

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4781/02

SCIENCE B

UNIT 1: Space, Energy and Life

HIGHER TIER

P.M. WEDNESDAY, 5 June 2013

1¼ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	24	
2.	11	
3.	11	
4.	6	
5.	6	
6.	12	
Total	70	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.
You will also need a copy of the Resource Folder to answer **Section A**.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.
Section A is based upon the Pre-Release Article.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
You are reminded that assessment will take into account the quality of written communication used in your answer to question 1(e) and question 4.

SECTION A

Answer all questions in the spaces provided.

Use the information in the separate resource booklet to answer the following questions.

1. (a) Explain how the shape of the blades causes the wind turbine to turn in the wind. [2]

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(b) Use the information in **Table 1** to answer the questions below.

(i) What is the range of wind speeds in which wind turbine **5** will operate? [1]

.....

(ii) State the value of the swept area by wind turbine **2**. [1]

(iii) I. State the maximum power output of wind turbine **2**. [1]

II. To give the maximum power output recorded in **Table 1**, the wind power must be 1500 kW.
Calculate the efficiency of wind turbine **2** using the equation: [2]

$$\% \text{ Efficiency} = \frac{\text{useful output power}}{\text{total input power}} \times 100$$

% Efficiency =

(c) A wind turbine has a blade diameter of 80 m.

(i) Calculate the swept area of the blades.

[2]

Swept area = m²

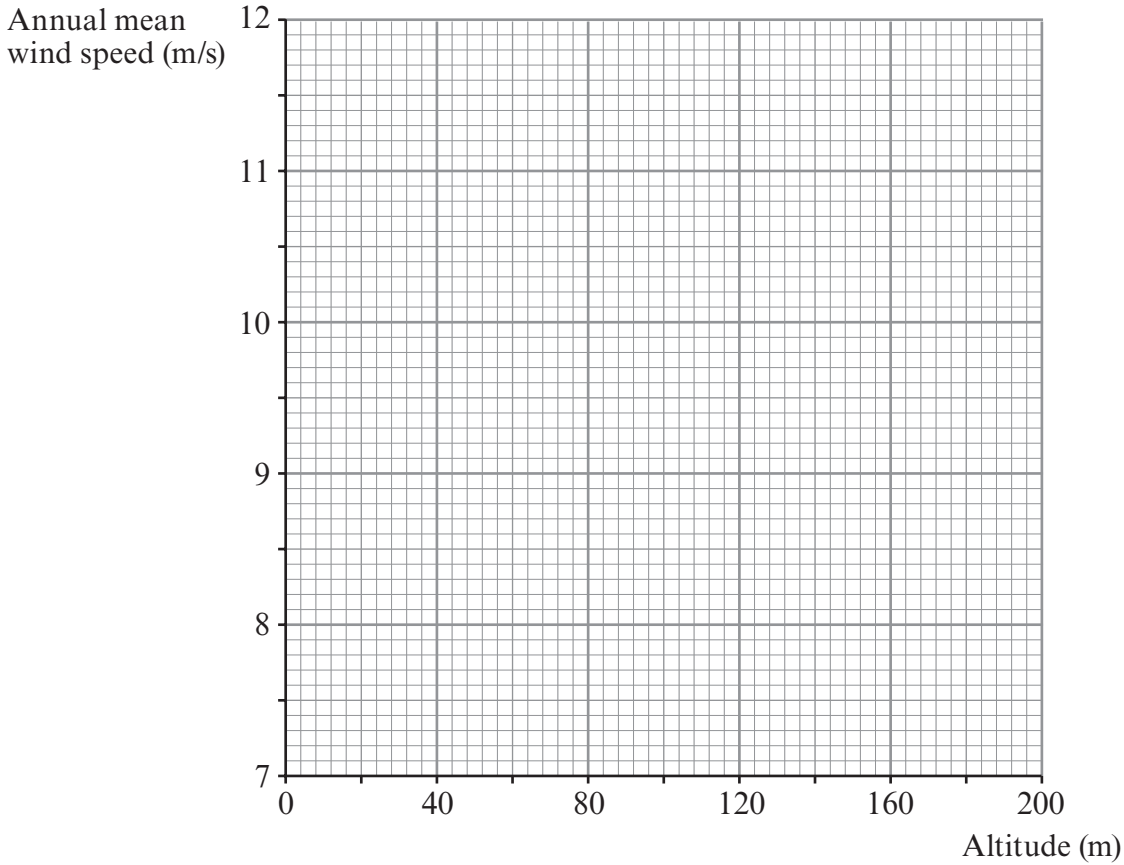
(ii) The turbine is placed at an altitude of 160 m.
Calculate the mean kinetic energy/second delivered to the turbine.
(Use $(\text{wind speed})^3 = 1300 \text{ m}^3/\text{s}^3$)

[2]

Mean kinetic energy/second = J/s

(d) (i) Use the information in **Table 2** to answer the questions below.

I. Plot a graph on the grid below to show how **annual mean wind speed** varies with **altitude**. [3]



II. Explain why the maximum power output of a wind turbine is affected by altitude. [2]

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(ii) Use the information in **Table 3** to explain why the power output of the wind turbine will be different in summer and winter. [2]

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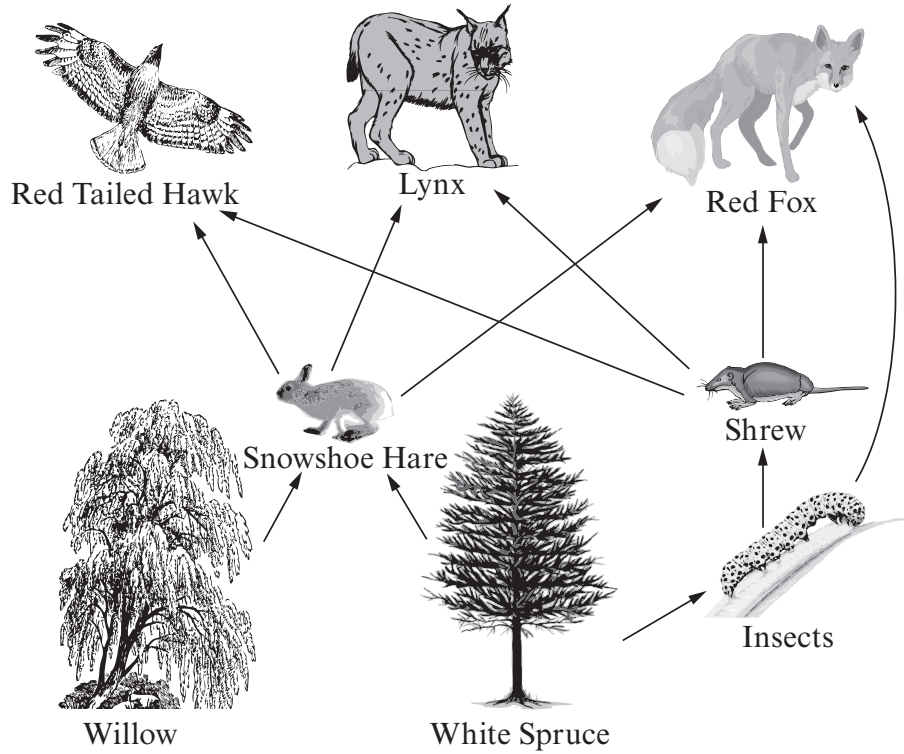
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SECTION B

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

2. The diagram below shows a food web.



(a) (i) Name the source of energy for this food web. [1]

(ii) Construct and label the pyramid of numbers for the food chain below: [3]

white spruce → insects → shrew → red fox.

(b) State **three environmental** factors that will affect the size of the **willow** population. [3]

1.
2.
3.

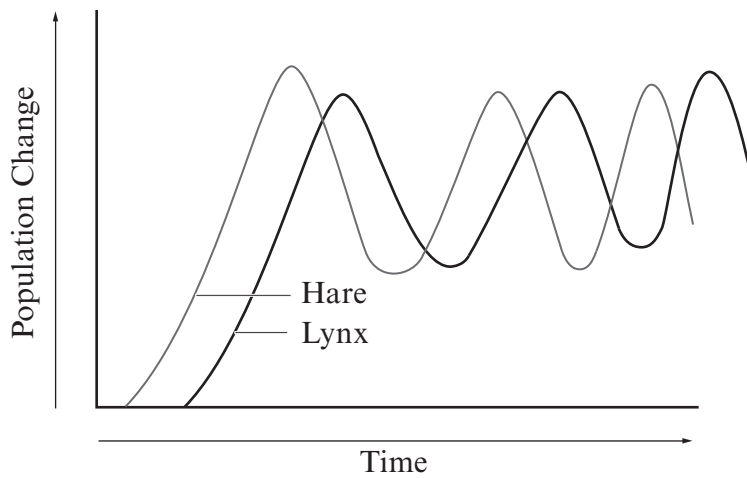
(c) In the natural habitat, the lynx is a predator of the snowshoe hare.



(i) State **one** way in which the hare is adapted to its environment. [1]

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(ii) The population of lynx and hares changes in the pattern shown in the graph.



Explain why the population change of lynx lags behind that of the hare. [3]

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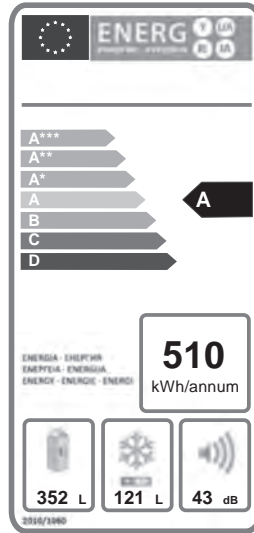
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3. A homeowner is shopping for a refrigerator.

She sees a label attached to each one. An example of a label is shown below.



The homeowner is given a leaflet containing information about four similar size refrigerators. The information is shown in the table below.

Model	Voltage V	Current A	Power W	Power kW	Units used in a year kWh	Annual Cost £
A	230	0.70	161	0.161	310	37.20
B	230	0.78	.....	.....	345	41.40
C	230	0.67	154	0.154	297	35.64
D	230	0.72	166	0.166	.....	38.40
E	230	.....	158	0.158	305	.....

(a) To answer the following questions you will need to use the equations below.

$$\text{Power} = \text{voltage} \times \text{current}$$

$$\text{Units used} = \text{power (kW)} \times \text{time (h)}$$

$$\text{Annual cost} = \text{cost of one unit (12p)} \times \text{units used in a year}$$

(i) Calculate the length of time model A uses electricity during the year. [2]

Time =

(ii) **Complete** the gaps in the table. [6]

Space for working.

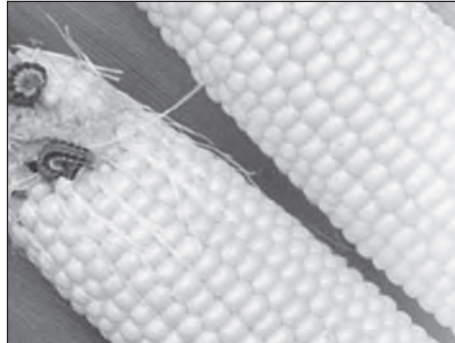
(b) (i) Model C was £5 more expensive to buy than model B. Explain why you would still recommend that the homeowner buys model C. [2]

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.....
.....

(ii) Apart from cost, state **one other** benefit of using model C instead of model B. [1]

.....
.....

5. Some insects feed on and destroy sweetcorn crops. Scientists have developed genetically modified (GM) sweetcorn that produces a poison, which kills these insects.



- (i) Explain the benefits to the environment of growing this type of sweetcorn. [3]

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- (ii) Explain why opponents of GM crops argue against using this type of sweetcorn. [3]

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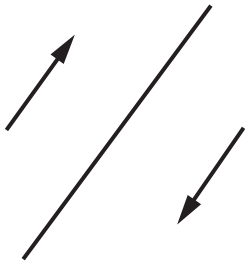
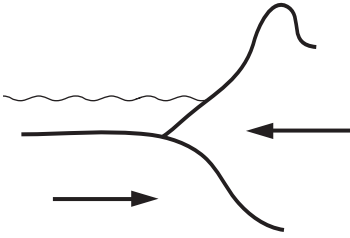
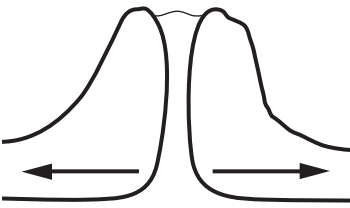
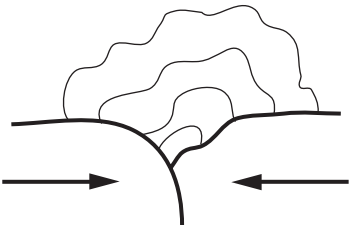
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6. The point where two or more tectonic plates meet is known as a plate boundary. There are four main types of plate boundary. These are conservative, destructive, constructive and collision boundaries.

(a) Complete the table below. *One has been completed for you.*

Type of Plate Boundary	Diagram	Description	
Conservative		Conservative plate boundaries occur when two plates slide past each other.	
Destructive		<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	[3]
Constructive		<p>.....</p> <p>.....</p> <p>.....</p>	[1]
Collision		<p>.....</p> <p>.....</p> <p>.....</p>	[2]

(b) The natural phenomena below occur at more than one plate boundary.

(i) At which plate **boundaries** could fold mountains be formed? [1]

.....

(ii) At which plate **boundaries** could earthquakes occur? [1]

.....

(iii) At which plate **boundaries** could volcanoes appear? [1]

.....

(c) Apart from the movement of tectonic plates, state **three other** natural causes that change the surface of the Earth. [3]

1.

2.

3.

END OF PAPER

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