

**ADVANCED GCE
CHEMISTRY**

Environmental Chemistry

THURSDAY 19 JUNE 2008

2815/03

Morning

Time: 50 minutes

Candidates answer on the question paper.

Additional materials: Scientific calculator
Data Sheet for Chemistry (Inserted)



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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 calculation.

FOR EXAMINER'S USE

Qu.	Max.	Mark
1	9	
2	10	
3	13	
4	13	
TOTAL	45	

This document consists of **9** printed pages, **3** blank pages and a *Data Sheet for Chemistry*.

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Answer **all** the questions.

- 1** In the UK 9% of solid domestic waste is recycled, 8% is incinerated and the rest goes to landfill. Incineration and landfill can both provide energy for the community.

(a) A gas is produced in landfill, as a result of decomposition, from which energy can be derived.

(i) What is the gas produced?

.....[1]

(ii) Under what conditions is the gas produced?

.....[1]

(b) Materials in solid waste can be incinerated to provide energy.

(i) Suggest **two** types of material found in solid waste that could be used to produce energy by incineration. State a compound found in each material.

.....

.....

.....

.....[4]

(ii) What is the other main environmental advantage of incineration?

.....[1]

(iii) Explain why temperature control is essential during incineration.

.....

.....[1]

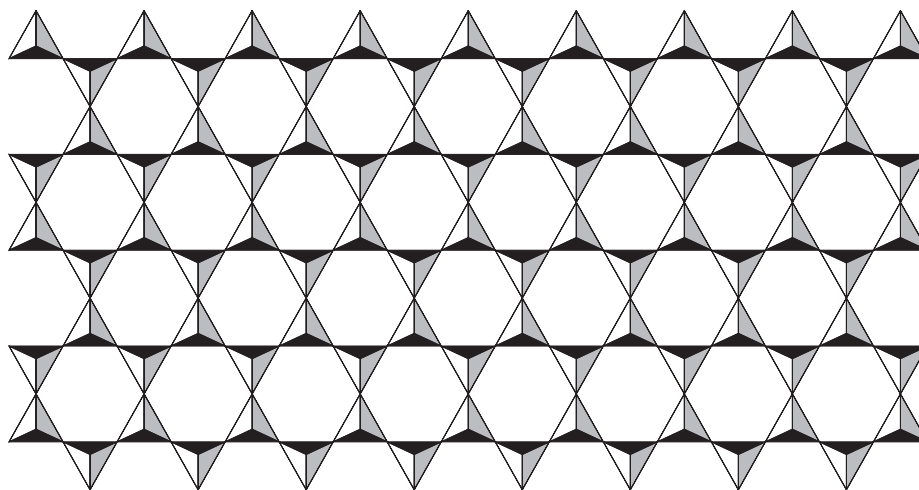
(c) Suggest a source of lead in solid waste.

.....[1]

[Total: 9]

- 2 Montmorillonite, $Al_2Si_4O_{10}(OH)_2$, is a 2:1 clay which can act as an important source of mineral ions needed for plant growth.

- (a) Clays are composed of tetrahedral and octahedral sheets that are combined in layers. The diagram shows a tetrahedral sheet.



- (i) Draw a 3D diagram of one of the  units showing all atoms and bonds.

Explain how the units are held together **within** the sheet.

.....

.....

.....

.....[4]

- (ii) Draw a 3D diagram of one of the units in an **octahedral** sheet showing all atoms and bonds.

[2]

- (iii) Suggest how these two types of sheet are bonded together **within** a 2:1 layer.

.....

[2]

- (b) The cation exchange capacity of clays is important in the supply of cations used as nutrients by plants.

- (i) Give the formula of a cation used as a nutrient.

.....[1]

- (ii) 2:1 Clays generally have higher cation exchange capacities than 1:1 clays.

Suggest **one** reason for this, **other than** replacement of silicon.

.....

[1]

[Total: 10]

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

Account for the acidity of normal rainwater, and explain why the presence of sulphur dioxide in the troposphere causes increased and stronger acidity in 'acid rain'.

Your answer should include equations.

[5]

Quality of Written Communication [1]

- (b)** Normal rainwater and acid rain both react with calcium carbonate in limestone to form hard water.

- (i) The hardness of water, caused by the presence of $\text{Ca}(\text{HCO}_3)_2(\text{aq})$, can be removed by boiling.

Explain the chemistry involved, with an equation.

.....[3]

- (ii) The $\text{Ca}^{2+}(\text{aq})$ ions in the hard water derived from acid rain cannot be removed by boiling.

Suggest a way in which $\text{Ca}^{2+}(\text{aq})$ ions could be removed.

.....

.....

.....

.....[2]

- (c) Explain the use of chlorine in the production of safe drinking (potable) water.

.....

.....

.....

.....

.....[2]

[Total: 13]

4 This question is concerned with gases in the atmosphere.

(a) State **three** processes which affect the concentration of carbon dioxide in the troposphere.

For each process state how it changes the concentration of carbon dioxide.

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

(b) (i) The presence of gases such as carbon dioxide and methane in the troposphere results in warming of the Earth's surface.

Explain the process involved.

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

(ii) State **two** factors which determine the contribution of a particular gas to the warming effect.

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

Explain the chemistry involved in the removal of ozone. Your answer should include equations.

.....[5]

[Total: 13]

END OF QUESTION PAPER

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