

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education  
 January 2003  
 Advanced Subsidiary Examination



**ENVIRONMENTAL SCIENCE**  
**Unit 1 Energy, Atmosphere and Hydrosphere**

**ESC1**

Friday 10 January 2003 Afternoon Session

**No additional materials are required.**  
 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 in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

- The maximum mark for this paper is 70.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

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

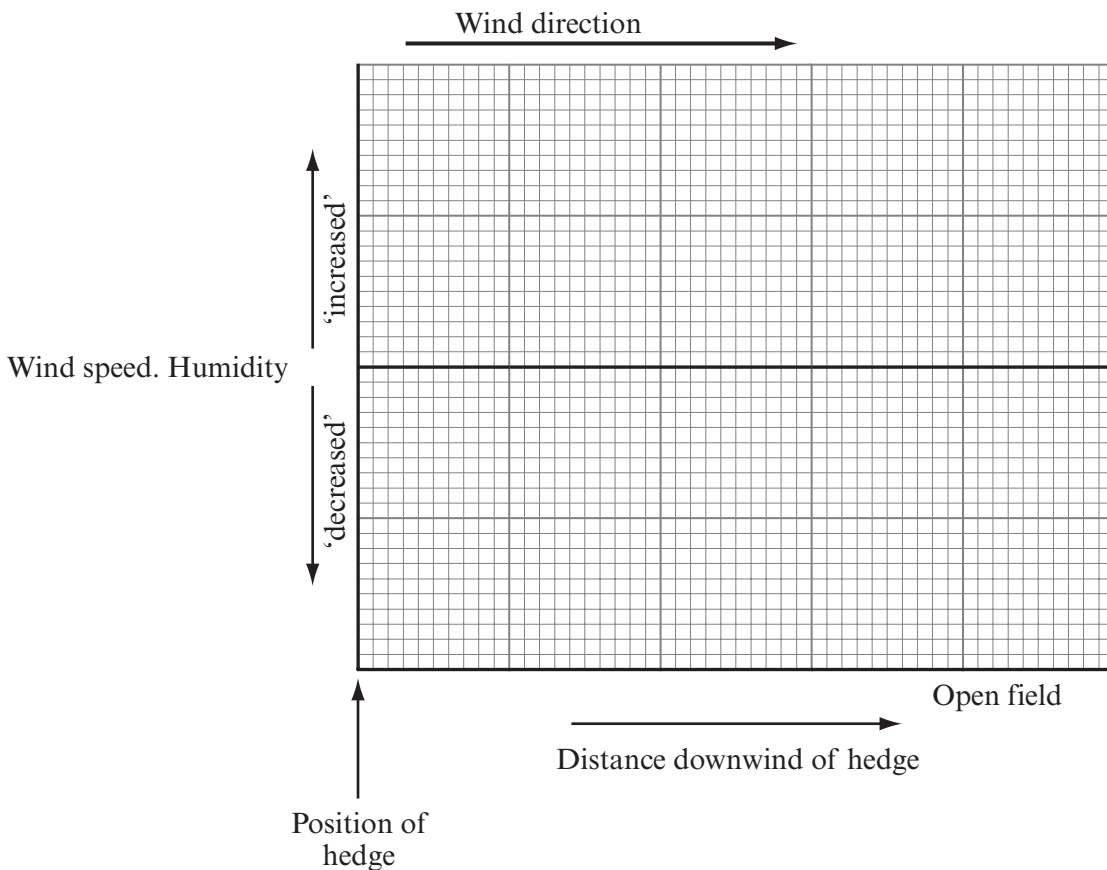
1 A microclimate may occur in an area where localised factors influence the regional climate.

(a) Outline **two** ways in which buildings may produce microclimates.

1. ....  
 .....  
 .....  
 .....  
 (2 marks)

2. ....  
 .....  
 .....  
 .....  
 (2 marks)

(b) Complete the graph with **two** labelled lines to show how wind speed and humidity at ground level, change downwind of a hedge.



(2 marks)

2 A major advantage of nuclear power is that the fuel has a high energy density. The equation shows the reaction for the release of energy during a nuclear reaction.

$$E = mc^2$$

(a) What do the letters *m* and *c* represent in this equation?

*m* .....

*c* .....

(1 mark)

(b) For a nuclear fission reaction to occur, a *critical mass* of a *fissile fuel* must be present.

Outline what is meant by:

*critical mass*; .....

.....

.....

.....

(2 marks)

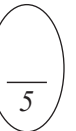
*fissile fuel*. .....

.....

.....

.....

(2 marks)



**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

3 (a) Describe how the atmosphere naturally prevents most ultraviolet light (UV) from the sun from reaching the Earth's surface.

.....  
.....  
.....  
.....  
.....  
.....

(3 marks)

(b) (i) Describe how a pollutant released by human activities may result in more UV light reaching the Earth's surface.

.....  
.....  
.....  
.....  
.....  
.....

(3 marks)

(ii) Give an international agreement intended to limit this damage to the atmosphere.

.....

(1 mark)

(c) State **one** industrial use of UV light.

.....

(1 mark)

- 4 Complete the table which shows some of the processes used to produce potable water (water of drinking quality).

Name of process	Purpose of process	Principle of operation of process
Screening		Water passed through wire sieves
Sedimentation	Removal of suspended solids	
Flocculation	Removal of colloidal solids, eg clay particles	
	Kill pathogens	Substance added is toxic to bacteria & other pathogens
Fluoridation		Addition of sodium fluoride solution

(5 marks)

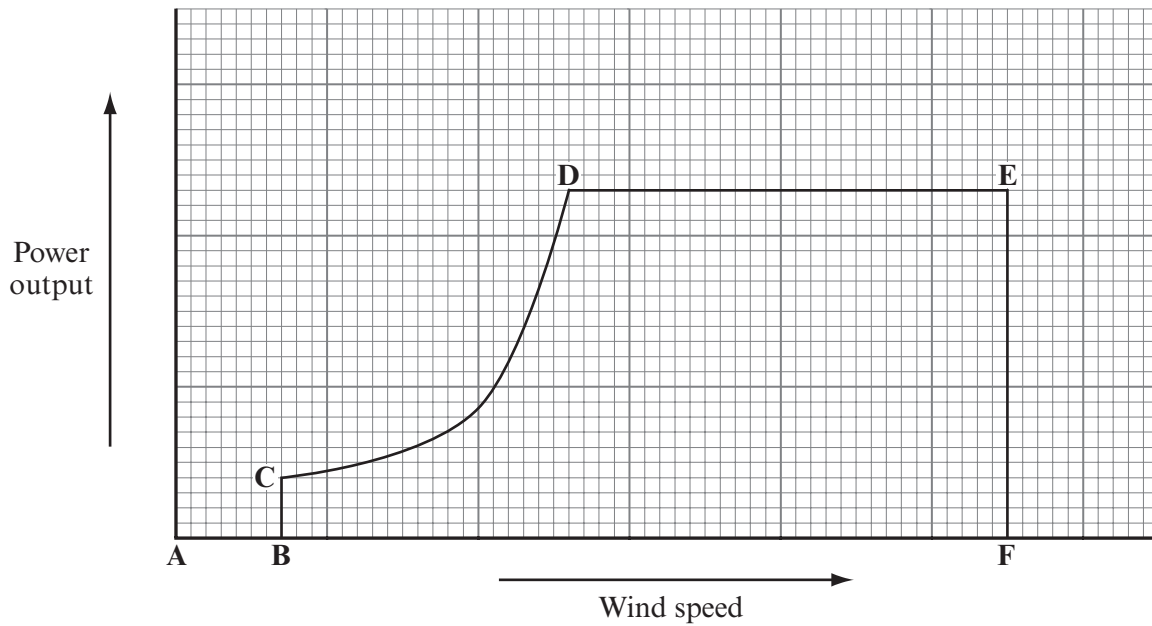
5

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

5 The power output from an aerogenerator is not proportional to wind speed.

The diagram shows the variations in power output from a typical aerogenerator.



(a) Explain the changes in power output shown for:

(i) **D–E;**

.....  
 .....  
 (1 mark)

(ii) **E–F.**

.....  
 .....  
 (1 mark)

- (b) The table shows the effect of changing wind speed and blade diameter on the electrical output (Watts) of one design of aerogenerator.

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	12 800.0
7.2	80.0	640.0	2240.0	5120.0	10 560.0	17 920.0

- (i) How does the power output of the aerogenerator change if the blade diameter is doubled?

.....  
(1 mark)

- (ii) How does the power output of the aerogenerator change if the wind speed doubles?

.....  
(1 mark)

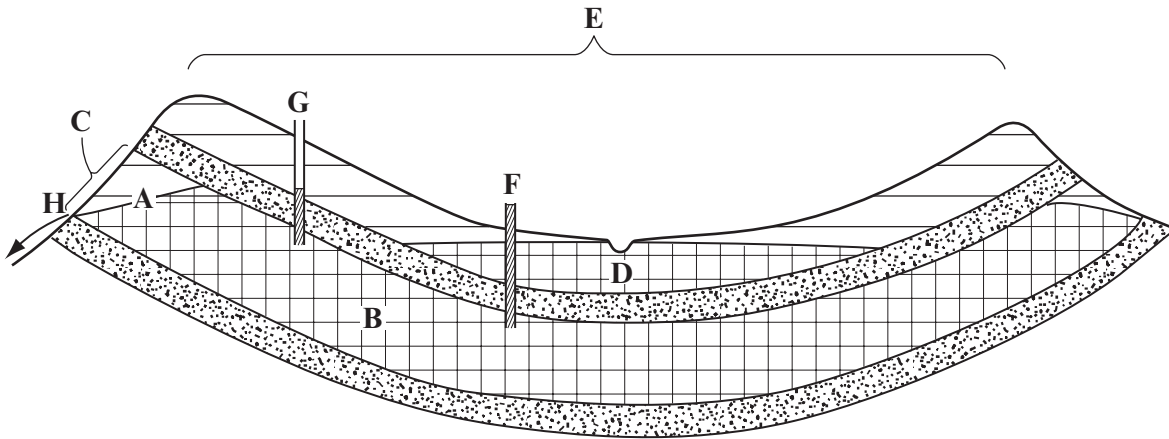
- (c) Name **two** other renewable energy resources which harness naturally occurring kinetic energy.

1. ....  
2. ....  
(2 marks)





**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

6 The diagram shows some of the features associated with different types of aquifers.



**Key**

-  permeable rock
-  impermeable rock
-  saturated aquifer
-  water in well

(a) Which of the letters on the diagram correspond to the following features?

- Water table .....
- Unconfined aquifer .....
- Confined aquifer .....
- Aquifer recharge area .....
- Spring .....
- Flowing artesian well .....
- Non-flowing artesian well .....
- Catchment area .....

(4 marks)



(b) Explain the terms:

(i) porous; .....  
.....  
.....  
.....  
(2 marks)

(ii) permeable. ....  
.....  
.....  
.....  
(2 marks)

(c) Exploitation of groundwater at an unsustainable rate may reduce future water supplies.

(i) Outline **two** other problems caused by unsustainable groundwater exploitation.

1. ....  
.....  
.....  
.....  
(2 marks)

2. ....  
.....  
.....  
.....  
(2 marks)

**QUESTION 6 CONTINUES ON THE NEXT PAGE**

**Turn over ►**

(ii) Outline **two** advantages of using water from aquifers for public water supplies.

1. ....  
.....  
.....  
.....  
.....  
*(2 marks)*

2. ....  
.....  
.....  
.....  
.....  
*(2 marks)*

(d) Many countries, such as Malta and Saudi Arabia, produce drinking water by the desalination of sea water.

Outline a named method of sea water desalination.

Method .....

Description .....

.....  
.....  
.....  
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.....  
.....  
*(4 marks)*

7 (a) Compare the environmental impacts of open-cast and deep mining for coal.

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.....  
.....  
.....  
.....  
.....

(4 marks)

(b) Outline why an oil company may decide **not** to exploit an oilfield even though oil has been found.

.....  
.....  
.....  
.....

(2 marks)

(c) Outline **two** techniques which may be used to continue crude oil production when the natural pressure of primary recovery in the oilfield has declined.

1. ....  
.....  
.....  
.....

(2 marks)

2. ....  
.....  
.....  
.....

(2 marks)

**QUESTION 7 CONTINUES ON THE NEXT PAGE**

**Turn over ►**

