Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Education
June 2007
Advanced Level Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

ENVIRONMENTAL SCIENCE **ESC5**
Unit 5 Pollution and Physical Resource Management

Tuesday 26 June 2007 1.30 pm to 3.00 pm

You will need no other materials.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English, clear presentation and appropriate use of specialist vocabulary. Question 6 should be answered in continuous prose. Quality of Written Communication will be assessed in this answer.
- This unit assesses your understanding of the relationship between the different aspects of Environmental Science.

For Examiner's Use			
Question	Mark	Question	Mark
1		5	
2		6	
3			
4			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

There are no questions printed on this page

Answer **all** questions in the spaces provided.

1 The table shows details of some pollutants.

Complete the table.

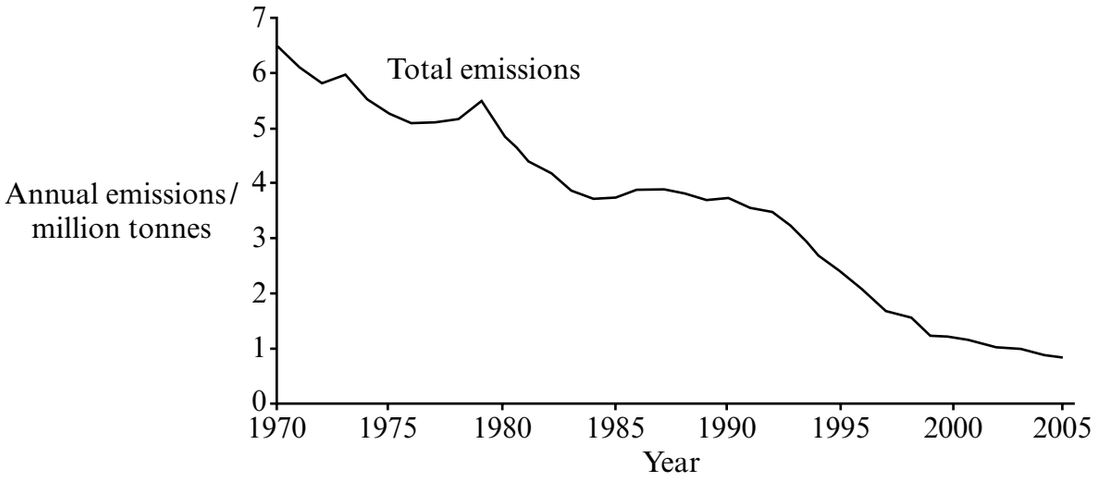
Property	**Description of property**	**Major pollutant which shows this property**
Persistence		DDT
Teratogenicity		The herbicide 2,4,5 T
Synergism		Cadmium with zinc
	Damaging to biological processes, usually by inhibiting enzyme action	Cyanide
Mutagenicity		Ionising radiation

(5 marks)

5

Turn over for the next question

2 The graph shows the emissions of sulphur dioxide in the UK.



(a) Outline **two** ways in which sulphur dioxide emissions have been reduced.

1 .....

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2 .....

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(2 marks)

(b) Describe an effect of acid rain on:

(i) living organisms

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(2 marks)

(ii) non-living objects.

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(2 marks)

(c) Describe how living organisms may be used to produce a biotic index to monitor acid pollution.

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(4 marks)

10

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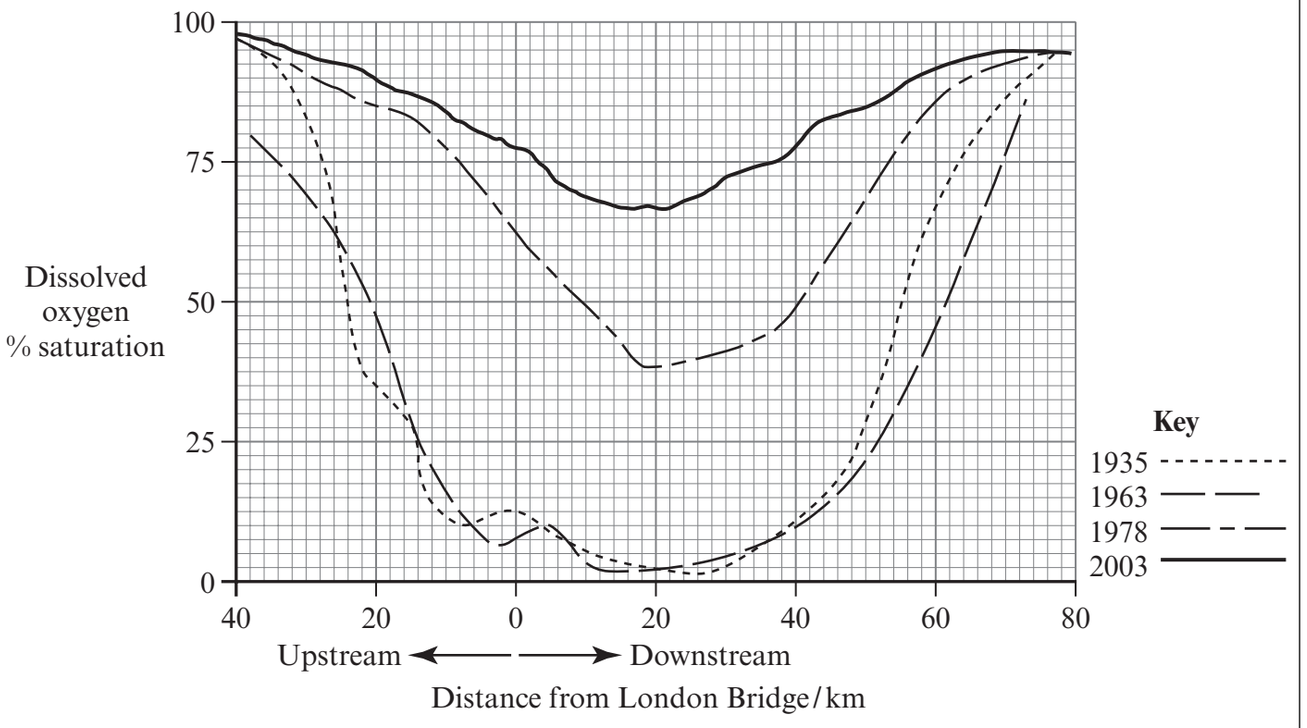
3 The graph shows the dissolved oxygen levels in the River Thames in four selected years.



(a) (i) Estimate the length of the river that had dissolved oxygen levels below 50 % in 1963.

..... km

(1 mark)

(ii) By how much did the dissolved oxygen % saturation level increase at London Bridge between 1935 and 2003?

..... %

(1 mark)

(b) Describe how organic matter in sewage causes the deoxygenation of rivers.

.....

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(1 mark)

(c) Explain the effect that low oxygen levels have on the biodiversity of aquatic ecosystems.

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(2 marks)

(d) Describe how the inorganic nutrients present in sewage effluent may also cause the deoxygenation of rivers.

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(2 marks)

(e) (i) Explain why an increase in water temperature may also affect the dissolved oxygen levels.

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(2 marks)

(ii) Which industry is the major source of hot water effluents?

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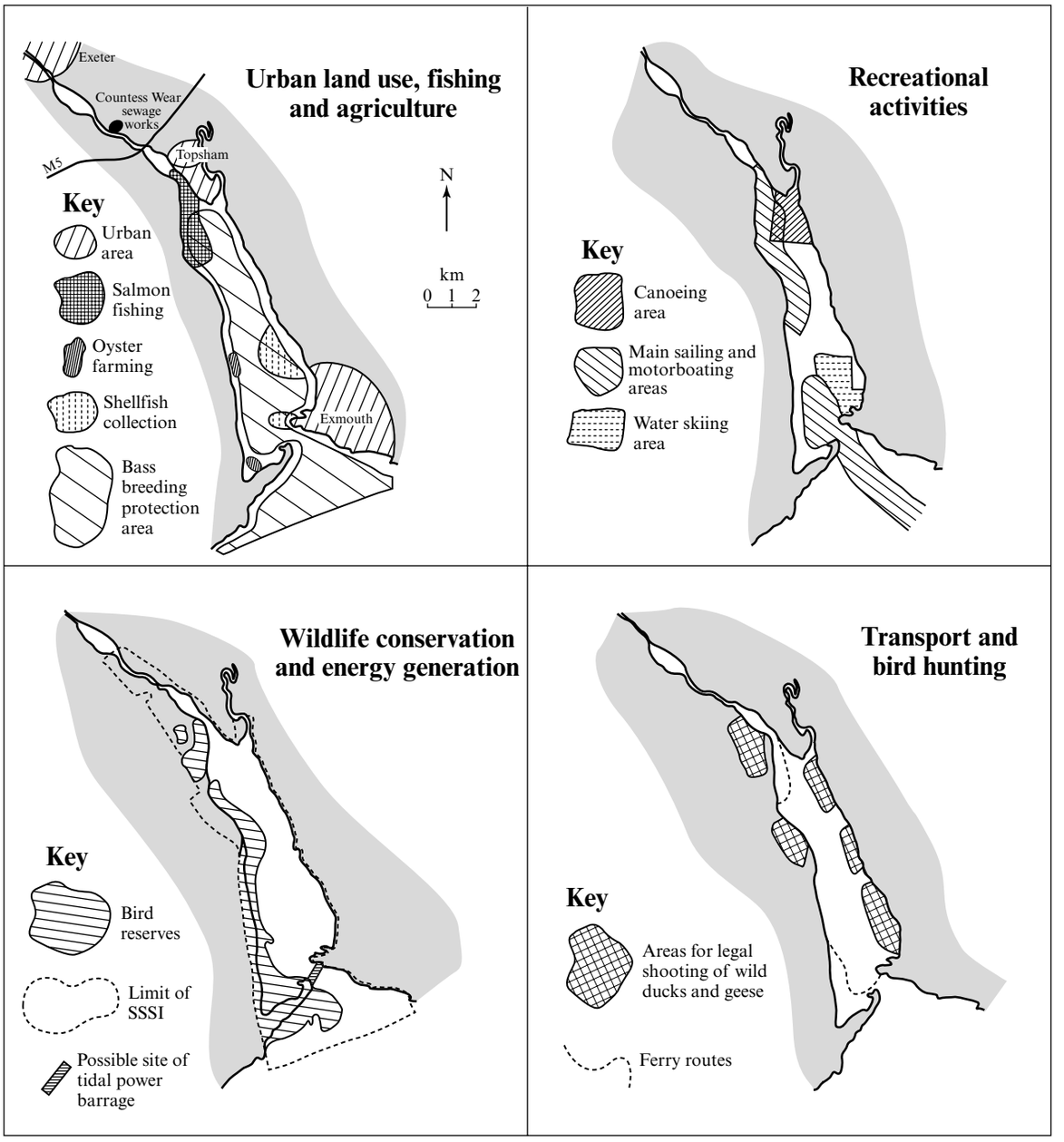
(1 mark)

10

4 The maps show the locations of different activities and area uses on the Exe estuary in southern England.



(a) Use an example from the Exe estuary to explain the resource management principle of:

(i) space zoning

.....

.....

(1 mark)

(ii) time zoning.

.....

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(1 mark)

(b) Suggest how **two** different conflicts between user groups may cause environmental problems in the Exe estuary.

1 .....

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2 .....

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(4 marks)

(c) Suggest why effluent discharges into the estuary are more likely to cause pollution than similar discharges into the open sea.

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(2 marks)

(d) Outline the difficulties of using estuaries to increase freshwater supplies in the future.

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(2 marks)

10

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5 Read the article about mercury pollution and then answer the questions that follow.

A research chemist was investigating the role of mercury in causing cancer. She was studying the organic mercury compound methyl mercury. The researcher took reasonable precautions: wearing safety glasses and latex gloves, working in a fume cupboard and using small quantities. The methyl mercury was supplied in sealed glass tubes which were cooled in iced water to reduce its volatility. The researcher transferred a small sample for testing and put the rest in a storage container. Then she sealed and labelled the tubes and cleaned up, disposing of the latex gloves.

Less than a year later she died from mercury poisoning.

After the experiment, she remembered spilling a small amount on her gloved hand. Later tests showed that the methyl mercury would have passed through the gloves and started entering her skin within 15 seconds. She had received an acute dose of mercury. It is now recommended that highly resistant multi-layered gloves should be worn under long neoprene rubber gloves when working with mercury.

Five months after the experiment she developed worrying symptoms: tingling fingers and slurred speech. She started to have problems with her balance and eyesight. Tests showed that she was suffering from mercury poisoning. Her blood mercury level was 4000 $\mu g\ kg^{-1}$ (microgrammes of mercury per kilogram), 80 times the toxic threshold. Methyl mercury in the blood passes easily into the brain. It is one of the most dangerous neurotoxins known. It causes abnormal foetal development, liver damage and kidney failure and it reduces coordination and sensitivity by inhibiting the action of enzymes which contain sulphur.

There have been many other cases of mercury poisoning.

Mercury nitrate was used to soften the fur that was used to make hats. Many hat workers suffered chronic poisoning due to bioaccumulation following frequent regular small doses. They suffered muscular shaking and slurred speech. Inorganic mercury fungicides were used to protect grain seeds that were supposed to be planted. In Iraq in 1971 some treated grain was used to make bread, resulting in over 400 deaths.

A plastics factory in Minamata, Japan discharged inorganic mercury waste into the sea. Bacteria changed this into methyl mercury which is more liposoluble. People that ate the local fish were eventually poisoned, with over 1400 dying. Mercury levels in the water were as low as 0.000008 $\mu g\ kg^{-1}$, but they were up to 1.2 $\mu g\ kg^{-1}$ in plankton, 24.1 $\mu g\ kg^{-1}$ in fish and 145 $\mu g\ kg^{-1}$ in humans.

(a) Outline the principles of **two** methods that the research chemist used to reduce the risk of exposure to mercury (lines 3–8).

1 .....

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2 .....

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(2 marks)

(b) Explain the difference between acute and chronic effects (lines 13 and 27).

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(2 marks)

(c) Give **two** pieces of evidence to show that mercury damages the nervous system.

1 .....

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2 .....

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(2 marks)

(d) Calculate the toxic threshold of mercury (lines 19–20).

Show your working.

..... $\mu g\ kg^{-1}$

(1 mark)

Question 5 continues on the next page

(e) Use the pollution problems caused by mercury that are described in the text to explain the importance of the following in mercury pollution.

(i) Bioaccumulation

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(2 marks)

(ii) Biomagnification

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(2 marks)

(iii) Liposolubility

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(2 marks)

(f) Suggest why the mercury on the grain seeds in Iraq may not have caused poisoning if they had been planted (lines 29–31).

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(2 marks)

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6 Write an essay on **one** of the following topics. Credit will be given for your understanding of the relationship between different areas of the subject, also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.

EITHER (a) Describe the methods used to monitor and reduce exposure to ionising radiation.

(20 marks)

OR (b) Discuss the problems caused by derelict land and describe the methods used to reclaim it.

(20 marks)

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(20 marks)

20

END OF QUESTIONS

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