is meant by the term *anaerobic*?

..... [1]

(b) Under anaerobic conditions, sulphur-containing compounds break down to release a gas.

Name this gas and state why its formation is undesirable.

.....

..... [2]

(c) In this question, one mark is available for the quality of spelling, punctuation and grammar.

Discuss the **advantages** and **disadvantages** of incinerating waste containing paper and plastic.

.....

.....

.....

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.....

.....

.....

Quality of Written Communication [1]

[Total: 8]

- 4 (a) Temporary hardness can arise in water which has trickled through rocks containing magnesium carbonate.

(i) Explain how this temporary hardness arises.

In your answer include an equation.

.....

.....

.....

..... [2]

(ii) Suggest **two** factors that might affect the amount of hardness in the water in (i).

.....

..... [2]

- (b) In areas where there is temporary hardness in the water, a deposit often forms on the heating elements of electric kettles.

Explain why.

.....

.....

..... [2]

- (c) Two processes used in the production of potable (drinking) water are:

- the addition of aluminium ions to the water;
- chlorination of the water.

Explain the purpose of each of these processes.

the addition of aluminium ions

.....

..... [2]

chlorination of the water

.....

..... [2]

[Total: 10]

END OF QUESTION PAPER

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