

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY

2815/03

Environmental Chemistry

Tuesday

28 JUNE 2005

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 the questions 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	14	
3	11	
4	7	
5	6	
TOTAL	45	

This question paper consists of 9 printed pages and 3 blank pages.

Answer **all** the questions.

1 All new cars sold in the UK must comply with regulations for the emission of nitrogen oxides, carbon monoxide and unburnt hydrocarbons from car exhausts.

(a) (i) Explain why nitrogen oxides and unburnt hydrocarbons cause particular concern when emitted together.

.....

[2]

(ii) Complete and balance the following equation for the **incomplete** combustion of octane to form carbon monoxide and water only.



(b) Three-way catalytic converters are now used to minimise emissions. An open honeycomb of thin-walled ceramic material is coated with transition metals such as platinum and rhodium. The metals act as heterogenous catalysts.

(i) Suggest why the ceramic material is *open* and *honeycombed*.

.....

[2]

(ii) Nitrogen monoxide, NO, is reduced by carbon monoxide on the catalyst. Write an equation for this reaction.

.....[1]

(iii) Catalytic converters are not effective until they reach an operating temperature of over 350°C.

Suggest **one** way in which the pollution produced as a car warms up could be minimised.

.....
[1]

[Total: 7]

2 Aerobic respiration releases carbon dioxide into the troposphere, where it is in equilibrium with carbon dioxide dissolved in surface waters.

(a) (i) Suggest **one** biological way in which carbon dioxide leaves the troposphere.

.....[1]

(ii) Explain how dissolved carbon dioxide is involved in the formation of temporary hardness in water. Your answer should include an equation.

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

(iii) Explain why boiling removes temporary hardness from water.

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

(b) Dissolved carbon dioxide, CO_2 (aq), in surface waters produces the ions H^+ (aq), HCO_3^- (aq) and CO_3^{2-} (aq).

(i) Explain the equilibria involved in the formation of these ions.

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

(ii) Explain why alkaline conditions may cause precipitation of dissolved calcium ions as calcium carbonate.

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

(c) Increasing carbon dioxide concentration in the troposphere may be linked to global warming.

(i) Suggest **two** factors, other than concentration, that determine the contribution of a gas to the **greenhouse effect**.

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

(ii) Why might the warming of surface waters increase the concentration of carbon dioxide in the troposphere?

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

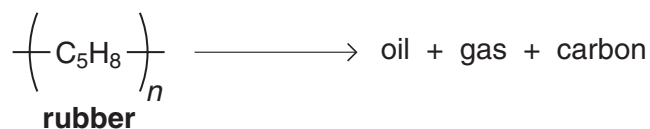
[Total: 14]

.....[10]

Quality of Written Communication [1]

[Total: 11]

- 4 Worldwide, 700 million car tyres are stockpiled, buried or burnt each year. In a new process, tyres can be broken down by heat to make useful products.



- (a) Explain how you can tell from its formula that rubber is unsaturated.

.....
[1]

- (b) Explain why the process above must be anaerobic rather than aerobic.

.....
[1]

- (c) Suggest **two** advantages of this new process over the disposing of tyres in landfill sites.

.....

[2]

- (d) The heat needed for the process can be supplied by burning the gas produced.

Explain, in terms of bond enthalpies, why the combustion of the gas is exothermic. Calculations are **not** required.

.....

[2]

- (e) What further process will be necessary to separate the oil into useful components?

.....[1]

[Total: 7]

5 (a) Chlorine is often used in water treatment.

(i) What are the products of the reaction of chlorine with water?

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

(ii) Why is chlorine used?

.....[1]

(b) Explain how chlorine compounds, such as CFCs, can cause damage to the ozone layer in the stratosphere.

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

[Total: 6]

END OF QUESTION PAPER

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