

**ADVANCED GCE
CHEMISTRY**

Environmental Chemistry

MONDAY 25 JUNE 2007

2815/03

Morning

Time: 50 minutes

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



Candidate
Name

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.**

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.
- 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.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	8	
2	15	
3	11	
4	11	
TOTAL	45	

This document consists of **10** printed pages, **2** blank pages and a *Data Sheet for Chemistry* insert.

Answer **all** the questions.

1 The composition of solid household waste in Eire during 2001 is shown in **Fig. 1.1** below.

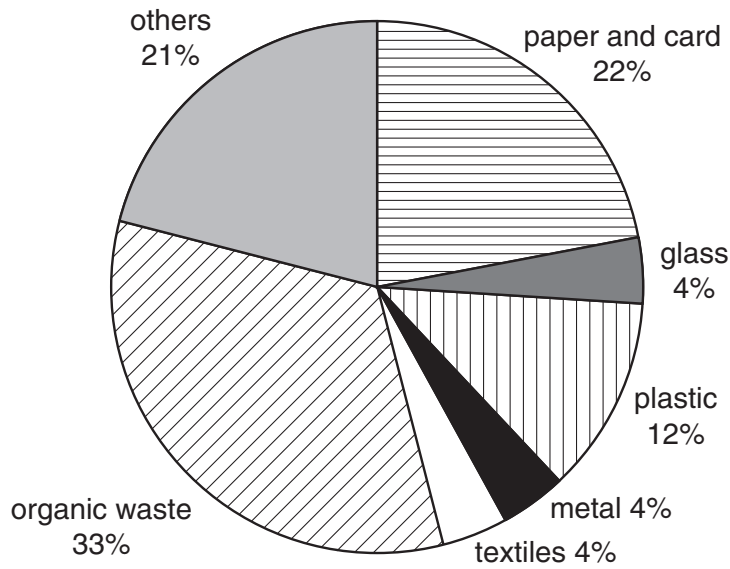


Fig. 1.1

(a) Thirty years ago plastics made up less than 2% of the waste. Suggest a reason for the increase since then.

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

(b) Solid waste may be disposed of by incineration.

(i) Identify **three** constituents of waste in **Fig. 1.1** that would produce carbon dioxide during incineration.

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

(ii) State **two** advantages of incineration.

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

(iii) Explain the importance of temperature control during incineration.

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

(c) Outline the importance of dissolved oxygen in each of the following.

(i) The support of aquatic life.

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

(ii) The treatment of domestic effluent (sewage).

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

[Total: 8]

2 The exhaust gases from aircraft include CO₂, CO, H₂O, and NO.

(a) (i) Explain the formation of CO and NO in aircraft engines.

CO

.....

NO

..... [2]

(ii) Draw a 'dot-and-cross' diagram to show the outer shell electrons in an NO radical.

[1]

(b) Nitrogen monoxide, NO, affects the equilibrium between oxygen and ozone in the stratosphere.

(i) What do you understand by the term *stratosphere*?

.....

..... [1]

(ii) Explain the benefit to mankind of an ozone layer in the stratosphere.

.....

.....

..... [2]

(iii) Using equations, outline the 'oxygen only' model for the formation of ozone in the stratosphere.

.....

.....

..... [2]

(iv) Explain how NO in the stratosphere reacts with ozone and with oxygen.

ozone

.....

oxygen

..... [2]

(c) In the troposphere, nitrogen monoxide, NO, leads to the formation of low level ozone and photochemical smog.

(i) Outline the role of free radicals in this process.

.....

.....

.....

.....

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.....

.....

..... [4]

(ii) The residence time of NO in the atmosphere is four days. Explain what is meant by the term *residence time*.

.....

..... [1]

[Total: 15]

(c) Explain how aqueous potassium ions in the soil water can be replenished from reserves in clay when they have been used up by plants.

.....

.....

.....

..... [2]

[Total: 11]

4 This question is about dissolved carbon dioxide and hard water.

(a) Power stations produce large amounts of carbon dioxide. One strategy for preventing this carbon dioxide reaching the atmosphere is to inject it deep into the oceans. The gas is more soluble at depth.

(i) Suggest **two** reasons for the increased solubility of carbon dioxide in oceans at depth.

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

(ii) Increasing the concentration of dissolved carbon dioxide at depth will increase the acidity of the water.

Explain, with equations, why solutions of carbon dioxide are acidic.

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

(b) The presence of dissolved carbon dioxide in rain can lead to the formation of temporary hardness in some natural waters.

(i) Explain how this happens.

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

(ii) Explain the chemistry involved in the softening of temporary hard water by boiling.

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

(c) Using equations, explain why the presence of sulphur dioxide in the atmosphere leads to the formation of sulphate ions, SO_4^{2-} , in the rainwater.

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

[Total: 11]

END OF QUESTION PAPER

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