Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

General Certificate of Education
Advanced Level Examination
June 2010

Environmental Studies ENVS3

Unit 3 Energy Resources and Environmental Pollution

Friday 18 June 2010 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 black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
  Two of these marks are for the Quality of Written Communication.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.
- Question 8 should be answered in continuous prose.
  Quality of Written Communication will be assessed in this answer.

ENVS3

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

1 Complete the table, which compares energy resources, by putting ticks in the appropriate boxes in each row.

The first two rows have been completed.

Feature of energy resource	**Energy resource**				
	Uranium 235	**Coal**	**Hydrogen**	**Wind power**	**Tidal power**
Renewable primary energy resource				✓	✓
It has the highest energy density	✓				
Its use releases CO_2					
Supply is unpredictable					
Secondary fuel					
Fossil fuel					
Supply is intermittent					

(5 marks)

5

2 Ozone is involved in many environmental issues.

2 (a) Outline how ozone is environmentally important in the following.

2 (a) (i) Acid rain

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(1 mark)

2 (a) (ii) The stratosphere

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(1 mark)

2 (a) (iii) Photochemical smogs

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(1 mark)

2 (a) (iv) Directly affecting living organisms

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(1 mark)

2 (b) Suggest how the low persistence of ozone affects the severity of the pollution it causes.

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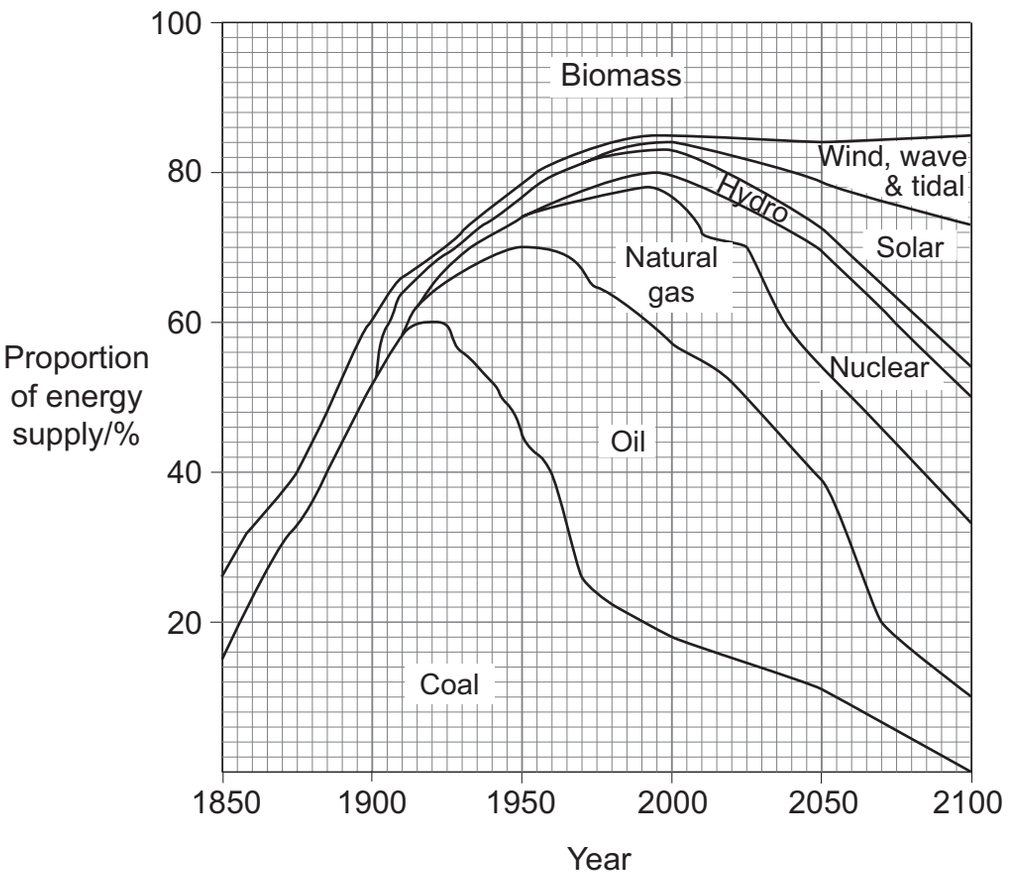
(1 mark)

5

Turn over for the next question

3 The long time required to develop new energy resources makes it important to plan early for future changes.

The graph shows how the energy used by humans has been supplied since 1850, with a prediction of future supplies.



3 (a) Estimate the percentage of total supplies provided by renewable resources in 2050.

..... %

(1 mark)

3 (b) Estimate the percentage of total supplies provided by oil in 2000.

..... %

(1 mark)

3 (c) Outline the arguments for and against the development of the following energy resources.

3 (c) (i) Nuclear power

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(4 marks)

3 (c) (ii) Solar power

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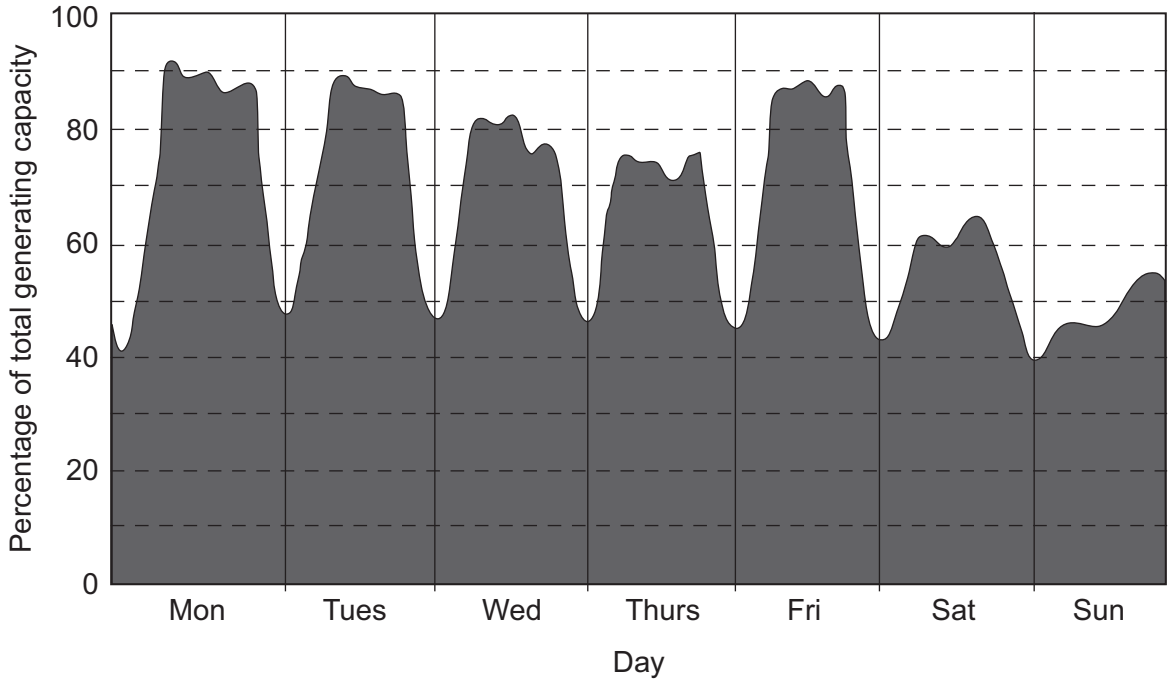
(4 marks)

10

Turn over for the next question

4 Energy demand and energy supply are not constant and do not match each other. This creates problems for the electricity supply industry.

The graph shows the demand for electricity during a seven day period in the UK.



4 (a) Describe the trends in demand for electricity.

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(3 marks)

4 (b) Suggest reasons for the difference in the trends on Monday and Sunday.

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(2 marks)

4 (c) Explain how the electricity industry can store surplus energy to help match fluctuations in demand.

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(5 marks)

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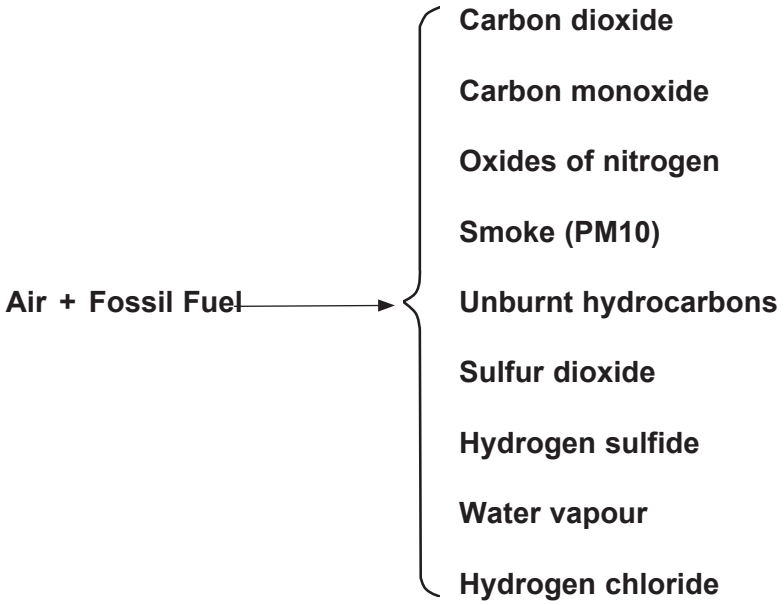
Turn over for the next question

5 The diagram shows some of the atmospheric pollutants produced by burning fossil fuels.



5 (a) Outline methods that may be used to reduce the emissions of:

5 (a) (i) oxides of nitrogen

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(2 marks)

5 (a) (ii) sulfur dioxide.

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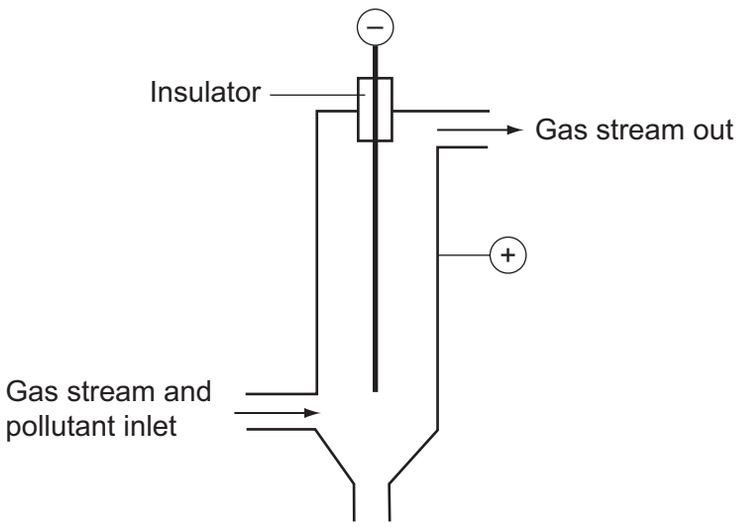
(2 marks)

5 (b) The diagram shows an electrostatic precipitator.



Explain how electrostatic precipitators are used to control pollution.

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(2 marks)

5 (c) Explain how lichens can be used to monitor atmospheric pollution.

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(4 marks)

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ANSWER IN THE SPACES PROVIDED

6 The table shows the effect of changes in wind speed and blade diameter on the power output of a wind turbine.

Blade diameter/ metres	Wind speed/kilometres per hour					
	8	16	24	32	40	48
0.6	0.6	4.8	16.0	38.4	73.0	128.0
1.2	2.4	19.2	64.0	153.6	292.0	512.0
1.8	5.0	40.0	140.0	320.0	660.0	1120.0
2.4	9.6	76.8	256.0	614.4	1168.0	2048.0
3.0	15.0	120.0	400.0	960.0	1840.0	3200.0
3.6	20.0	160.0	560.0	1280.0	2640.0	4480.0
4.8	38.4	307.2	1024.0	2457.6	4672.0	8192.0
6.0	60.0	480.0	1600.0	3840.0	7360.0	12800.0
7.2	80.0	640.0	2240.0	5120.0	10560.0	17920.0

Units of power = watts

6 (a) What is the effect on the power output of:

6 (a) (i) doubling wind speed

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(1 mark)

6 (a) (ii) doubling the blade diameter?

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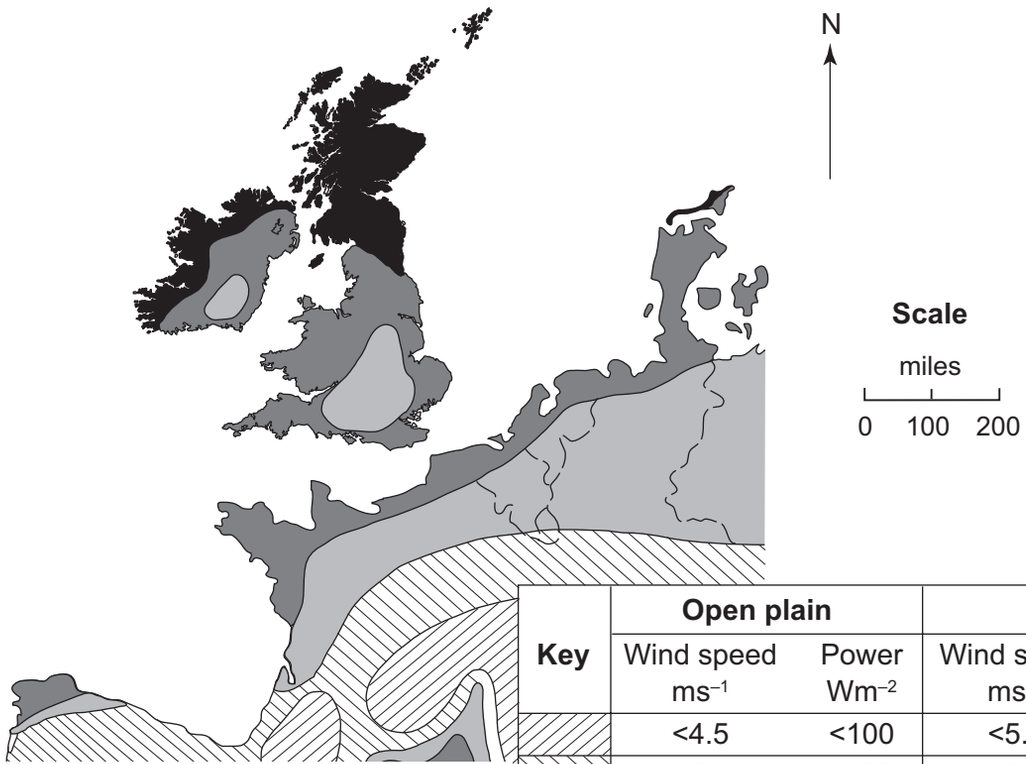
(1 mark)

Question 6 continues on the next page

6 (b) The map shows how mean wind power varies in different parts of NW Europe. The actual wind speed is affected by the local topography.



Key	Open plain		Coast	
	Wind speed ms^{-1}	Power Wm^{-2}	Wind speed ms^{-1}	Power Wm^{-2}
	<4.5	<100	<5.0	>150
	5.0	150	5.5	200
	6.0	250	6.5	325
	7.0	400	7.5	500
	>7.5	>500	>8.5	>700

Suggest **two** reasons why wind farms are not always built in the windiest areas.

1 .....

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2 .....

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(2 marks)

6 (c) Explain how economic strategies have been used to encourage the use of renewable energy.

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(3 marks)

6 (d) Outline the ways in which the use of wind turbines may cause damage to the natural environment.

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(3 marks)

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Turn over for the next question

7 Read the article and then answer the question that follows.

The effects of benzene, a possible serious pollutant

What are the main health hazards associated with inhaling or swallowing benzene?
Short-term exposure causes depression of the central nervous system, marked by drowsiness, dizziness, headache, nausea, loss of coordination, confusion and unconsciousness. Exposure to 20 000 ppm for 5 to 10 minutes may result in death. Exposure at 100 ppm causes headache, tiredness and nose irritation. No effects are found at 25 ppm.

What are the long-term health effects of exposure to benzene?

- **Skin** Prolonged or repeated contact causes redness, dryness, cracking (dermatitis) due to the defatting action of this solvent.

- **Blood and blood-forming organs** The numbers of circulating red blood cells, white blood cells and platelets are reduced.

- **Nervous system** Two limited studies suggest that benzene may have effects on the nervous system. Exposure levels were not accurately measured and the experimental subjects were exposed to other chemicals. Symptoms included an increased incidence of headaches, fatigue and memory loss.

Does benzene cause cancer?
There is strong evidence of the carcinogenicity of benzene in humans, particularly with cancer of the lymph system, lung cancer and bladder cancer. However, there are common limitations in the human studies because exposures usually cannot be accurately assessed, the number of cases is small and, frequently, there is exposure to other chemicals.

Does benzene affect reproductive systems?
Benzene crosses the placenta but the evidence that it affects the foetus is inconclusive. In a study of one woman exposed to benzene during two pregnancies, at levels producing severe maternal toxicity, both children were healthy and did not have chromosomal alterations. In another study, 14 children of female workers exposed to benzene and other organic solvents did have chromosomal changes. There was no discussion of maternal toxicity or of birth defects. Animal evidence indicates that benzene is not teratogenic, but is foetotoxic at exposure levels which also resulted in mild maternal toxicity.

Does benzene act in a synergistic manner with other materials?
Studies with animals have shown that ethanol increases the blood system changes caused by benzene. Exposure to toluene slows the rate of clearance of benzene by competing for metabolic pathways.

Is there potential for benzene to accumulate in the body?
Metabolism of benzene occurs mainly in the liver, producing other substances which produce the toxic effects. In humans, the physiological half-life is one to two days. Benzene is primarily exhaled through the lungs, or excreted in the urine.

Use the problems identified in the article to describe the main features of a good scientific study to investigate the effects on humans of a chemical that is released into the environment.

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(10 marks)

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8 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 for grammar, punctuation and spelling.

EITHER

8 (a) Discuss the methods that can be used to reduce the energy used in transport systems and industry. *(20 marks)*

OR

8 (b) Discuss the methods used to treat solid wastes to reduce pollution. *(20 marks)*

OR

8 (c) Explain how the severity of pollution can be affected by the features of the environment into which pollutants are released. *(20 marks)*

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(20 marks)

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END OF QUESTIONS

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