WJEC GCSE SCIENCE B

SCIENCE



EXAM QUESTION PACK

UNIT 1 FOUNDATION TIER 4781 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4781/01

S16-4781-01

SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

A.M. FRIDAY, 10 June 2016

1 hour 15 minutes

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**8**	
	2.	**7**	
	3.	**8**	
	4.	**8**	
	5.	**9**	
	6.	**6**	
Section B	**7.**	**11**	
	8.	**13**	
	Total	**70**	

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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 B**.

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.

INFORMATION FOR CANDIDATES

Section B is based upon the Pre-Release Article.
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 (QWC) used in your answer to question **7***(c)*.

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SECTION A

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

1. The table shows information about planets in our Solar System. Use this to answer the questions that follow.

Planet	Mean distance from the Sun (AU)	Diameter (Mm)	Time to spin on axis	Time to orbit the Sun (Earth years)	Number of known moons
Mercury	0.4	5	59 days	0.24	0
Venus	0.7	12	243 days	0.6	0
Earth	1.0	13	23 hours, 56 mins	1	1
Mars	1.5	7	24 hours, 37 mins	2	2
Jupiter	5.2	143	9 hours, 55 mins	12	63
Saturn	9.5	120	10 hours, 39 mins	29	61
.....	19.2	51	17 hours, 14 mins	84	27
Neptune	30.0	50	16 hours, 7 mins	165	13

(a) (i) Complete the table. [1]

(ii) Vesta is one of the largest asteroids. Estimate the distance of Vesta from the Sun and its time to orbit the Sun. [2]

distance of Vesta from the Sun = ... AU

time for Vesta to orbit the Sun = ... Earth years

(iii) Pluto is too small to be classed as a planet. Estimate the diameter of Pluto. [1]

..... Mm

(b) It is suggested that Venus does not have any moons because it is too small to hold them in orbit.

(i) Name **two** planets that are smaller than Venus. [2]

..... and .....

(ii) Which of these planets disproves the suggestion? ..... [1]

(c) Name the planet with the shortest day. [1]

.....

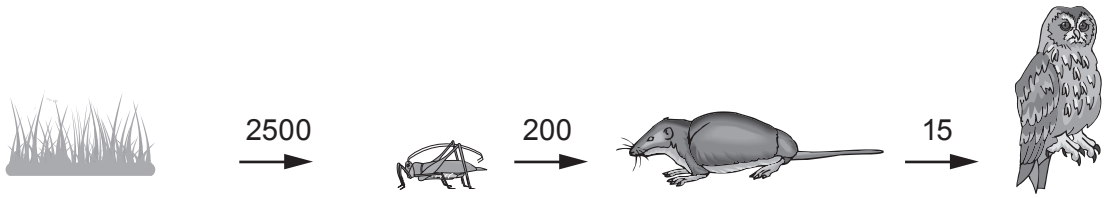
8

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2. The diagram shows the flow of energy through a food chain (in kJ).



(a) (i) Name the energy source for the food chain. ..... [1]

(ii) Name the green plant in this food chain. ..... [1]

(iii) Name the predator of the shrew. ..... [1]

(b) (i) Calculate the reduction in useful energy from shrews to owls. [1]

energy reduction = ... kJ

(ii) Calculate the efficiency of the energy transfer from shrews to owls.
Use the equation: [2]

$$\text{efficiency \%} = \frac{\text{useful output energy}}{\text{total input energy}} \times 100$$

efficiency % = ...

(iii) Give **one** reason for the decrease in useful energy transferred through the food chain. [1]

.....

.....

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7

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3. Some builders sharing a house were worried about their electricity bill.

They decided to record how much electricity they used.
They found that they used 145 units in one week.
One unit of electricity costs 18 p.

(a) Calculate the cost of electricity for one week. [2]

Use the equation:

total cost = cost of 1 unit × units used

cost = ... p

(b) Cooking using an electric oven costs the builders £4.80 a week.
They found that if they did the cooking using a microwave they would use only **5 units** in a week.

(i) Calculate the cost of using the microwave for a week. [1]

cost = ... p

(ii) Calculate the saving per week if the microwave is used instead of the electric oven. [1]

saving = ... p

(iii) The cost of the microwave was £54.60. Calculate how many weeks it took for the saving on the electricity bill to cover the cost of buying the microwave. [2]

answer = ... weeks

(c) The builders used a kettle for a total of 3.5 hours per week.
The kettle used 8.4 units per week.
Calculate the power of the kettle. [2]

Use the equation:

$$\text{power (kW)} = \frac{\text{number of units}}{\text{time (h)}}$$

power = ... kW

8

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4. *(a)* The stages in the process of natural selection are shown below. They are not in the correct order. ***One*** *of the statements is not relevant*.

A Genes passed on to future generations
B These individuals are more likely to survive
C Some individuals have advantageous traits
D These individuals successfully reproduce
E The genes undergo genetic modification

Arrange the statements in order by placing the letters in the boxes below. [4]

....

(b) The following statements are views about genetic modification (GM) of crops.

A It could reduce the use of artificial chemicals
B It could result in designer food containing certain nutrients
C It could result in allergic reactions
D It could result in less biodiversity
E It could result in higher yields

Complete the table below to show whether **each** statement is an advantage or disadvantage of GM. *One has already been done as an example*. [4]

Advantage	Disadvantage
A	

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8

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5. The table shows properties of types of waves in the electromagnetic (em) spectrum.

Spectrum of Electromagnetic Radiation			
Type	Typical wavelength (cm)	Frequency (Hz)	Energy (eV)
radio waves	100	3×10^{8}	10^{-6}
microwave	10	3×10^{9}	10^{-5}
infrared	0.01	3×10^{12}	0.01
.....	7×10^{-5}	4.3×10^{14}	2
ultraviolet	4×10^{-5}	7.5×10^{14}	3
.....	10^{-7}	3×10^{17}	10^{3}
gamma rays	10^{-9}	3×10^{19}	10^{5}

(a) (i) Complete the table. [2]

(ii) Describe how the wavelength changes from gamma rays to radio waves. [1]

.....

(iii) Describe how the frequency changes from gamma rays to radio waves. [1]

.....

(iv) Name the em waves with the highest energy. ..... [1]

(b) Show how you can calculate the speed of em waves by substituting values from the table into the equation below: [2]

wave speed = frequency × wavelength

wave speed = ... × .....

(c) State **two** decisions that are made before modern space science projects go ahead. [2]

1. .....

2. .....

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6. *(a)* State **two** uses of land that can lead to a reduction of habitats. [2]

1. .....

2. .....

(b) Name **two** schemes designed to maintain biodiversity. [2]

1. .....

2. .....

(c) We have become more sustainable by reusing plastic carrier bags. State **two** other ways to increase sustainability. [2]

1. .....

2. .....

6

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SECTION B

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

Use the information in the separate Resource Folder to answer the following questions.

7. Use the information in **Diagram 1** to answer the questions below.

(a) Complete the table below: [3]

Stored carbon pool	Quantity (billions of tonnes)
soil	2300
fossil pool	10000
atmosphere	.....
oceans (total)	.....
plant biomass	.....

(b) Humans contribute 9 billion tonnes of carbon to the atmosphere every year. The net increase in the atmosphere is only 4 billion tonnes.

Give **two** reasons for this difference. [2]

1. .....

2. .....

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(c) Explain how carbon is recycled between the land and the atmosphere. [6 QWC]

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8. *(a)* Read the information about carbon footprint and **Table 1** to answer the questions below.

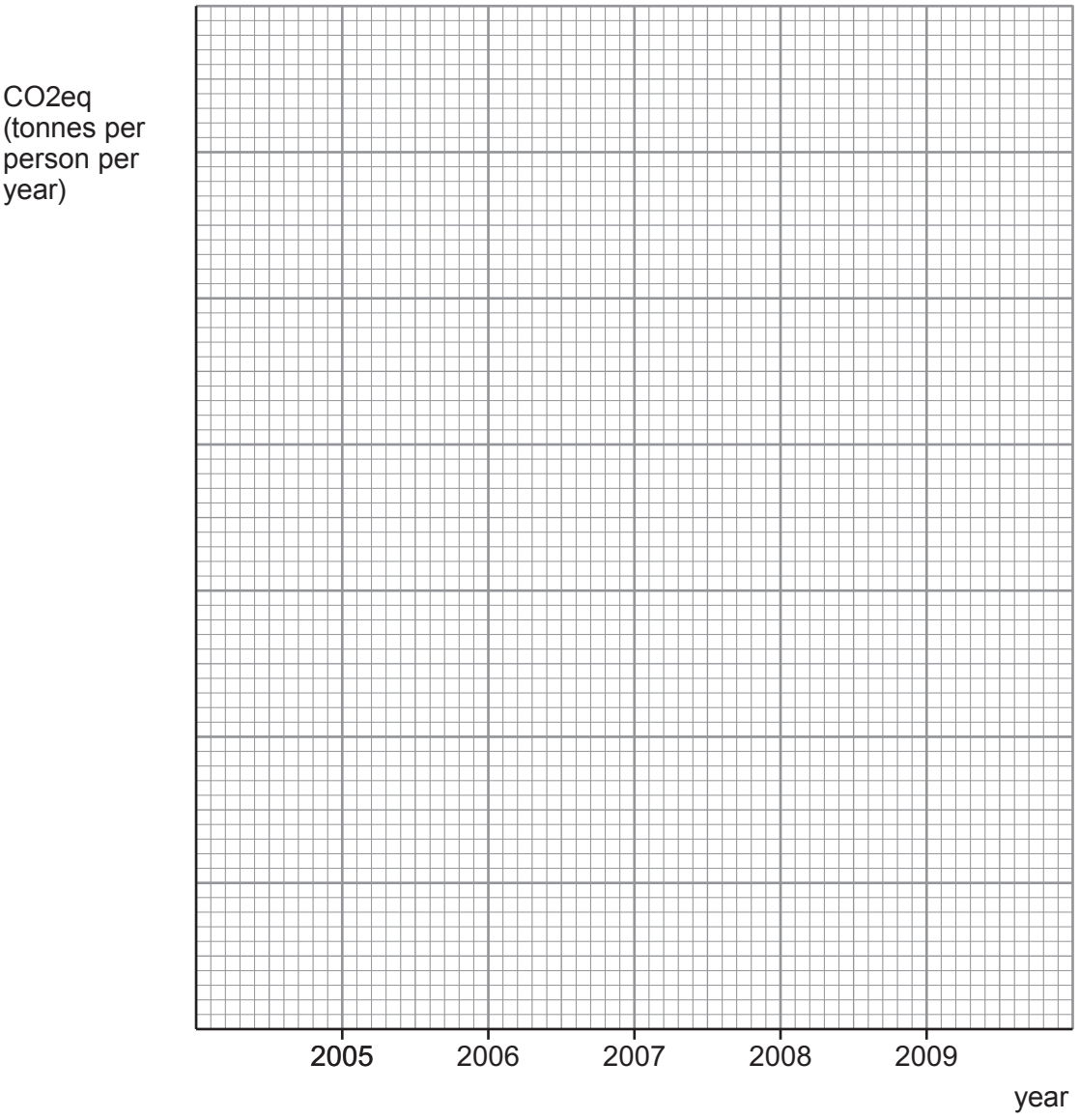
(i) State the countries which produced the lowest carbon dioxide emissions in 2009. [1]

.....

(ii) Name the country with the biggest increase in carbon dioxide emissions in tonnes per person per year between 2005 and 2009. [1]

.....

(iii) Plot a graph on the grid below to show how carbon dioxide emissions per person has changed over time in the UK. [4]



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(iv) Use the data to estimate the year in which the carbon dioxide emissions per person in the UK will reach the maximum allowed for sustainable living. Show how you arrived at your answer. [3]

year = ...

(b) A homeowner installs photovoltaic cells on the roof of their house and a log burner in their living room.
Describe how this will alter the pie chart of their personal CO_2 contributions shown in **Diagram 2**. [2]

.....

.....

(c) A farmer supplies 2000 kg of beef to the food industry every year. He is told that if he changed to supplying 2000 kg of poultry instead, he would reduce his carbon footprint. Use the information in **Table 2** to calculate the savings in his carbon footprint. [2]

Savings in carbon footprint = ... kgCO2eq

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END OF PAPER

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SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

A.M. THURSDAY, 14 January 2016

1 hour 15 minutes

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**10**	
	2.	**10**	
	3.	**8**	
	4.	**8**	
	5.	**10**	
Section B	**6.**	**12**	
	7.	**6**	
	8.	**6**	
	Total	**70**	

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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** (Pre-Release Article) to answer **Section B**.

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Section B is based upon the **Pre-Release Article**.

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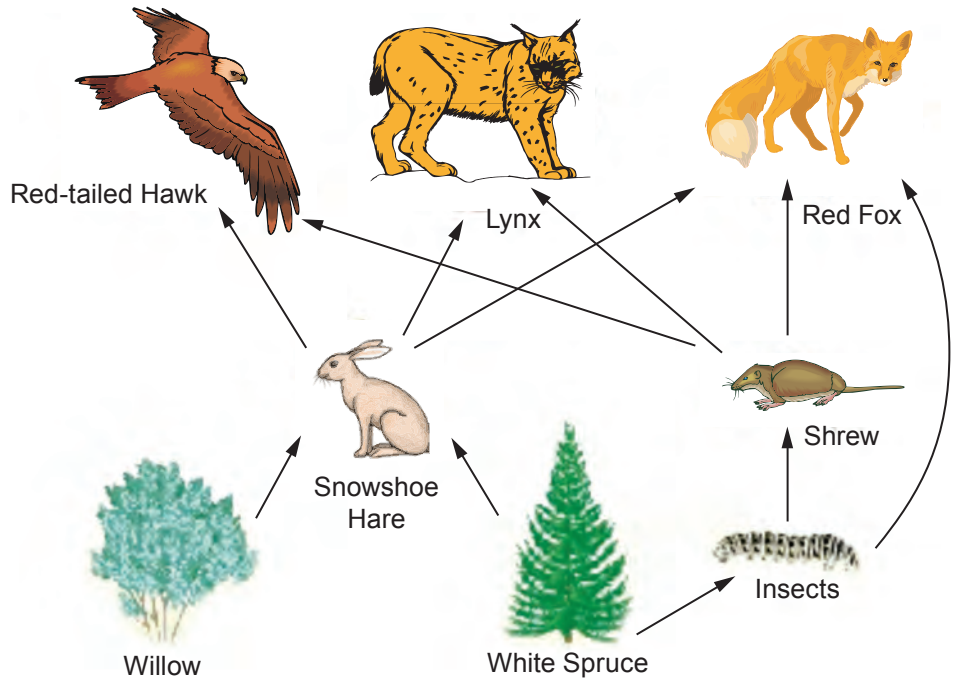
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SECTION A

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

1. The picture shows a food web.



(a) Answer each question using the food web.

(i) Name **one** producer. ..... [1]

(ii) Name **one** herbivore. ..... [1]

(iii) Name the prey of the shrew. ..... [1]

(b) (i) State **three** factors that will affect the size of the white spruce population. [3]

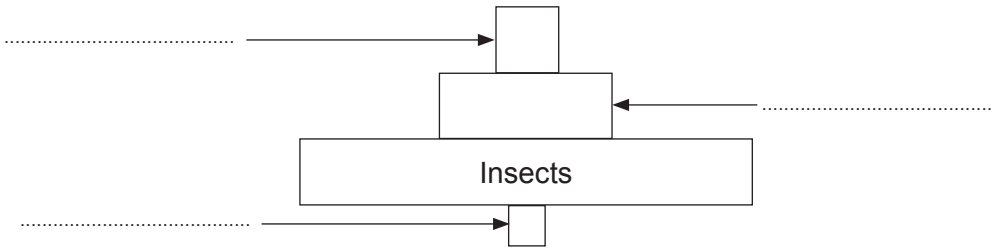
1. .....

2. .....

3. .....

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

(c) Label the pyramid of numbers below for one food chain in the web: [3]



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2. A homeowner is shopping for a washing machine. He compares information about four different models.

Model	Price (£)	Power (W)	Power (kW)	Units used per year (kWh/y)	Annual running cost (£)	Annual running cost (p)
A	350	2200	2.2	220		
B	345	2400		240	38.40	3840
C	320	2700	2.7	270	43.20	4320
D	340	2100	2.1			3360

(a) (i) Calculate the annual running cost for model **A** using the equation: [2]

annual cost = cost of one unit (16p) x units used in a year

cost = ...

(ii) State the power of model **B** in kW. [1]

power = ... kW

(iii) Calculate the length of time model **C** uses electricity during the year, by using the equation: [2]

$$\text{time (h)} = \frac{\text{units used}}{\text{power (kW)}}$$

time = ... h

(iv) State the annual running cost of model **D** in £. [1]

cost = £ .....

(v) The information assumes all models are used for the same time. Calculate the units used per year by model **D**. [1]

units used = ...

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(b) Complete the table below to select which model you would recommend as the best value for money. [3]

Model	Cost to buy (£)	Annual running cost (£)	10 year running cost	Total cost over 10 years
B	345	38.40	.....	.....
C	320	43.20	.....	.....

Best value for money = model .....

10

3. The table gives information about different regions of the electromagnetic (em) spectrum.

Region	Wavelength (m)	Frequency (Hz)
radio	2	150 000 000
microwave		
infra-red		
visible		
.....		
.....		
.....		

(i) Complete the table by placing X-rays, gamma rays and ultraviolet in the correct positions. [2]

(ii) Calculate the speed of em waves in space using information from the table and the equation:

wave speed = frequency x wavelength [2]

speed = ... m/s

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(iii) Complete the following sentences by underlining the correct word(s) in brackets. [4]

As you move down the table from radio waves the **wavelength** (*decreases* / *stays the same* / *increases*).

As you move down the table from radio waves the **frequency** (*decreases* / *stays the same* / *increases*).

As you move down the table from radio waves the **wave speed** (*decreases* / *stays the same* / *increases*).

As you move down the table from radio waves the **wave energy** (*decreases* / *stays the same* / *increases*).

8

4. *(a)* (i) In the table below, tick (✓) the statements that show the effects of raw sewage. [3]

Effect	(✓)
increases the number of bacteria in water	
increases oxygen content of water	
causes diseases in surfers	
decreases oxygen content of water	
increases biodiversity of river animals	

(ii) Name **two** types of chemicals used in intensive farming that cause water pollution. [2]

1. .....

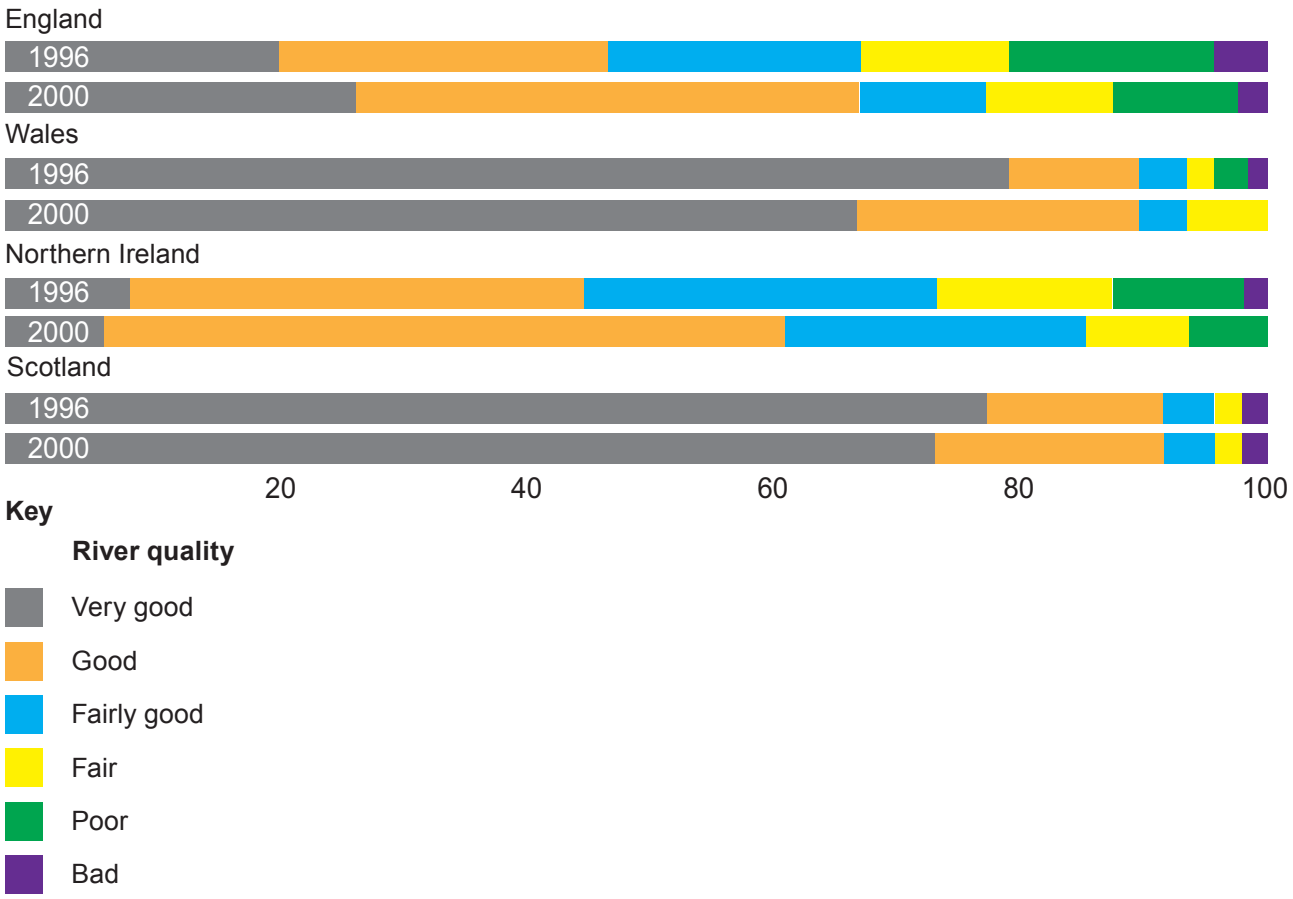
2. .....

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(b) The chart shows how river quality in the UK changed over a 4 year period.



Use the information in the chart to answer the following questions.

(i) Name the country with the least 'very good' water in 1996. [1]

.....

(ii) Name **one** country with **no** 'bad' water quality in 2000. [1]

.....

(iii) Name the country with the biggest drop in 'very good' water quality between 1996 and 2000. [1]

.....

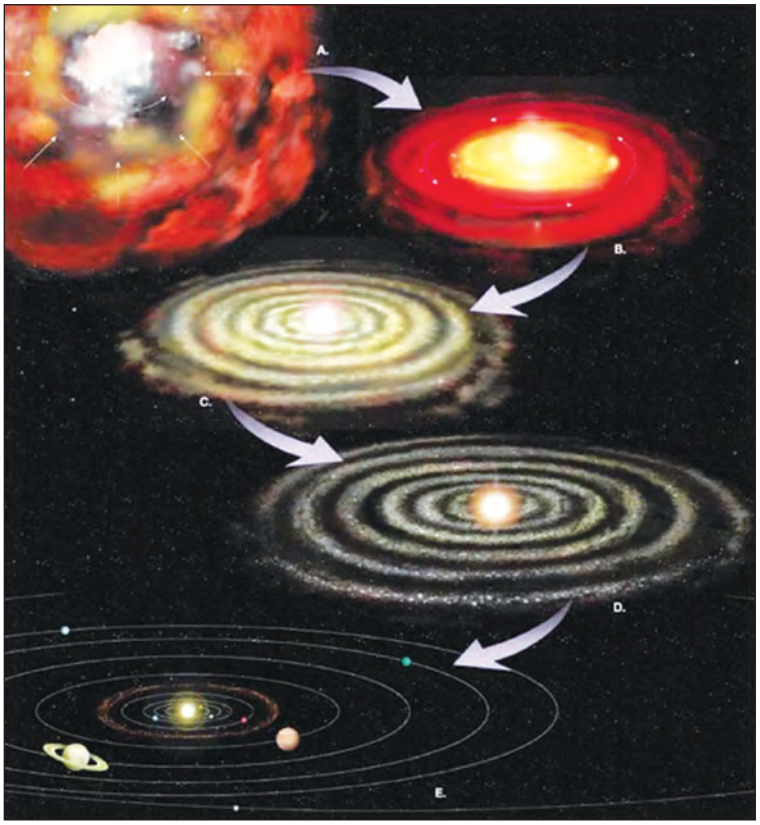
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5. *(a)* Use the detail in the picture to help you describe how the Sun and the Solar System were formed. [4]



.....

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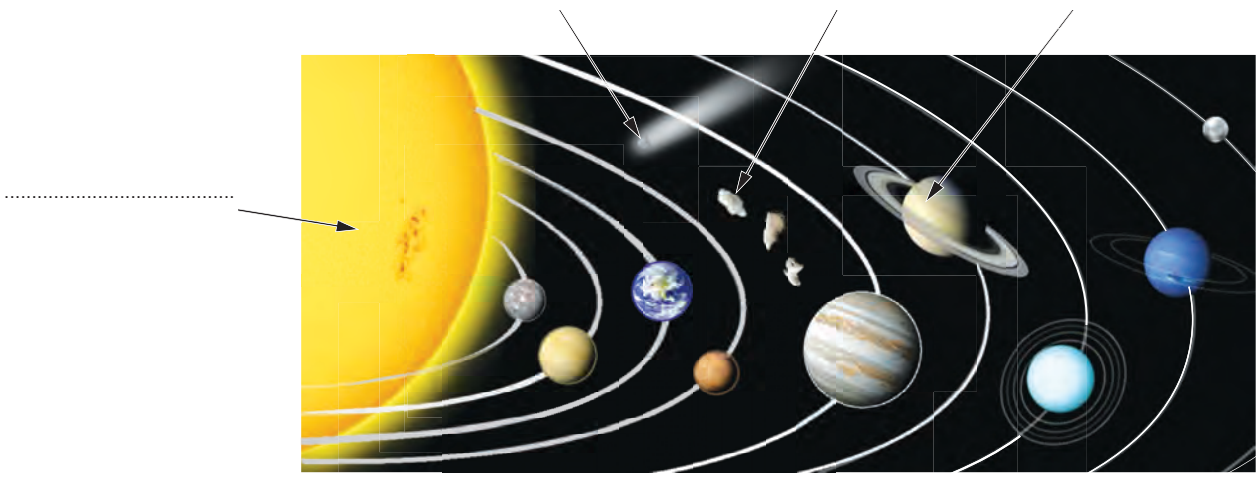
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(b) (i) The diagram shows structures found within the Solar System. Label the structures shown by the arrows. [4]



(ii) Name the cloud that forms the outer edge of the Solar System. [1]

.....

(iii) Name the bodies that orbit some planets but are not shown on the diagram. [1]

.....

10

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SECTION B

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

Use the information in the separate Resource Folder to answer the following questions.

6. *(a)* Use the information in **Table 1** to answer the question below.

Calculate the drop in the power generated by non-renewable sources from 2010 to 2050. Assume that the maximum power generated remains at a constant 34 GW. [2]

Drop in power generation by non-renewable sources = ... GW

(b) (i) Use the information in **Table 2** to answer the following questions.

A 10 MW power station needs 60 000 tonnes of willow crop per year.

I. Calculate the area of land needed to grow this amount of willow crop. [1]

area ..... km^2

II. Calculate the energy content of 60 000 tonnes of willow crop. [1]

energy content = ... units

(ii) Explain why burning biofuels is more environmentally friendly than burning fossil fuels. [2]

.....

.....

.....

.....

.....

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(c) Use the information about wind power on **page 5** to answer the following question.

Complete the table by ticking (✓) the correct column for each steady wind speed.

One has been completed as an example. [3]

Steady wind speed (m/s)	Zero power output	Rated output power	Between zero and rated output power
2.9	✓		
27.2			
19.6			
12.2			

(d) Describe the advantages of tidal water turbines compared to wind turbines using your knowledge and the information in **Table 3**. [3]

.....

.....

.....

.....

.....

.....

.....

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7. Compare the use of wind power and nuclear power to generate electricity using the information in **Table 4** and your own knowledge. [6 QWC]

Include in your answer, details about:

- cost effectiveness;
- effect on the environment;
- reliability.

6

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8. Use the information about solar panels on **page 7** to answer the questions that follow.

(i) Calculate the efficiency of a solar panel using the equation: [2]

$$\text{percentage efficiency} = \frac{\text{useful output power}}{\text{total input power}} \times 100$$

percentage efficiency = ...

(ii) Household voltage is 230 V. Calculate the maximum current that can be drawn from a solar panel of area 1 square metre, using the equation:

$$\text{current} = \frac{\text{power}}{\text{voltage}}$$

[2]

current = ... A

(iii) Calculate the energy (Wh) produced by a 5 square metre solar panel in 6 hours of good sunlight. [2]

energy = ... Wh

6

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GCSE MARKING SCHEME

JANUARY 2016

SCIENCE B
UNIT 1 - FOUNDATION TIER
4781/01

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INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

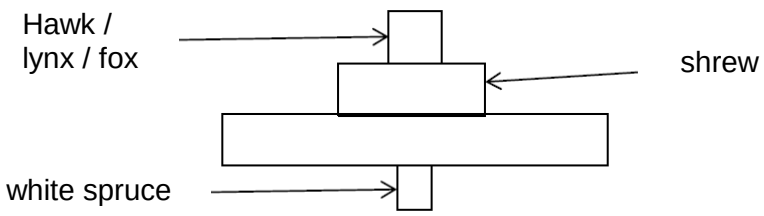
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GCSE SCIENCE B

UNIT 1 FOUNDATION TIER

JANUARY 2016 MARK SCHEME

Section A

Question	Marking point	Marks
1 (a) (i)	willow / white spruce	1
(ii)	snowshoe hare / insects	1
(iii)	insects	1
(b) (i)	Any **three** of: disease competition for nutrients with willow competition for light number of consumers/insects/snowshoe hares Accept deforestation	3
(ii)	sunlight (accept Sun)	1
(c)	1 mark for each correct response  	3

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<table>
<tr><th>Question</th><th>Marking point</th><th>Marks</th></tr>
<tr><td>2 (a) (i)</td><td>220 x 16 (1) = 3 520 p or £35.20 (1)</td><td>2</td></tr>
<tr><td>(ii)</td><td>2.4 (kW)</td><td>1</td></tr>
<tr><td>(iii)</td><td>270/2.7 (1) = 100 (h) (1)</td><td>2</td></tr>
<tr><td>(iv)</td><td>£33.60</td><td>1</td></tr>
<tr><td>(v)</td><td>210</td><td>1</td></tr>
<tr><td>(b)</td><td>1 mark for each correct column
<table><tr><th>Model</th><th>Cost to buy (£)</th><th>Annual running cost (£)</th><th>10 year running cost</th><th>Total cost over 10 years</th></tr><tr><td>B</td><td></td><td></td><td>384</td><td>729</td></tr><tr><td>C</td><td></td><td></td><td>432</td><td>752</td></tr></table>Model B</td><td>2

1</td></tr>
<tr><td>3 (i)</td><td>All correct (2)
1 or 2 correct (1)
<table><tr><th></th></tr><tr><td>Ultra violet</td></tr><tr><td>X-ray</td></tr><tr><td>Gamma-ray</td></tr></table></td><td>2</td></tr>
<tr><td>(ii)</td><td>speed = 2 x 150 000 000 (1) = 300 000 000 (m/s) (1)</td><td>2</td></tr>
<tr><td>(iii)</td><td>As you move down the table from radio waves the wavelength (<u>decreases</u> / stays the same / increases). (1)
As you move down the table from radio waves the frequency (decreases / stays the same / <u>increases</u>). (1)
As you move down the table from radio waves the wave speed (decreases / <u>stays the same</u> / increases). (1)
As you move down the table from radio waves the wave energy (decreases / stays the same / <u>increases</u>). (1)</td><td>4</td></tr>
<tr><td>4. (a) (i)</td><td><table><tr><th>Effect</th><th>(✓)</th></tr><tr><td>increases the number of bacteria in water</td><td>✓</td></tr><tr><td>increases oxygen content of water</td><td></td></tr><tr><td>causes diseases in surfers</td><td>✓</td></tr><tr><td>decreases oxygen content of water</td><td>✓</td></tr><tr><td>increases biodiversity of river animals</td><td></td></tr></table></td><td>3</td></tr>
<tr><td>(ii)</td><td>pesticides (1) fertilisers (1)</td><td>2</td></tr>
</table>

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Question	Marking point	Marks
(b) (i)	N Ireland	1
(ii)	Wales / N Ireland	1
(iii)	Wales	1
5 (a)	gas and dust cloud (1) pulled in by gravity (1) spirals into a disc (1) the Sun forms at the centre (due to gravity pull) (1) other dust particles stuck together (to make rocks which collided) to make planets (1) *Any four points*	4
(b) (i)	Sun, comet, asteroid (belt), Saturn	4
(ii)	Oort	1
(iii)	moons	1

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Section B

<table>
<tr><th>Question</th><th>Marking point</th><th>Marks</th></tr>
<tr><td>6 (a)</td><td>Reduction from 29 to 3 (1) = 26 (GW) (1)
or
31 – 5 (1) = 26 (GW) (1)</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>I. Area = (60 000/15) = 4000 (km^2) (1)
II. Energy content = (60 000 x 20) = 1200000 (units) (1)</td><td>2</td></tr>
<tr><td>(ii)</td><td>CO_2 released during burning (1)
= CO_2 absorbed during growing / photosynthesis (1)
so carbon neutral (1)
Any two points
The points must be correctly and coherently connected to be awarded two marks</td><td>2</td></tr>
<tr><td>(c)</td><td>1 mark for each correct point
<table><tr><th>Steady wind speed (m/s)</th><th>Zero power output</th><th>Maximum power output</th><th>Between zero and maximum power output</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td>27.2</td><td>✓</td><td></td><td></td></tr><tr><td>19.6</td><td></td><td>✓</td><td></td></tr><tr><td>12.2</td><td></td><td></td><td>✓</td></tr></table></td><td>3</td></tr>
<tr><td>(d)</td><td>smaller, larger power output, more reliable, less of an eyesore</td><td>3</td></tr>
</table>

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Question	Marking point	Marks
(7)	Indicative content • power output one nuclear power station is equivalent to 900 wind turbines • nuclear power stations last 3 times longer / in the lifetime of one nuclear power station equivalent 2700 wind turbines. • cost wind turbines more than double the cost of a nuclear power station / nuclear option cheaper per unit produced • wind power is less reliable • radioactive waste more detrimental to the environment since it has to be stored safely for long periods of time / danger of leakage into the ecosystem. **Marking bands** **5 - 6 marks.** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 - 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 - 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
(8) (i)	200/1000 (1) x 100 = 20 (1)	2
(ii)	Current = 200/230 (1) = 0.87 / 0.9 (A) (1)	2
(iii)	5 x 200 x 6 (1) = 6000 (Wh) (1)	2

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GCSE

4781/01

S15-4781-01

SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

P.M. FRIDAY, 5 June 2015

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**9**	
3.	**8**	
4.	**10**	
5.	**12**	
6.	**6**	
7.	**9**	
8.	**6**	
9.	**3**	
Total	**70**	

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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 B**.

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.

INFORMATION FOR CANDIDATES

Section B is based upon the Pre-Release Article.
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 (QWC) used in your answer to question **7***(a)*.

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SECTION A

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

1. *Reduce*, *reuse* and *recycle* schemes are used to improve sustainability.

(a) Complete the table to state whether each method is an example of a reduce, reuse or recycle scheme. [5]

Method	Scheme Reduce, reuse or recycle?
charging shoppers for carrier bags	.....
crushing and melting aluminium drink cans to make new ones	.....
using low energy lamps	.....
donating clothes and furniture to charity shops	.....
insulating homes	.....

(b) Some of these methods reduce the waste sent to landfill sites. State **two** benefits of reducing landfill waste. [2]

1. .....

2. .....

7

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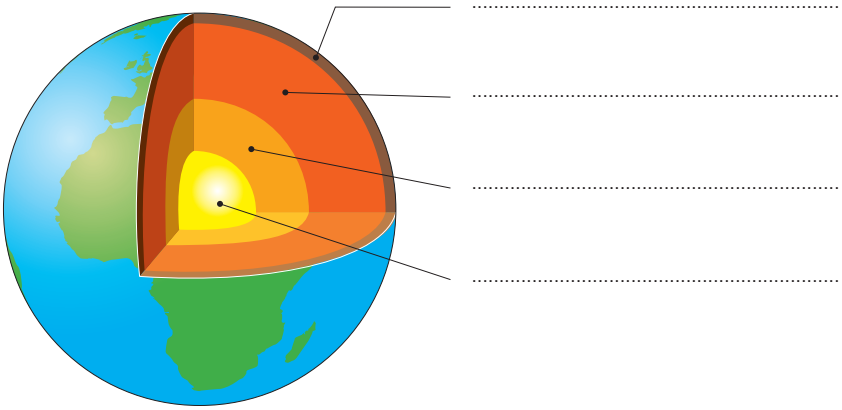
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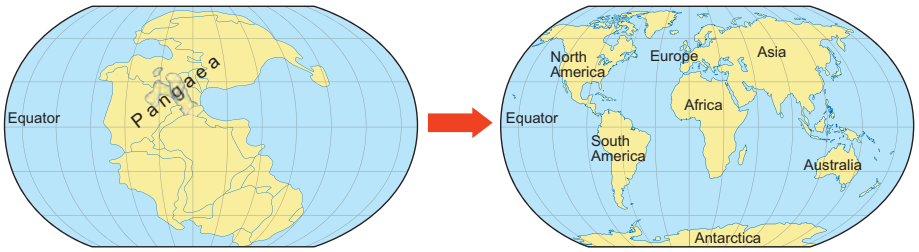
2. The diagram below shows the structure of the Earth.

(a) Label the **four** parts shown using words from the box. [4]

solid iron core	**mantle**	**crust**	**liquid outer core**	**continent**



(b) The diagrams below show how the surface of the Earth has changed over a long period of time. There was only one mass of land 3 billion years ago. This was called Pangaea.



3 billion years ago Today

Complete the paragraph below which explains how these changes have happened. [5]

The ..... is broken into sections called tectonic plates. The plates float on the ..... . The ..... are on the plates. Convection currents in the ..... move the tectonic plates very ..... .

9

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3. The table below shows what happens to the energy taken in each day by living things in a food chain.

Living thing	Energy (MJ) per day		
	As waste	Released during respiration	Used for growth
plant	18	12	8
caterpillar	14	22	4
bird	16	30	4

(a) (i) Calculate the total energy taken in by the plant each day. [1]

Energy taken in = ... MJ

(ii) The bird takes in 50 MJ of energy every day. Calculate the percentage of energy released during respiration. [2]

Percentage = ... %

(iii) State how the amount of energy released during respiration changes as you move higher in the food chain shown in the table. [1]

.....

Give **one** reason for this change. [1]

.....

(b) Crops can be sprayed with a pesticide which kills large numbers of caterpillars. Explain the effect of spraying crops on the other living things in this food chain. [3]

.....

.....

.....

.....

.....

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4. Infra-red (I-R) radiation from the Sun travels through space at a speed of 3×10^8 m/s. I-R radiation is one part of the electromagnetic (em) spectrum. Other regions of the em spectrum include **visible light, ultraviolet, radio waves** and **microwaves**.

(a) (i) Complete the **first column only** to show the missing regions of the em spectrum in order of increasing wavelength. [2]

Region of em spectrum	Typical wavelength (m)
visible light	.....
I-R	4×10^{-6} (0.000004)
.....	.....
.....	.....



Increasing wavelength

(ii) Typical wavelengths (in metres) for each region of the em spectrum are listed below in a random order.

0.02	5×10^{-7} (0.0000005)	600

Use these values to complete the **wavelength column** in the table. [2]

(iii) State the speed of visible light through space. ..... m/s [1]

(iv) State which region of the em spectrum, **in the table**, has the highest frequency. [1]

.....

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(b) (i) The following statements describe how the greenhouse effect occurs on Earth.

	Statement
A	I-R from the Sun arrives on Earth
B	Gases emit I-R back to Earth
C	The surface warms up by absorbing I-R
D	Gases in the atmosphere absorb I-R
E	Earth emits I-R

Arrange the statements in the correct order in the boxes below. [3]
The first box has been completed for you.

A	.....	.....	.....	.....

(ii) Name **one** greenhouse gas. ..... [1]

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10

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5. Homeowners who generate electricity from solar power save money and get paid for the energy they produce.

(a) State **two** ways using solar power benefits the **environment**. [2]

1. .....

.....

2. .....

.....

(b) The total savings for a typical **2.4 kW** household installation of solar panels are:

- £1 100 a year from the Generation Tariff
- £80 a year from the Export Tariff
- £120 a year reduction of current electricity bills.

(i) Calculate the total saving in a year. [1]

Saving = £ .....

(ii) If the solar panels cost £7 800 to install, calculate the payback time. [2]

Payback time = ... years

(iii) State **how** the payback time for the solar panel will be affected if the power output from the panel is less than 2.4 kW. [1]

.....

(iv) Give **two** reasons why the power output from the panel may be less than 2.4 kW. [2]

1. .....

2. .....

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(c) (i) One unit of electricity costs 15 p. Calculate how many units must have been produced to save the homeowner £120 (12 000 p). [2]

Use the equation:

$$\text{number of units} = \frac{\text{saving}}{\text{cost per unit}}$$

Number of units = ...

(ii) Calculate the number of hours of sunshine required by the 2.4 kW solar panels to generate the number of units for your answer in *(c)*(i). [2]

Use the equation:

$$\text{time} = \frac{\text{number of units}}{\text{power}}$$

Time = ... hours

12

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SECTION B

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

Use the information in the separate Resource Folder to answer the following questions.

6. Use **Diagram 1** to answer the following questions.

(a) Describe how the diagram shows the universe has changed over time. [1]

.....

(b) Explain why the diagram does not support the Steady-State theory of the universe. [2]

.....

.....

.....

(c) Imagine **C** is our galaxy, the Milky Way. Compare how the distances of galaxies **A** and **D** from the Milky Way have changed from the early universe to some time later. [2]

.....

.....

(d) Arrange galaxies **A**, **B**, **D** and **E**, in order of speed of travel away from **C** from fastest to slowest. [1]

Fastest .... *Slowest*

6

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7. Use the information in **Diagram 2**, **the text** and **Table 1** to answer the following questions.

(a) Describe how the properties of galaxies change from left to right along the Hubble Classification Scheme. [6 QWC]

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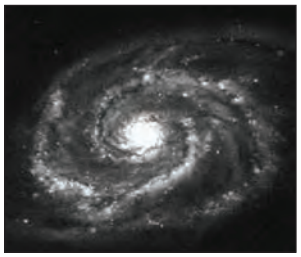
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(b) Write down the class of each galaxy shown in the diagrams below. [3]

The first one has been done for you.



Class E0



Class .....



Class.....



Class .....

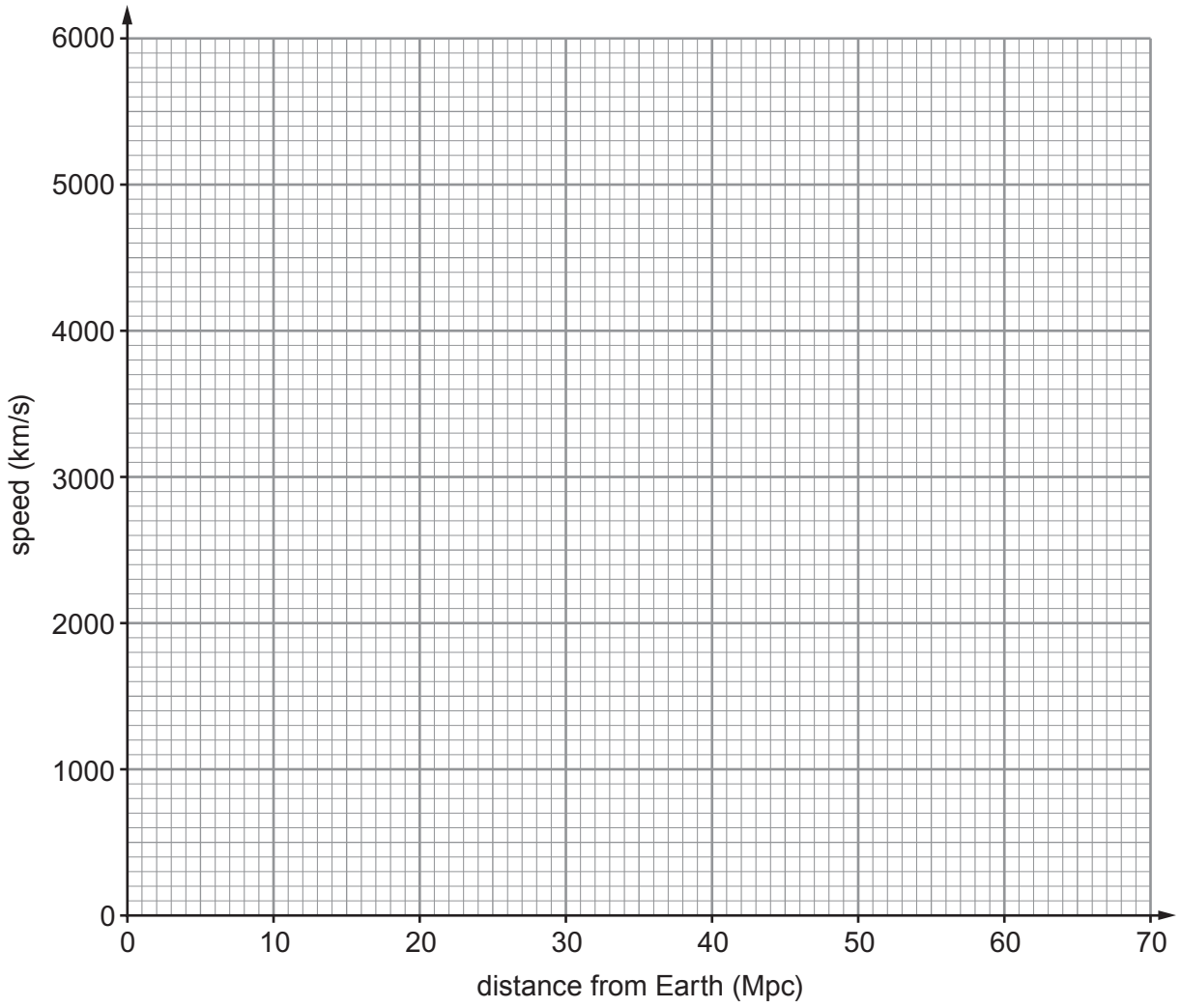
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8. *(a)* Use the data in **Table 2** to plot a graph on the grid below.
Use **only** the data for the six galaxies from NGC-4486 to NGC-5548.
Add a straight line of best fit that goes through the origin. [3]



(b) Use your graph to find a value for the Hubble constant. [3]

Hubble constant = ... km/s/Mpc

6

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9. Refer to **Diagram 3** to answer this question.

Describe how the surface temperature of our Sun will change as it becomes a red giant similar to Aldebaran and then a white dwarf similar to Sirius B. You should include data in your answer. [3]

.....

.....

.....

.....

3

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SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

P.M. THURSDAY, 15 January 2015

1 hour 15 minutes

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**8**	
	2.	**6**	
	3.	**9**	
	4.	**8**	
	5.	**9**	
	6.	**6**	
Section B	**7.**	**24**	
	Total	**70**	

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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** (Pre-Release Article) to answer **Section B**.

INSTRUCTIONS TO CANDIDATES

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INFORMATION FOR CANDIDATES

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Section B is based upon the **Pre-Release Article**.

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SECTION A

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

1. During the last 100 years, the percentage of land area covered by forest has fallen by 20%. At the same time, there has been a rapid increase in the Earth's human population. There has also been an increase in captive breeding programmes.

(a) Give **two** reasons why more land is needed as the population increases. [2]

1. .....

.....

2. .....

.....

(b) (i) Describe what is meant by the term *captive breeding programmes*. [2]

.....

.....

.....

(ii) State **one** reason why these programmes are important. [1]

.....

.....

(c) Many people believe that intensive farming is better at producing enough food. Other people prefer their food to be produced by organic farming.

In the table below, **tick (✓)** to show whether the statement is linked with intensive farming **or** organic farming. *One row has been completed as an example.* [3]

	Intensive farming	Organic farming
Uses pesticides	✓	
Produces more food		
Produces cheaper food		
Does not use caged animals		

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2. *(a)* Complete the sentences below. [5]

(i) The Universe began as the result of an ..... known as the Big Bang.

(ii) The Universe continues to ..... away from the Big Bang.

(iii) The evidence for the Big Bang is provided by ..... shift measurements.

(iv) Cosmic ..... Background radiation is the remains of energy produced by the Big Bang.

(v) The Universe is estimated to be 13.5 thousand ..... years old.

(b) Light years are used when measuring the Universe. What is a light year? [1]

.....

6

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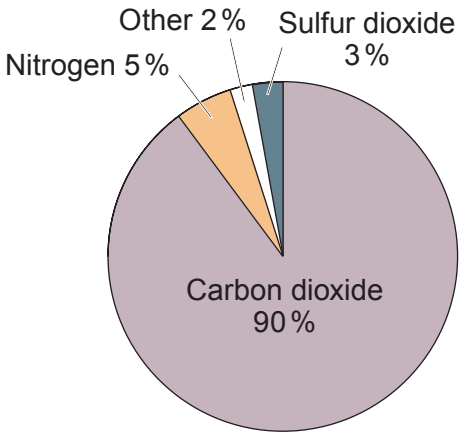
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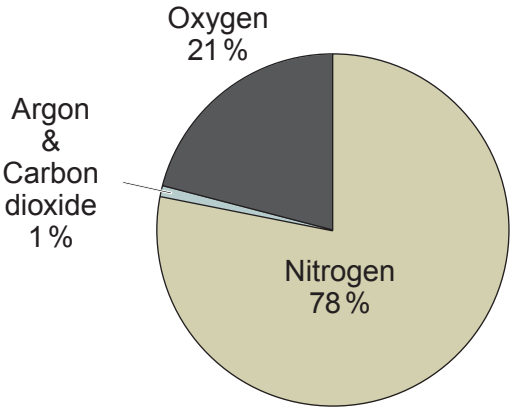
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3. *(a)* The pie charts below show how the present day atmosphere on Earth compares with the early atmosphere millions of years ago.

Early atmosphere



Today's atmosphere



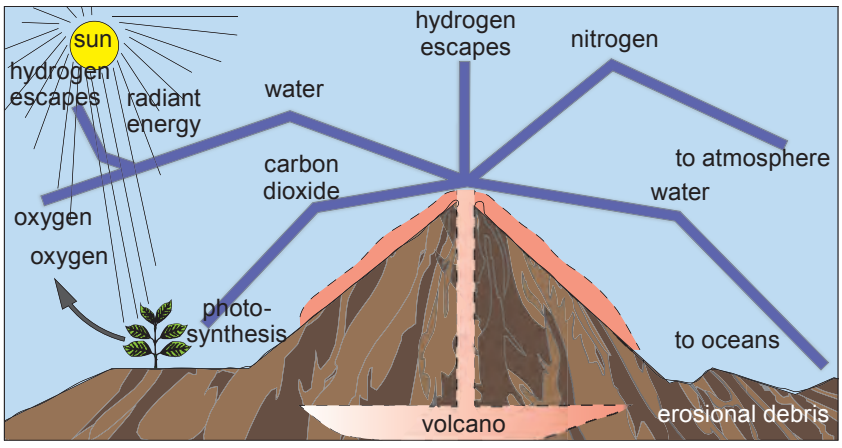
(i) State **three** ways today's atmosphere is different from the early atmosphere. [3]

1. .....

2. .....

3. .....

(ii) Use the information in the diagram below to give **two** ways volcanoes helped the atmosphere of the Earth to change. [2]



1. .....

.....

2. .....

.....

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(b) The table below shows information about gases found in the atmosphere on Venus, Earth and Mars.

Atmospheric gas	Venus	Earth	Mars
CO_2	98 %	0.03 %	90 %
N_2	1 %	78 %	2.5 %
O_2	0.0 %	21 %	2.5 %

(i) Name the planet that has the biggest greenhouse effect and give **one** reason for your answer. [2]

Planet .....

Reason .....

.....

(ii) Scientists claim that the global warming on Earth is increasing.
State **two** effects of global warming. [2]

1. .....

2. .....

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9

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4. *(a)* (i) Complete the table of the electromagnetic (em) spectrum to show the positions of **visible**, **ultra-violet** and **infra-red** radiation. [2]

Gamma rays	X rays	.....	.....	.....	Microwaves	Radio waves

(ii) Complete the sentences below by **underlining** the correct word in the brackets. [3]

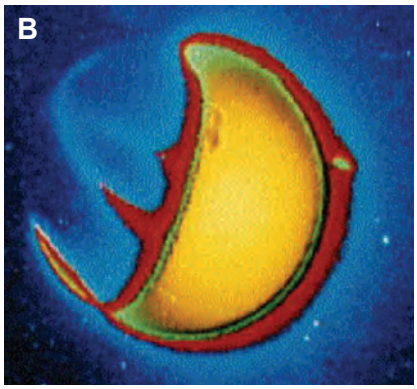
The wavelength *(decreases / stays the same / increases)* from gamma rays to radio waves.

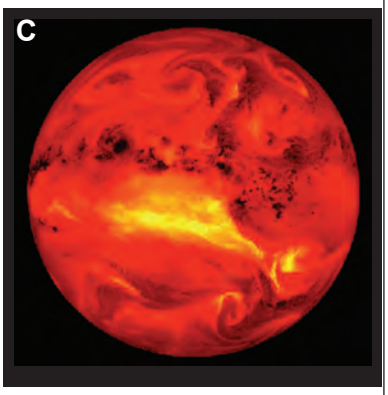
The frequency *(decreases / stays the same / increases)* from gamma rays to radio waves.

The wave energy *(decreases / stays the same / increases)* from gamma rays to radio waves.

(b) These pictures of the Earth were taken using different parts of the em spectrum.







Complete the table below. [3]

Picture	Features	Type of em wave used to take the picture
A	Land, clouds and sea clearly seen.	.....
B	One side appears ..... than the other.	ultra-violet
C	Shows patterns of water vapour in the atmosphere that has trapped heat.	.....

8

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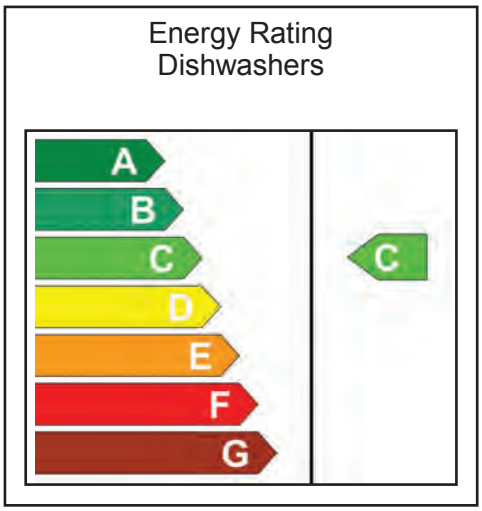
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5. Dishwashers are rated by the amount of energy they use. Dishwashers rated **A** use less energy and are cheaper to run than those rated **G**.



The following table gives information about dishwashers rated **A**, **B** and **D**.

Dishwasher energy rating	Voltage (V)	Current (A)	Units of energy used per year (kWh)
A	230	4	210
B	230	6	315
D	230	8	420

(a) Calculate the power of dishwashers rated **D** using the equation: [2]

power = voltage x current

Power = ... kW

(b) Circle, from the list below, the energy used per year by a dishwasher rated **C**. [1]

200 310 350 430

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(c) A homeowner buys a dishwasher rated **D**.

(i) Find the cost of using this dishwasher for a year using the equation: [2]

cost = units used x cost per unit

One unit of electricity costs 20p.

Cost = £ .....

(ii) Complete the following sentence by **underlining** the correct words in the brackets. [1]

The dishwasher rated **A** costs *(half as much as / the same as / more than)* the dishwasher rated **D** to run.

(iii) The homeowner could have bought a dishwasher rated **A** that cost £35 more than the one rated **D**. State **one** reason why the dishwasher rated **A** would have been more cost effective. [1]

.....

.....

(d) Use the information in the table opposite, and your answer to part *(a)*, to calculate the time that the dishwasher rated **D** was used during a year. [2]

Use the equation:

$$\text{time (h)} = \frac{\text{units used}}{\text{power (kW)}}$$

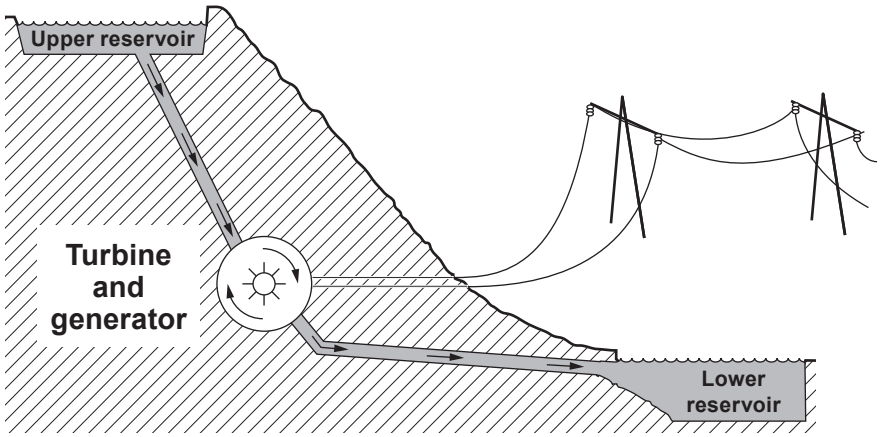
Time = ... h

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6. The diagram shows how electricity is generated in a hydroelectric power station.



The hydroelectric power station is only used when we need more electricity than the rest of the power stations around the country can supply.

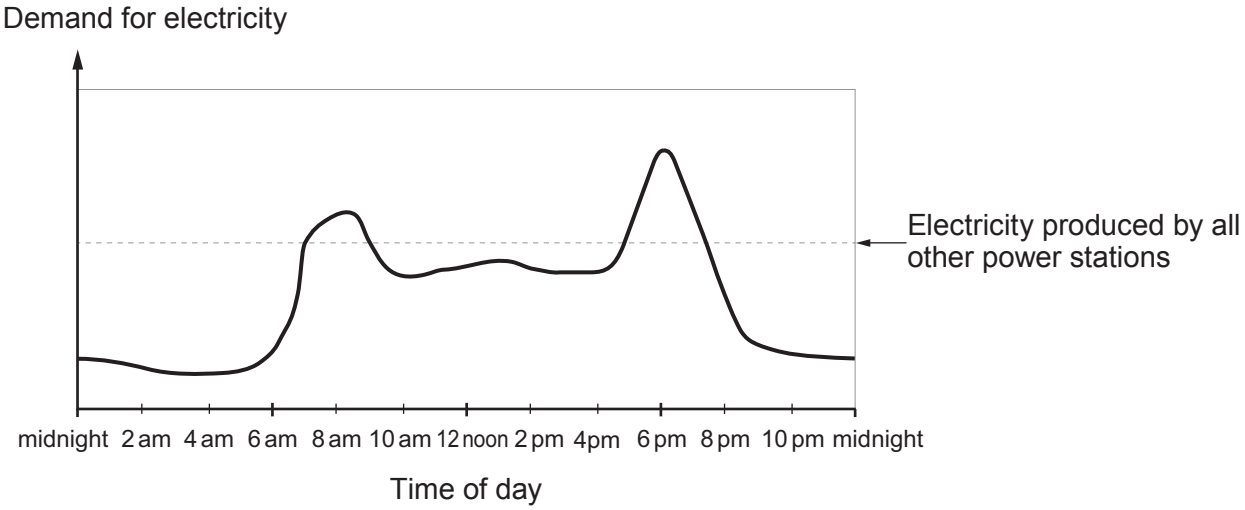
(a) (i) State **one** reason why a hydroelectric power station is quicker to start up than a coal or gas power station. [1]

.....

(ii) State **one** disadvantage to wildlife of using hydroelectric power. [1]

.....

(b) The need for electricity changes in the way shown below.



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(i) Demand for electricity is greater than supply from 'all other power stations' between 7.00 a.m. and 9.00 a.m. State **one** *other* part of day where demand for electricity is greater than supply. [2]

Between ..... p.m. and .....p.m.

(ii) **Underline** the best time to use electricity to pump water from the lower reservoir to the upper reservoir. [1]

Midnight	–	6 a.m.
6 a.m.	–	10 a.m.
10 a.m.	–	4 p.m.
4 p.m.	–	8 p.m.

(iii) Give **one** reason for your answer. [1]

.....

6

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SECTION B

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

Use the information in the separate Resource Folder to answer the following questions.

7. *(a)* (i) Give **one** reason why phytoplankton and plants **only** increase the oxygen concentration during sunlight hours. [1]

.....

.....

(ii) Give **one** reason why living phytoplankton and other plants are **only** found in the epilimnion layer of water. [1]

.....

.....

(b) Name the process by which phytoplankton and plants will decrease the oxygen concentration at night. [1]

.....

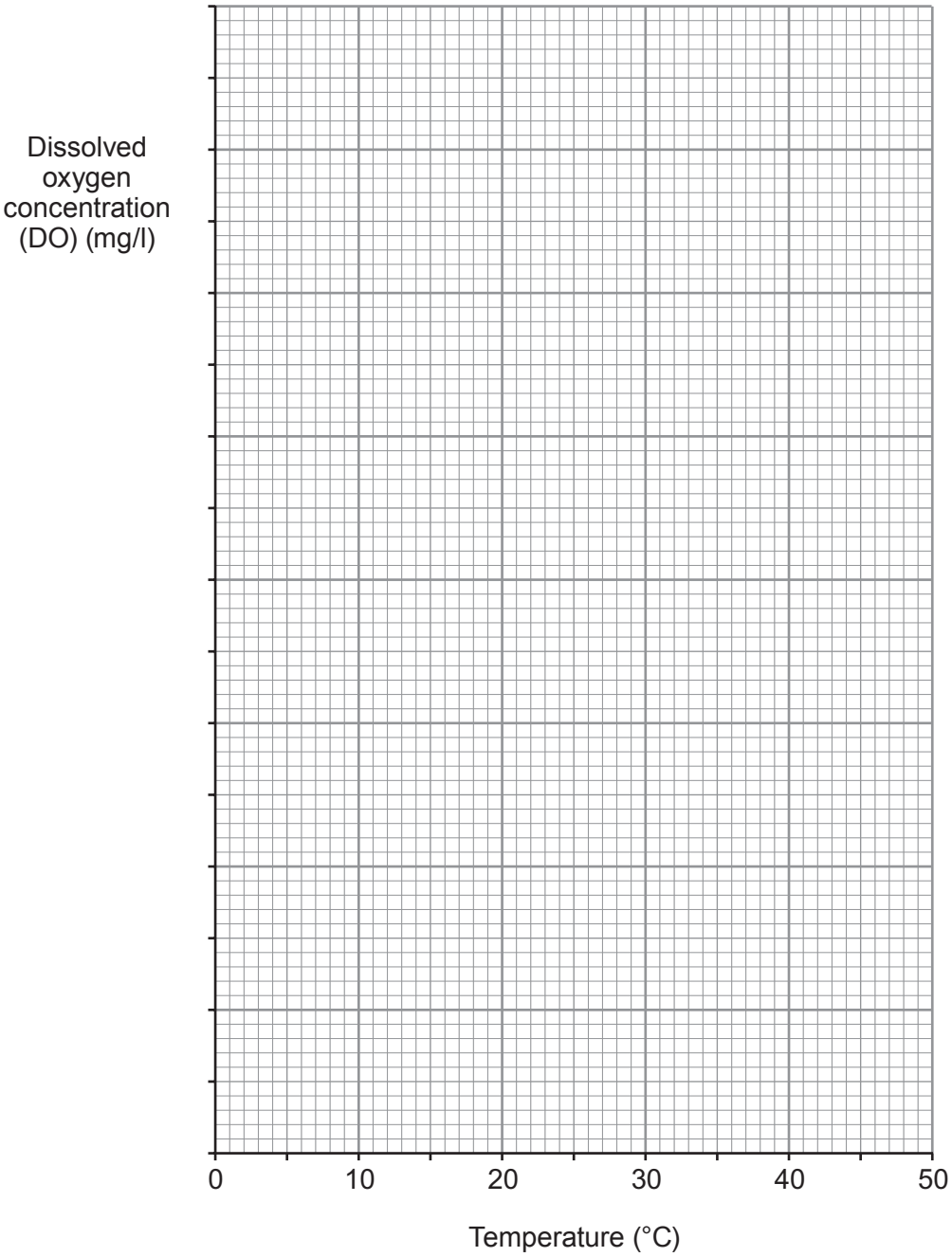
(c) (i) Use the information in **Table 1** to complete the table below and then plot a graph to show how the dissolved oxygen concentration varies with temperature. [5]

Temperature (°C)	Dissolved oxygen concentration (DO) (mg/l)
0	.....
6	.....
10	.....
14	.....
20	.....
26	.....
30	.....
40	.....

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(ii) Describe the pattern shown by your graph. [2]

.....

.....

(iii) Continue your graph to estimate the temperature at which oxygen levels become low enough to cause stress to fish. [1]

.....

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(d) (i) Use **Graph 2** and your answer to *(c)*(ii) to describe how the dissolved oxygen concentration will vary in the epilimnion between May and November. [3]

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(ii) Use the information in **Diagram 1** and **Graph 1** to complete the table below for the year **2006**. [4]

Month	Dissolved oxygen concentration (DO) (mg/l)	Condition of fish
May	9	OK
June	.....	.....
July	.....	.....
August	.....	.....
September	.....	.....

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(e) Use the food web in **Diagram 3** to answer the following question.
The dissolved oxygen concentration drops enough to decrease the number of anchovies.
Describe how this will affect the other living things in the food web. [QWC 6]

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24

END OF PAPER

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GCSE MARKING SCHEME

SCIENCE B

JANUARY 2015

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2015 examination in GCSE SCIENCE B. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
FOUNDATION TIER	1
HIGHER TIER	5

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GCSE SCIENCE B FOUNDATION TIER

JANUARY 2015 MARK SCHEME

Section A

<table>
<tr><th colspan="3">Question</th><th>Marking point</th><th>Marks</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>More land for (any) building [1] more land for food [1]</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><u>Endangered</u> animals (are bred) [1] in zoos/wildlife parks [1]</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Protect (endangered) animals / prevent extinction of an animal</td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td>[1 x 3]
<table><tr><th></th><th>Intensive farming</th><th>Organic farming</th></tr><tr><td>Uses pesticides</td><td>✓</td><td></td></tr><tr><td>Produces more food</td><td>✓ (1)</td><td></td></tr><tr><td>Produces cheaper food</td><td>✓ (1)</td><td></td></tr><tr><td>Does not use caged animals</td><td></td><td>✓ (1)</td></tr></table></td><td>3</td></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td>Explosion</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Expand</td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Red</td><td>1</td></tr>
<tr><td></td><td></td><td>(iv)</td><td>Microwave</td><td>1</td></tr>
<tr><td></td><td></td><td>(v)</td><td>Million</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Distance light travels in a year</td><td>1</td></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td>Any three of (to max 3 marks):
The (% of) carbon dioxide has decreased [1]
Sulfur dioxide decreased/No Sulfur dioxide [1]
Nitrogen has increased [1]
Oxygen has appeared / increased [1]</td><td>3</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Volcanic eruptions released nitrogen [1] and water into the atmosphere [1]</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Venus [1] Most/more carbon dioxide [1]</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>More extreme weather / hotter [1]
Melting ice caps / rising sea levels / flooding [1]</td><td>2</td></tr>
</table>

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Question			Marking point	Marks
4	(a)	(i)	All correct [2] one correct [1] U-V | Visible | I-R	**2**
		(ii)	<u>increases</u> <u>decreases</u> <u>decreases</u>	**3**
	(b)		Visible Brighter / darker I-R	**3**
5	(a)		230 x 8 = 1 840 (W) [1] 1.84 KW [1]	**2**
	(b)		350 circled [1]	**1**
	(c)	(i)	420 x 20 = 8 400 [1] £84 [1]	**2**
		(ii)	<u>half as much</u>	**1**
		(iii)	Saves more on running costs in a year / saves more than £35 [1]	**1**
	(d)		420 / 1.84 (ecf) [1] answer = 228.26 / 228.3 hours [1]	**2**
6	(a)	(i)	No water to heat up	**1**
		(ii)	Flooding of land destroys habitats	**1**
	(b)	(i)	5 p.m. - 7.30 p.m. (+/- 15 mins)	**2**
		(ii)	Between midnight and 6.00 a.m.	**1**
		(iii)	Low demand / ‘spare’ electricity is used	**1**

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Section B

<table>
<tr><th colspan="3">Question</th><th>Marking point</th><th>Marks</th></tr>
<tr><td>7</td><td>(a)</td><td>(i)</td><td>That is the time <u>photosynthesis</u> occurs [1]</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Light penetrates this layer / does not penetrate lower. [1]</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Respiration [1]</td><td>1</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>Temperature (^{0}C)</th><th>Dissolved oxygen (DO) (mg/l)</th></tr>
<tr><td>0</td><td>14.60</td></tr>
<tr><td>6</td><td>12.43</td></tr>
<tr><td>10</td><td>11.27</td></tr>
<tr><td>14</td><td>10.29</td></tr>
<tr><td>20</td><td>9.07</td></tr>
<tr><td>26</td><td>8.09</td></tr>
<tr><td>30</td><td>7.54</td></tr>
<tr><td>40</td><td>6.41</td></tr>
</table>
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<tr><td></td><td></td><td>(iii)</td><td>Between 44-45˚C (from candidates graph)</td><td>1</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>Temperature increases (May-Aug) <u>and</u> then decreases (to Nov) [1] (May to August) DO decreases <u>and</u> then increases (to November) [1] reference to months [1]</td><td>3</td></tr>
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<tr><td>July</td><td>5</td><td>Stressed</td></tr>
<tr><td>August</td><td>3</td><td>Choking</td></tr>
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</table></td><td>4</td></tr>
</table>

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Question			Marking point	Marks
	(e)		Indicative content • Food supply / prey of the anchovies will increase i.e. zooplankton and phytoplankton. • Less competition for these food sources will result in an increase in invertebrates and bivalves. • Animals that feed on anchovies will decrease in number e.g. gulls, waders and bass. • Since they have no other food source they may die. • Ospreys will decrease / die. • Bald eagles will feed more on Sea Ducks so their numbers will decrease meaning less competition for swans so their number will increase **Marking bands** **5-6 marks.** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

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GCSE SCIENCE B HIGHER TIER

JANUARY 2015 MARK SCHEME

Section A

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Section B

Question			Marking point	Marks
2	(a)		230 x 8 = 1840 (W) [1] 1.84 kW [1]	**2**
	(b)		Any value between 316 and 419	**1**
	(c)	(i)	420 x 20 = 8 400 [1] £84 [1]	**2**
		(ii)	**A** uses half the units of **D** [1] so would only cost £42 to run saving more than the extra cost (in a year) [1] *The points must be correctly and coherently connected to be awarded two marks*	**2**
	(d)		420 = 1.84 (ecf) x time [1] manipulation [1] answer = 228.26 / 228.3 hours [1]	**3**
3	(a)	(i)	An increase in population needs more land for housing / more land for food [1] so forest are cleared for land / for farming [1] *The points must be correctly and coherently connected to be awarded two marks*	**2**
		(ii)	Habitats destroyed [1] so less biodiversity [1] Also accept less photosynthesis [1] so adds to greenhouse effect / more CO_2[1] *The points must be correctly and coherently connected to be awarded two marks*	**2**
		(iii)	Endangered animals are bred [1] so prevents extinction [1] *The points must be correctly and coherently connected to be awarded two marks*	**2**
	(b)		For intensive farming: higher yield / cheaper [2 max] Against: uses artificial chemicals / animal welfare / quality of product [2 max] Question total [3 max]	**3**
4		(i)	The % of carbon dioxide has decreased [1] nitrogen <u>and</u> oxygen has increased [1]	**2**
		(ii)	Volcanic eruptions released (nitrogen and) water into the atmosphere [1] which split into hydrogen and oxygen [1] green plants developed and used water and carbon dioxide in photosynthesis [1] so producing oxygen [1] [Question total 3 max] *The points must be correctly and coherently connected to be awarded the marks.*	**3**
		(iii)	More carbon dioxide on Venus [1] gases in the atmosphere absorb (infra-red) radiation emitted from planet surface [1] **which is then** re-emitted back to the planet [1] *The points must be correctly and coherently connected to be awarded two marks.*	**3**

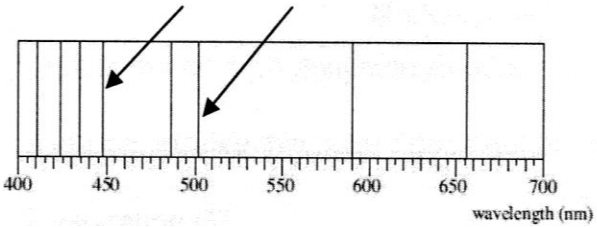
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Question			Marking point	Marks
5	(a)	(i)	No delay in start up	**1**
		(ii)	Flooding of land destroys habitats	**1**
	(b)	(i)	7.30a.m. and 9a.m. 5p.m. - 7.30p.m. ± 15 mins	**2**
		(ii)	Low demand [1] so 'spare' electricity is used [1]	**2**
	(c)		**Indicative content** • Electricity from power station is increased to a higher voltage • Using a step-up transformer • This reduces the current so there is less heating of the cables • Resulting in a lower energy loss • A step down transformer reduces the voltages for users to a safe level. **Marking bands:** **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	**6**

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Question			Marking point	Marks
6	(a)	(i)	Both must be correct for 1 mark  	**1**
		(ii)	Both must be correct for 1 mark 452 & 507 (nm)	**1**
	(b)	(i)	(High energy) gamma rays [1] stretched as Universe expanded [1]	**2**
		(ii)	Conversion 0.1cm to 0.001m [1] subs/manipulate [1] answer = 3×10^{11} Hz [1]	**3**

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4781/01

SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

P.M. FRIDAY, 6 June 2014

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**6**	
3.	**4**	
4.	**7**	
5.	**10**	
6.	**8**	
7.	**4**	
8.	**24**	
Total	**70**	

4781 010001

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 B**.

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 B 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 **8***(a)(ii)*.

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SECTION A

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

1. *(a)* Tick (✓) the correct box to complete each statement below. [3]

(i) According to the theory of evolution, new species evolve by:

artificial selection ☐

natural selection ☐

unnatural selection ☐

(ii) Individuals in a species show a wide range of variation because of differences in their:

genes ☐

hormones ☐

cells ☐

(iii) The individuals most likely to survive to reproduce are those:

with no immunity to disease ☐

poorly suited to the environment ☐

well suited to the environment ☐

(b) (i) Describe what is meant by the term *biodiversity*. [2]

.....

.....

(ii) Explain why the number of different species is not distributed evenly on Earth. [2]

.....

.....

.....

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7

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Turn over.

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2. Intensive farming methods include the use of pesticides, fertilisers, herbicides, and 'battery' farming. These methods increase food production but there are disadvantages.

Complete the table using words from the box below.
*The first line has been completed for you. Do **not** use a word more than once.* [6]

input	nutrients	plants	output	biodiversity	indoors	rivers
insects	warm	sunlight	**animals**	**poison**		

Intensive farming method	Reason for use	Disadvantage
Pesticide spray	Removes **animals** that feed on the crop	May **poison** useful organisms
Herbicide spray	Removes competing	Reduces .....
Fertiliser spray	Adds ..... to the soil	Causes dense plant growth in .....
'Battery' farming	Increases	Keeps animals .....

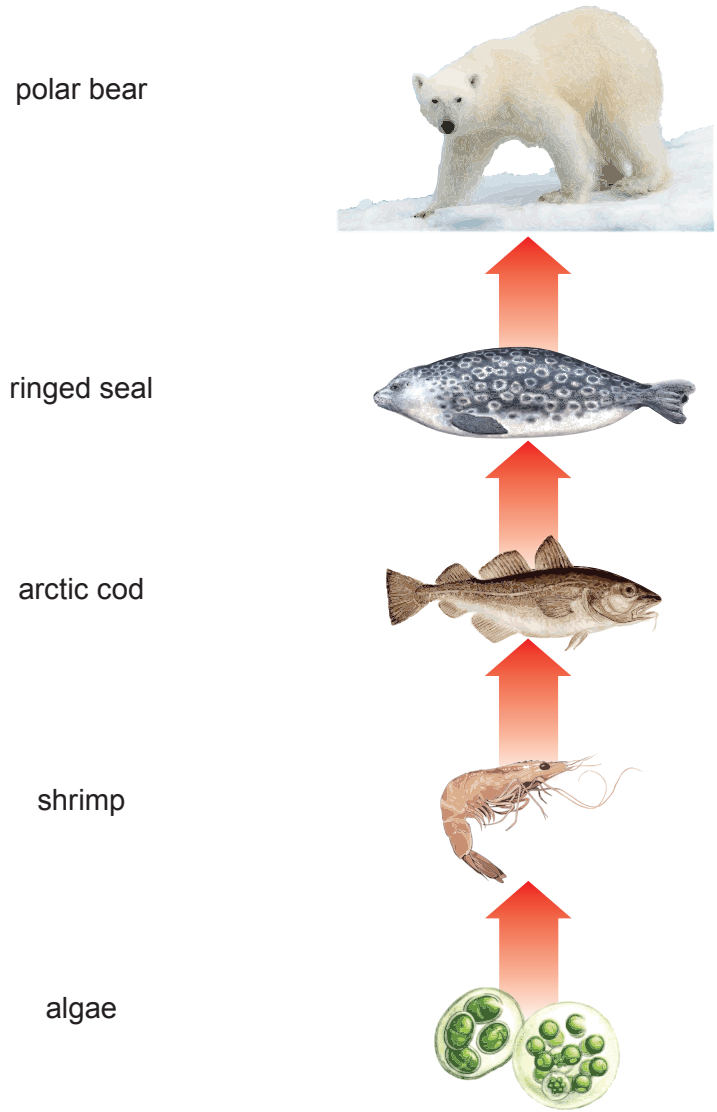
6

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3. About 150 tonnes of the highly toxic heavy metal mercury enters the environment every year. Some of this will enter the food chain below.



(a) State the *source* of energy for the food chain. ..... [1]

(b) (i) How does mercury get into the body of shrimps? [1]

.....

(ii) Explain why the effect of mercury is most harmful to the polar bear. [2]

.....

.....

.....

.....

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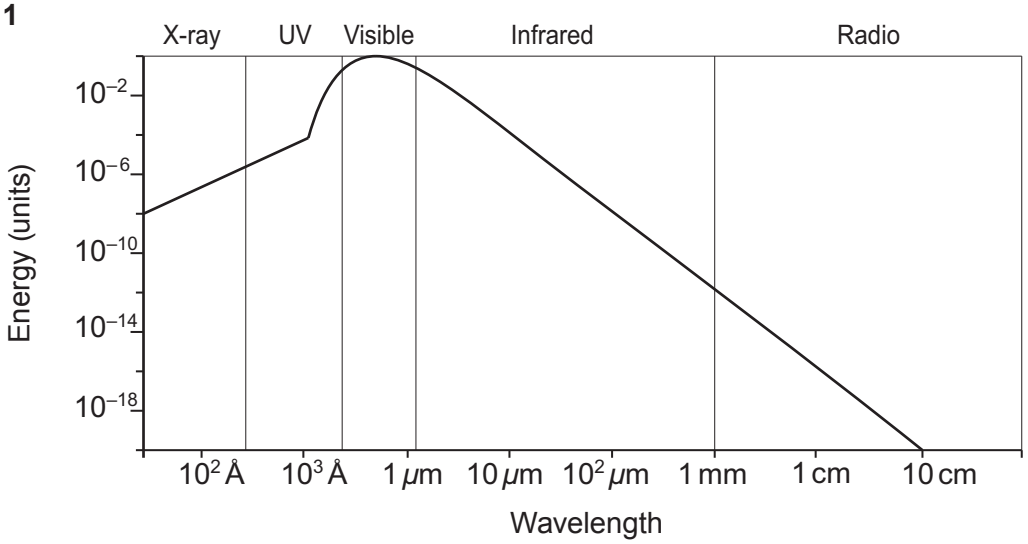
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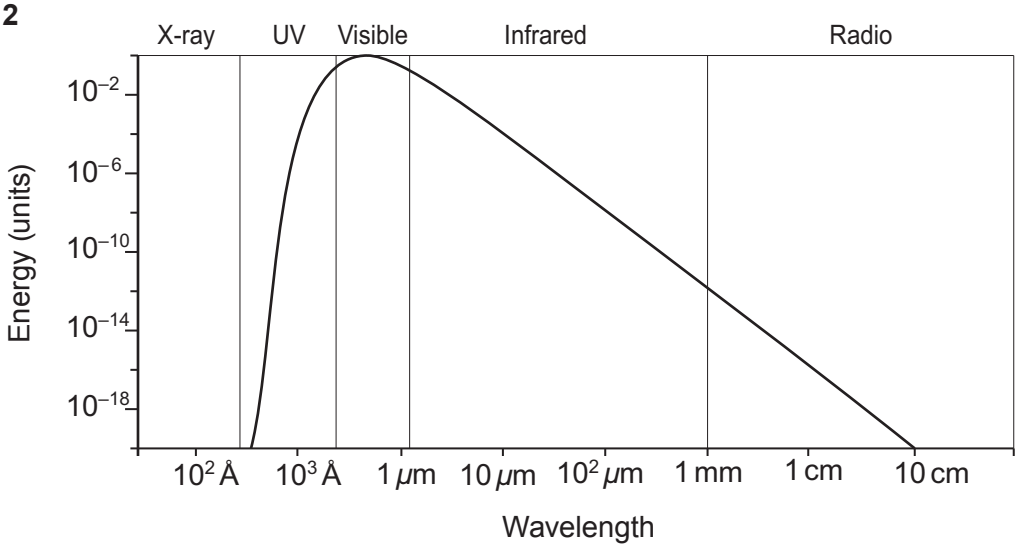
4. Graph **1** shows the energy given out by the Sun at different wavelengths.

Graph **1**



Graph **2** shows the expected energy given out by the Sun at the same wavelengths.

Graph **2**



(i) Name **two** regions of the electromagnetic spectrum **not** shown on the graphs. [2]

1 .....

2 .....

(ii) State **one** similarity between graphs **1** and **2**. [1]

.....

.....

(iii) State **one** difference between graphs **1** and **2**. [1]

.....

.....

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(iv) Use the graphs to find the wavelength of the longest radio waves given out by the Sun. [1]

..... cm

(v) Calculate the frequency of the longest radio waves emitted from the Sun. You will need to use your answer from (iv) and the equation: [2]

$$\text{frequency} = \frac{\text{wave speed}}{\text{wavelength}}$$

Speed of light = 30 000 000 000 cm/s

Frequency = ... Hz

7

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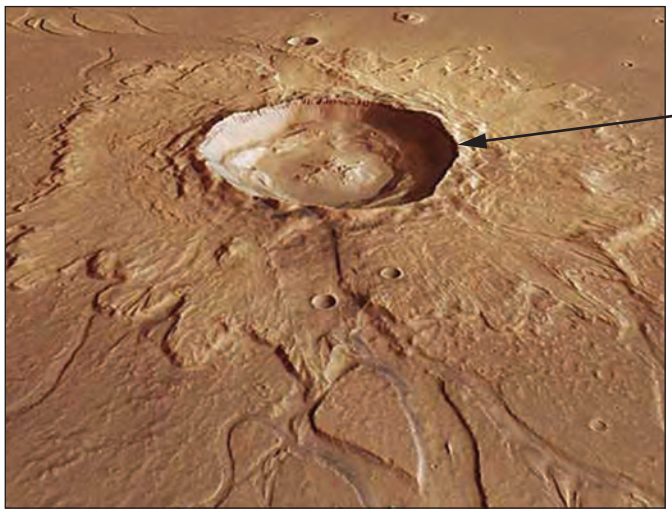
Examiner only

5. The photographs below show different features on Mars.

(a) Use words from the list below to complete the labels. [2]

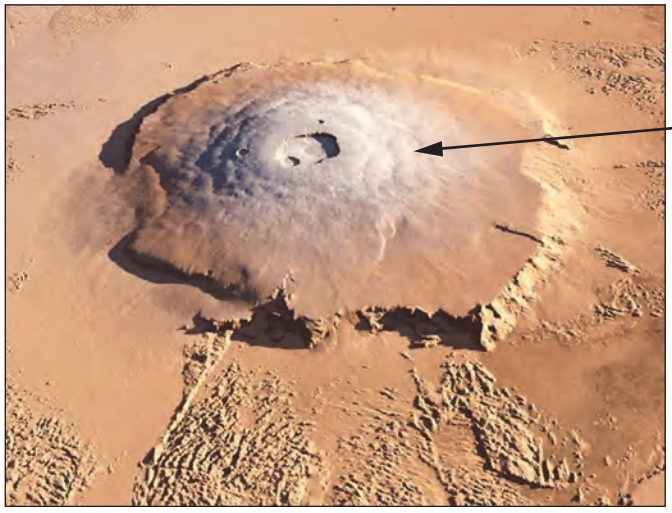
volcano *ice cap* *crater*

Photograph 1



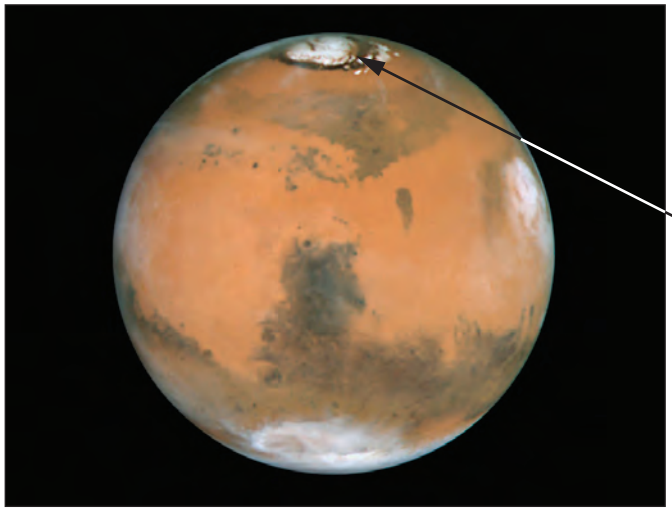
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Photograph 2



.....

Photograph 3



.....

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(b) (i) Name the substance that flows from a volcano when it erupts.

..... [1]

(ii) What does the presence of a volcano suggest about the early core of Mars? [1]

.....

.....

(iii) It has been suggested that the surface of Mars may be made from tectonic plates. Give **one** reason how the presence of volcanoes supports this idea. [1]

.....

(c) There are many more craters on the surface of Mars than on the surface of Earth.

(i) How were these craters formed? [1]

.....

(ii) Give **one** reason why this suggests there is a 'thinner' atmosphere on Mars. [1]

.....

.....

(d) (i) Only **frozen** water has been found on Mars, for example, at the ice cap. What does this tell us about the climate on Mars? [1]

.....

.....

(ii) Carbon dioxide makes up 95% of the atmosphere on Mars.
Explain how you would expect this to affect Mars' climate. [2]

.....

.....

.....

10

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6. Large areas of land are used to grow trees that will be cut up to make wood chips. The wood chips are used instead of gas, coal or oil, as fuel in boilers.

(a) Explain why the supply of wood chips is renewable. [2]

.....

.....

.....

(b) (i) Name **one** gas given out when wood chips are burned. [1]

.....

(ii) Name the gas **used by** trees during photosynthesis. [1]

.....

(iii) Give **one** reason why using wood chips as a fuel is carbon neutral. [1]

.....

(c) Some coal power stations have been converted to run on wood chips.
They also act as combined heat and power (CHP) stations.
These make use of the heat in water to provide central heating for the power station and houses nearby.

One CHP station receives 500 MW of power from burning wood chips. Of this, 220 MW is distributed for district heating and 180 MW is transferred to the National Grid.

(i) Calculate the total useful output power. [1]

Useful output power = ... MW

(ii) Calculate the efficiency of the power station using the equation: [2]

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

Efficiency = ... %

8

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7. Less landfill waste will be produced if people 'reduce, reuse and recycle'.

Complete the table below to state whether each action is an example of reduce, reuse or recycle. *The first one has been done for you.* [4]

Action	Is it an example of reduce, reuse or recycle?
Place glass bottles in bottle bank	recycle
Make compost from left over fruit and vegetable peelings	.....
Buy food with less packaging	.....
Buy 'bags for life'	.....
Don't buy more than you need	.....

4

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SECTION B

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

Use the information in the separate Resource Folder to answer the following questions.

8. *(a)* Use the information in **Diagram 1** and **Table 1** to answer the following questions.

(i) Arrange the houses **A, B** and **C** in order of amount of energy loss starting with the house that loses least energy. [2]

House ..... House ..... House .....

Loses least energy ⟶ Loses most energy

(ii) Compare the cost effectiveness of loft insulation, double-glazing and cavity wall insulation. [6 QWC]

In your answer you should compare:

- the energy saved by each type of insulation
- the value for money of each type of insulation.

.....

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(b) Refer to the information about **double-glazing** and **Graph 1** to answer the following questions.

(i) I. Describe how the rate of loss of energy is related to the size of the air gap. [1]

.....

.....

.....

II. Give **one** reason why makers of double-glazing are unlikely to use an air gap larger than 20 mm. [1]

.....

.....

(ii) A house has a window area of 24 m^2. The air gap used in the windows is 15 mm. There is a 20 °C temperature difference between the inside and outside of the house.

Calculate the rate of loss of energy through the windows of the house. [2]

Rate of loss of energy = ... W

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(c) Refer to the information about **cavity walls** and **Table 2** to answer the following questions.

(i) I. Which of the materials used in the wall will be most effective at reducing heat loss? ..... [1]

II. Give **one** reason for your answer. [1]

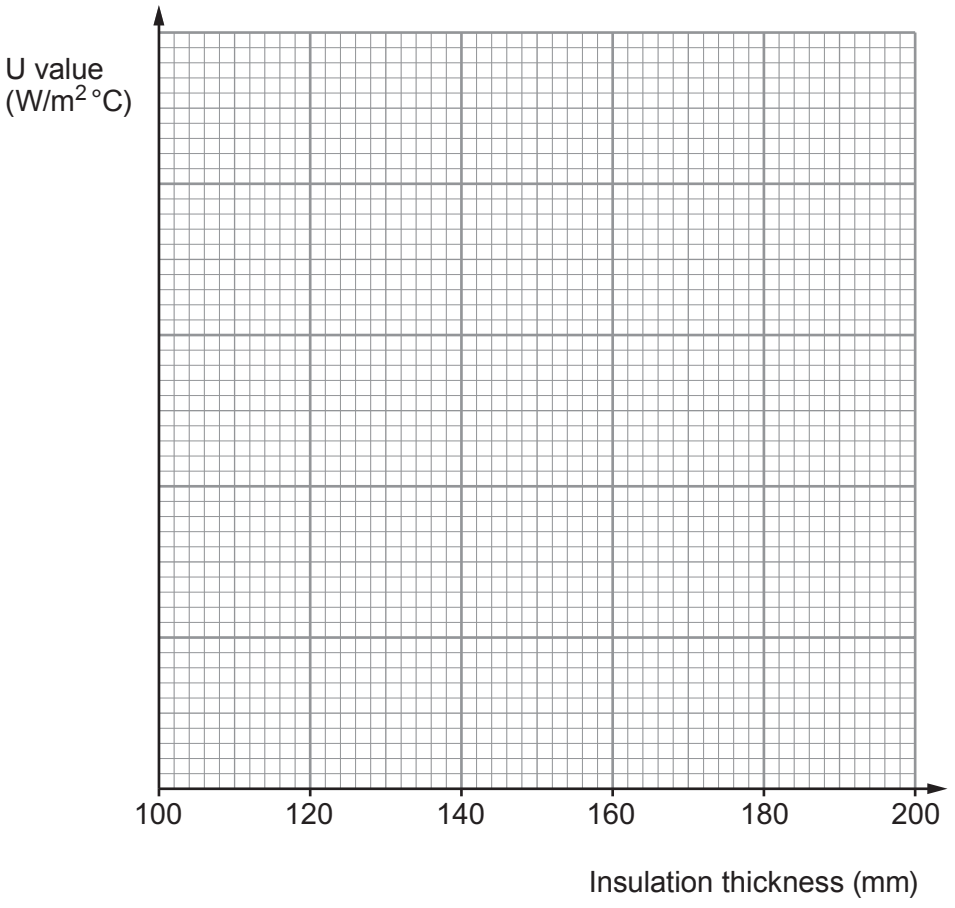
.....

(ii) Calculate the **total** R value for the wall. [1]

R value = ... W

(d) Refer to the information about **loft insulation** and **Table 3** to answer the following questions.

(i) Plot a graph of U value against insulation thickness for insulator **B**. [4]



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(ii) Use your graph to find the thickness of insulator **B** that needs to be used to achieve a U value of 0.16 W/m^2 °C. [1]

Thickness = ... mm

(e) A heating system uses 2000 W of electrical power to keep a house at constant temperature.

Calculate the cost of using the heating for 24 h. Include the **unit** in your answer. [4]
One unit of electricity costs 14p.

Cost = ...

END OF PAPER

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GCSE MARKING SCHEME

SCIENCE B

SUMMER 2014

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2014 examination in GCSE SCIENCE B. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
Unit 1 - Foundation Tier	1
Unit 1 - Higher Tier	5
Unit 2 - Foundation Tier	10
Unit 2 - Higher Tier	13

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GCSE SCIENCE B

UNIT 1 FOUNDATION TIER (4781/01)

SUMMER 2014 MARK SCHEME

<table>
<tr><th colspan="3">Question</th><th>Marking detail</th><th>Mark</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>Natural selection</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Genes</td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Well suited to the environment</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>The variety / range (of life) (1) in the world / habitat / ecosystem (1)</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Richer in tropics / rainforest / equator (1) because of greater resources / more favourable living conditions (1) (accept converse). The second point can be awarded for coherently and correctly linking the conclusion.</td><td>2</td></tr>
<tr><td>2</td><td colspan="2"></td><td>1 mark for each correct answer
Correct words (bold text) to complete statement are shown in the table below.
<table><tr><th>Intensive farming method</th><th>Reason for use</th><th>Disadvantage</th></tr><tr><td>Herbicide spray</td><td>plants</td><td>biodiversity</td></tr><tr><td>Fertiliser spray</td><td>nutrients</td><td>rivers</td></tr><tr><td>‘Battery’ farming</td><td>output</td><td>indoors</td></tr></table></td><td>6</td></tr>
<tr><td>3</td><td>(a)</td><td></td><td>Sunlight</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>The shrimps (intake mercury) as they feed / eat algae.</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>As bigger animals eat smaller animals/polar bears eat a <u>lot</u> (1) bioaccumulation / the concentration level of mercury increases / to toxic levels. (1) The second point can be awarded for coherently and correctly linking the conclusion.</td><td>2</td></tr>
<tr><td>4</td><td colspan="2">(i)</td><td>Gamma rays
Microwaves</td><td>2
1</td></tr>
<tr><td></td><td colspan="2">(ii)</td><td>From visible to radio waves graphs are identical / maximum wavelength of radio waves the same / at longer UV wavelength, the graphs are similar / they both go down to 10 cm / both have a maximum in the visible region.</td><td>1</td></tr>
<tr><td></td><td colspan="2">(iii)</td><td>No X-rays in the theoretical graph / ‘kink’ (in UV region) / starts at a longer wavelength (1)</td><td></td></tr>
<tr><td></td><td colspan="2">(iv)</td><td>Longest wavelength = 10 cm</td><td>1</td></tr>
<tr><td></td><td colspan="2">(v)</td><td>Subs (1) answer = 3 000 000 000Hz (1)</td><td>2</td></tr>
</table>

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Question			Marking detail	Mark
5	(a)		Labels down: crater – volcano – ice cap *All correct* (2); 1 *correct* (1)	2
	(b)	(i)	Lava / molten rock / magma	1
		(ii)	Must be a molten core / hot / liquid core	1
		(iii)	Volcano formed at their <u>boundaries</u> / where they meet / moving over each other	1
	(c)	(i)	Craters caused by meteors / asteroids	1
		(ii)	More meteors got through atmosphere / don't burn up	1
	(d)	(i)	Temperatures must be low	1
		(ii)	Global warming (1) because carbon dioxide is a greenhouse gas / carbon dioxide traps heat (1) *The second point can be awarded for coherently and correctly linking the conclusion.*	2
6	(a)		Because new trees are planted / more trees are grown (1) to replace those cut down (1) *The second point can be awarded for coherently and correctly*	2
	(b)	(i)	Carbon dioxide / CO_2	1
		(ii)	Carbon dioxide / CO_2	1
		(iii)	Carbon emissions caused by burning are balanced by carbon intake by photosynthesis	1
	(c)	(i)	400 MW	1
		(ii)	subs 400/500 [1] (allow ecf from bi) ans = 80%	2
7			1 mark for each correct answer (bold text) Action / Is it reduce, reuse or recycle? *Place glass bottles in bottle bank* – *recycle* Make compost from left over fruit and vegetable peelings – recycle Buy food with less packaging – reduce Buy 'bags for life' – re-use Don't buy more than you need – reduce	4

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Question	Marking detail	Mark
8 (a) (i)	C-B-A All correct 2; 1 correct 1	2
(ii)	Indicative content: • The loft saves 1200 J/s and double-glazing saves 800 J/s. • The cavity wall insulation saves 1000 J/s • The loft insulation is also the cheapest to install. • Therefore installing loft insulation would save the householder most money and the payback time would be shortest. • However, double-glazing saves least energy and costs significantly more than other methods so the payback time would be the longest. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

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Question			Marking detail	Mark
(b)	(i)	I.	The larger the air gaps the lower the (rate of) energy loss.	1
		II.	(After 20mm), not much increase in saving	1
	(ii)		Reading from graph of 50 (W/m^2) (1) 50 x 24 (1) = 1 200 W (correct answer only - 1 200 W (2))	2
(c)	(i)	I.	Foam insulation	1
		II.	Largest R value	1
	(ii)		Total R value = 6	1
(d)	(i)		Scale (at least half y axis) (1) plots (2) suitable best fit line (1)	4
	(ii)		Value from their graph (e.g. 148 +/-2) (1)	1
(e)			Convert 2000 W to 2 KW (1) units used = 2 x 24 = 48 (1) cost = 48 (allow ecf) x 14 = 672 (1) matching unit (1) (either 672p or £6.72). (NOT £6.72p)	4

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GCSE SCIENCE B

UNIT 1 - HIGHER TIER (4781/02)

SUMMER 2014 MARK SCHEME

Question	Marking detail	Mark
1 (a) (i)	C-B-A All correct 2; correct 1	2
(ii)	Indicative content: • The loft insulation saves 1200 J/s and double-glazing saves 800 J/s. • The cavity wall insulation saves 1000 J/s. • The loft insulation is also the cheapest to install. • Therefore installing loft installation would save the householder most money and the payback time would be shortest. • However, double-glazing saves least energy and costs significantly more than the other methods so the payback time would be the longest. **5-6 marks** The candidates constructs an article, integrated account correctly linking relevant points such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

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Question			Marking detail	Mark
(b)	(i)	III.	The larger the air gaps the lower the (rate of) energy loss.	1
		IV.	(After 20mm), not much increase in saving	1
	(ii)		Reading from graph of 50 (W/m^2) (1) 50 x 24 (1) = 1 200 W (correct answer only - 1 200 W (2))	2
(c)	(i)	III.	Foam insulation	1
		IV.	Largest R value	1
	(ii)		Total R value = 6	1
(d)	(i)		Scale (at least half y axis) (1) plots (2) suitable best fit line (1)	4
	(ii)		Value from their graph (e.g. 148 +/-2) (1)	1
(e)			Convert 2000 W to 2 KW (1) units used = 2 x 24 = 48 (1) cost = 48 (allow ecf) x 14 = 672 (1) matching unit (1) (either 672p or £6.72). (NOT £6.72p)	4

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Question	Marking detail	Mark
2 (a)	Indicative content: • Organisms that are best adapted to their environment are those that are most likely to survive. • The better-adapted organisms will reproduce at a greater rate than the less well-adapted organisms. • Organisms with the most favourable genetic adaptions out-compete other organisms in a population. • Natural selection is dependent on the existence of mutations in the genes. • Natural selection taking place over the course of many generations can change the characteristics of the original population of organisms. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points such as those in the indicative content, which allows shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
(b) (i)	The variety / range of life (1) in the world / habitat / ecosystem / area (1)	2
(ii)	Richer in tropics / rain forest / equator (1) because of greater resources / more favourable living conditions (1) (accept converse). *The second point can be awarded for coherently and correctly linking the conclusion.*	2

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<table>
<tr><th colspan="2">Question</th><th>Marking detail</th><th>Mark</th></tr>
<tr><td>3</td><td></td><td>6 x 1 marks

<table><tr><th>Intensive farming method</th><th>Action</th><th>Disadvantages</th></tr><tr><td>Fertiliser spray</td><td>Add nutrients to the soil</td><td>Eutrophication / causes dense plant growth in rivers</td></tr><tr><td>Pesticide spray</td><td>Remove animals that feed on the crop</td><td>Reduces biodiversity/poison helpful organisms.</td></tr><tr><td>‘Battery’ farming</td><td>Increased product</td><td>Lower quality product/ethical concerns / keep animals indoors</td></tr></table></td><td>6</td></tr>
<tr><td>4</td><td>(i)</td><td>Craters caused by meteors (1) large numbers of craters / meteors got through atmosphere / lack of erosion (1) so atmosphere must be ‘thin’ (1)
The third mark can be awarded for coherently and correctly linking to three points.</td><td>3</td></tr>
<tr><td></td><td>(ii)</td><td>Must be a molten core (1) (possible) tectonic plates (1) for volcano to be formed at their boundaries (1)
Accept similar structure to earth for 1 mark.</td><td>3</td></tr>
<tr><td></td><td>(iii)</td><td>Temperatures must be low (1) so no ‘global’ warming (1) so lack of greenhouse gases / low concentrations (1)
The third mark can be awarded for coherently and correctly linking the three points.</td><td>3</td></tr>
<tr><td>5</td><td>(i)</td><td>Mining / Industry (Not: from ships)</td><td>1</td></tr>
<tr><td></td><td>(ii)</td><td>The shrimps take in mercury as they feed. (1) Concentration is low (1) As bigger animals eat many smaller animals / bioaccumulation / the concentration level of mercury increases to toxic levels. (1) The third point can be awarded for coherently and correctly linking the conclusion.</td><td>3</td></tr>
</table>

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Question			Marking detail	Mark
6	(i)		Any **three** from: • from visible to radio waves graphs are identical • maximum wavelength of radio waves the same • at longest U-V wavelength the graphs are similar • no X-rays in the theoretical graph • they both go down to 10 cm • both have a maximum in the visible region.	3
	(ii)		Longest wavelength = 10 cm converted to 0.1m (1) subs / manipulate (1) Answer = 3×10^9 / 3 000 000 000) Hz (1) Allow ecf for incorrect wavelength	3
7	(a)	(i)	They will never run out (1) because new trees are planted to replace those cut down (1) *The second point can be awarded for coherently and correctly linking the conclusion.*	2
		(ii)	Carbon emissions caused by <u>burning</u> [1] are balanced by carbon intake by <u>photosynthesis</u> [1] (CO_2 given out = same as taken in (1) only) *The second point can be awarded for coherently and correctly linking the conclusion*.	2
	(b)	(i)	500 x 0.8 answer = 400 MW Substitution (1) manipulation (1) answer (1)	3
		(ii)	180 MW [1] (allow ecf from bi, their answer - 220)	1
		(iii)	If water is piped over large distances it will cool too much	1
	(c)		Demand fluctuates / if demand increases / if a power station breaks down [1] other power stations can be brought on line to avoid power cuts [1] *The second point can be awarded for coherently and correctly linking the conclusion.*	2

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4781/01

SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

P.M. THURSDAY, 16 January 2014

1 hour 15 minutes

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**9**	
	2.	**10**	
	3.	**5**	
	4.	**5**	
	5.	**7**	
	6.	**10**	
Section B	**7.**	**18**	
	8.	**6**	
	Total	**70**	

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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 B**.

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 B 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 **8**.

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SECTION A

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

1. The koala bear is not really a bear.

Bears have heavy bodies with extremely powerful limbs. Each limb has five strong, sharp claws used for tearing and digging. Most bears are partly carnivorous. They have a long snout.

Koalas are *diprotodont* meaning "two front teeth". They are herbivores. They have a condition called "fused fingers". In diprotodonts, the second and third digits of the feet are completely fused together, except for the claws.





(a) Which features of an animal would scientists use to decide whether to classify it as Diprotodontia? [2]

.....

.....

.....

(b) The scientific classifications of koalas and other animals are shown in the table below.

Level of classification	Polar bear	Grizzly bear	Koala bear	Wombat	Kangaroo
Kingdom	Animalia	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata	Chordata
Class	Mammalia	Mammalia	Mammalia	Mammalia	Mammalia
Order	Carnivora	Carnivora	Diprotodontia	Diprotodontia	Diprotodontia
Family	Ursidae	Ursidae	Phascolarctidae	Vombatidae	.....
Genus	*Ursus*	*Ursus*	*Phascolarctos*	*Vombatus*	.....
Species	*maritimus*	*horriblis*	*cinereus*	*ursinus*	*rufus*

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(i) Which level of classification shows that koalas are **not** related to grizzly bears? [1]

.....

(ii) In the 18th century Carl Linnaeus developed the system of giving all living organisms a two-word scientific name.

How does this system help scientists in different countries who are studying these animals? [1]

.....

.....

(iii) Complete the scientific name for koalas. *Phascolarctos* ..... [1]

(iv) The scientific name for a kangaroo is *Macropus rufus* and it belongs to the family Macropodidae.

Use this information to **complete** the table opposite. [2]

(c) Koalas only live in the wild in Australia. The koala only eats leaves from eucalyptus trees.

Give **two** reasons why the koala population is under threat. [2]

1. .....

.....

2. .....

.....

9

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2. The picture shows solar panels installed on the roof of a house. Each solar panel converts the Sun's radiant energy directly into electrical energy.



On a typical summer day in the UK, the solar radiation energy input per second to the panel is 5000 W. The useful energy transfer per second is 500 W.

(a) (i) Calculate the efficiency of the panel using the equation: [2]

$$\% \text{ efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100$$

% efficiency = ...

(ii) Calculate the maximum current that this panel could supply to the 230 V house circuits using the equation: [2]

$$\text{current} = \frac{\text{power}}{\text{voltage}}$$

Current = ... A

(b) On most Summer days it is claimed the panel will generate electricity, as described above, for 10 hours. Calculate the maximum units produced in a day using the equation: [2]

Units produced (kWh) = power (kW) × time (hours)

Units produced = ... kWh

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(c) The typical cost of solar panels for a home is £10 000.
It is claimed that the panels will produce a saving of 50p per day.

(i) Calculate the payback time of buying the solar panels. [2]

Payback time = ... days

(ii) State what will happen to the payback time if the mean hours of sunshine a year increases. [1]

.....

(iii) State what will happen to the payback time if the cost of one unit of electricity increases. [1]

.....

10

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3. The table compares PVC and wooden window frames. The data can be used to decide which is the more sustainable option.

	Wooden	PVC
Natural gas consumption in replacing heat lost through the window	178 kg	183 kg
Coal and oil used in production and/or painting	5.37 kg	18.23 kg
Carbon dioxide produced	457 kg	487 kg
Units of phosphate washed into streams	67	1.6
Waste after use without recycling	16.5 kg	28.2 kg

Use the information in the table to answer the following questions.

(i) Give **one** reason why wooden window frames will not have as much impact on landfill sites as those made from PVC. [1]

.....

.....

(ii) Give **one** reason why wooden window frames will have more impact on fish compared to those made from PVC. [1]

.....

.....

(iii) Give **one** reason why wooden window frames will not have as much impact on the atmosphere as those made from PVC. [1]

.....

.....

(iv) Give **two** reasons why less fossil fuels are used with wooden window frames than PVC. [2]

1. .....

2. .....

5

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4. (i) Theories about the universe have changed over time as more evidence has become available. Initially the Steady-State theory was widely accepted. The Big Bang is now widely accepted.

Write the following statements into the table below to show which theory of the universe each one supports. [4]

- Red shift
- CMBR (Cosmic Microwave Background Radiation)
- The universe looks the same at all times
- The universe looks the same at any place

Steady State model of the universe	Big Bang model of the universe
.....	.....
.....	.....
.....	.....
.....	.....

(ii) In astronomy distances are measured in light years. What is meant by a light year? [1]

.....

.....

5

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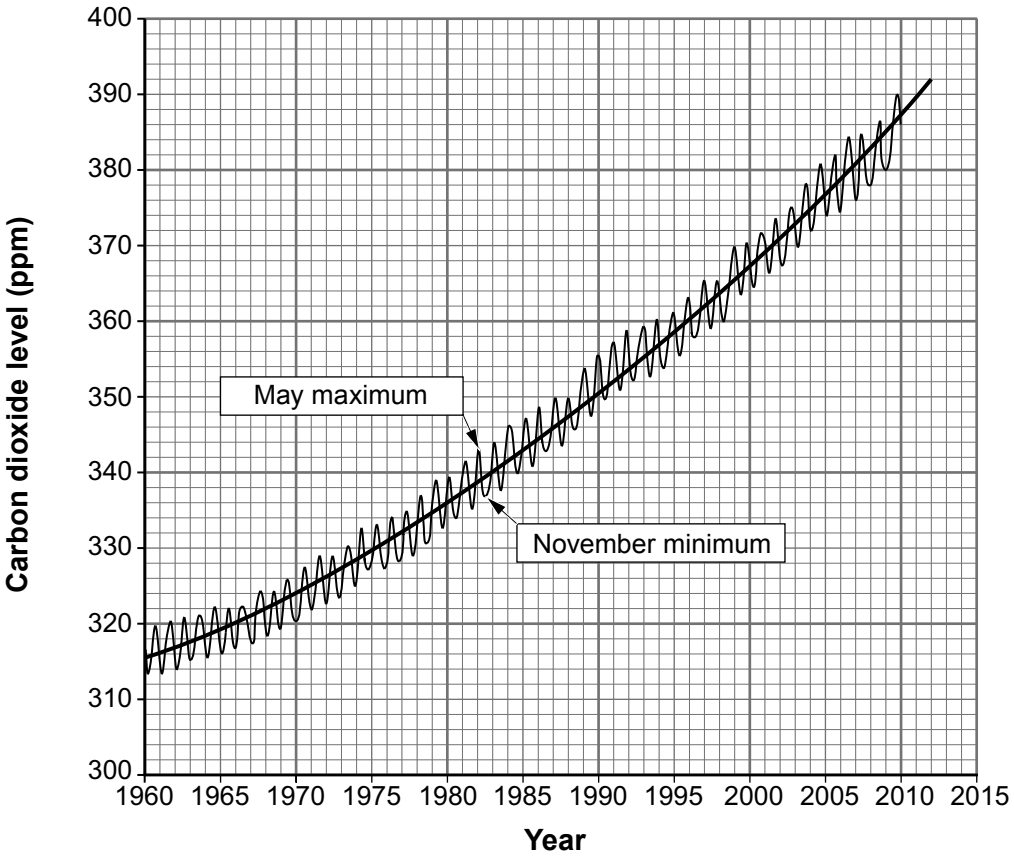
5. *(a)* Add ticks (✓) to the table to show the effect (if any) of each process on carbon dioxide levels in the atmosphere. *You should only add **one** tick (✓) to each row. One row has been completed for you as an example.* [4]

Process	Increases CO_2	Decreases CO_2	No effect on CO_2
Animal respiration	✓		
Photosynthesis			
Burning gas			
Plant respiration			
Cutting down trees			

(b) The graph shows the carbon dioxide levels in the atmosphere for the past 50 years.

The wavy line records the variation in levels during each year. Every year the maximum occurs in May, at the beginning of the plant growing season. Every year the minimum occurs in November, at the end of the growing season. The solid trend line shows the same data but with the yearly variations removed.

Atmospheric Carbon Dioxide During the Past 50 Years



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(i) Give **one** reason why the maximum carbon dioxide level occurs in May. [1]

.....

(ii) Describe the trend in carbon dioxide levels over time shown by the graph. [1]

.....

.....

(iii) Continue the graph to estimate the carbon dioxide level (ppm) in 2015. ..... [1]

7

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6. The **Least Weasel** is the smallest member of the weasel family. The photographs below show this weasel during summer and winter.





The table gives some facts about the Least Weasel.

Least Weasel facts

Predators	foxes, eagle owls, buzzards.
Food	mice, rabbits, gerbils.
Reproduction	3 to 9 offspring in each litter
Body feature	• dense fur coat • yellow brown in summer • white in winter • feet with hairy soles

Use **only the information above** to answer the questions below.

(i) Name **one** prey of the Least Weasel. ..... [1]

(ii) Name **one** animal that feeds on the Least Weasel. ..... [1]

(iii) State whether the Least Weasel is an omnivore, carnivore or herbivore. ..... [1]

(iv) Name **one** body feature that helps the Least Weasel to keep warm in winter. [1]

.....

(v) How do the Least Weasel's feet help it to move around in icy conditions? [1]

.....

(vi) Describe how the change of fur colour in winter helps the weasel to survive. [2]

.....

.....

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(vii) Many weasels are eaten, but the number of living weasels stays about the same from year to year. Suggest **one** reason for this. [1]

.....

(viii) Suggest **one** reason why farmers growing crops do not consider weasels to be a pest. [1]

.....

(ix) Suggest **one** reason why farmers who grow crops think weasels are a benefit to them. [1]

.....

10

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SECTION B

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

Use the information in the separate Resource Folder to answer the following questions.

7. Use the information in **Table 1** to answer the questions that follow.

(a) (i) Which planet is closest in size to Earth? ..... [1]

(ii) Which planet has a day length longer than its year? ..... [1]

(iii) Name the only planet that does not have an atmosphere. ..... [1]

(b) Suggest a relationship between the number of moons around a planet and **one** *other* factor in **Table 1**. [2]

.....

.....

(c) (i) Describe how the temperature on a planet depends on the distance from the Sun. [1]

.....

(ii) Explain why Venus does not follow this trend. [2]

.....

.....

.....

(d) Ceres is a dwarf planet found in the asteroid belt.

(i) **Estimate** its temperature. ..... °C [1]

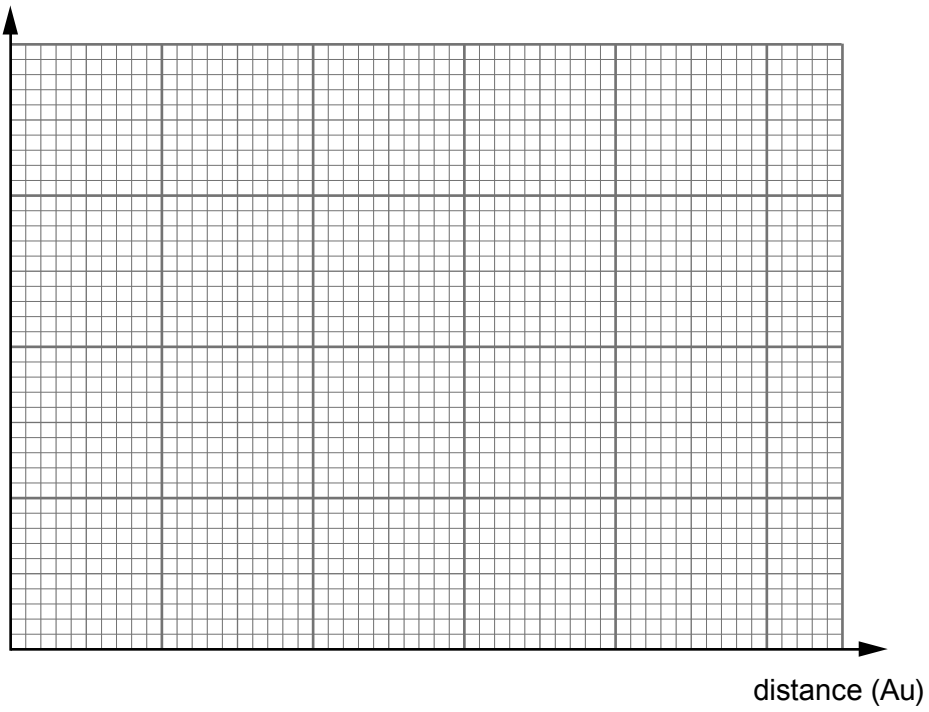
(ii) **Estimate** its orbital time around the Sun. ..... Earth years [1]

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(e) (i) Plot a graph to show how the time it takes a planet to orbit the Sun depends on distance from the Sun.
Only include the planets **Earth**, **Mars**, **Jupiter** and **Saturn** in your graph. [4]



(ii) It was once thought that the time of orbit would be proportional to distance from the Sun.

Does your graph agree with this statement? ..... [1]

Give **one** reason for your answer.

.....

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(f) Answer the following questions using **only** information from the Resource Folder.

(i) Give **one** reason why an Earth-based telescope would not be able to see the surface of Venus. [1]

.....

.....

(ii) Give **one** reason why an Earth-based telescope may not be able to see the rings around Uranus. [1]

.....

.....

(g) **Draw** a diagram to show the path of a comet as it orbits the Sun. [1]

● **Sun**

18

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8. Use only the information in the Resource Folder to compare the four inner planets with the four outer planets of the Solar System. (6 QWC)

6

END OF PAPER

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GCSE MARKING SCHEME

GCSE SCIENCE B

JANUARY 2014

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2014 examination in GCSE SCIENCE B. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
Unit 1 Science B - Foundation Tier	1
Unit 1 Science B - Higher Tier	5
Unit 2 Science B - Foundation Tier	10
Unit 2 Science B - Higher Tier	14

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GCSE SCIENCE B

Unit 1 Foundation Tier

SECTION A

Question			Marking detail	Mark
1	(a)		Teeth - “two front teeth”	1
			Feet - the second and third digits of the feet are (completely) fused together, (except for the claw).	1
	(b)	(i)	The order	1
		(ii)	Avoids confusion from common names /same in every country	1
		(iii)	cinereus	1
		(iv)	Macropodidae Macropus	1 1
	(c)		Any **two** from: Increase in logging/agriculture, urban development, decreased the habitat, reduced food source. Not: natural disaster	2
2	(a)	(i)	Substitution [1] answer = 10% [1]	2
		(ii)	Substitution [1] answer = 2.2 A [1]	2
	(b)		Conversion 500 W to 0.5 kW [1] answer = 5 kWh [1] Answer: 5000 kWh - 1 mark only	2
	(c)	(i)	10 000/0.5 [1] = 20 000 (days) [1] Answer: 200 days - 1 mark only	2
		(ii)	Decrease	1
		(iii)	Decrease	1
3		(i)	Less waste (with wood)	1
		(ii)	More phosphate (washed into streams)	1
		(iii)	Less carbon dioxide produced	1
		(iv)	Less coal/oil used to produce them [1] less heat loss through window so less gas burned [1]	2

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<table>
<tr><th colspan="2">Question</th><th>Marking detail</th><th>Mark</th></tr>
<tr><td>4</td><td>(i)</td><td>Steady state model of the universe
• The universe looks the same at all times
• The universe looks the same at any place

Big Bang model of the universe
• Red shift
• CMBR

1 mark each for each point in the correct column</td><td>4</td></tr>
<tr><td></td><td>(ii)</td><td>Distance travelled by light in 1 year</td><td>1</td></tr>
<tr><td>5</td><td>(a)</td><td><table><tr><th>Process</th><th>Increases CO_2</th><th>Decreases CO_2</th></tr><tr><td>Photosynthesis</td><td></td><td>✓</td></tr><tr><td>Burning gas</td><td>✓</td><td></td></tr><tr><td>Plant respiration</td><td>✓</td><td></td></tr><tr><td>Cutting down trees</td><td>✓</td><td></td></tr></table></td><td>4</td></tr>
<tr><td></td><td>(b) (i)</td><td>Start of plant growing season</td><td>1</td></tr>
<tr><td></td><td>(ii)</td><td>Carbon dioxide levels over time are increasing / going up</td><td>1</td></tr>
<tr><td></td><td>(iii)</td><td>400 (ppm) (allow 398-400)</td><td>1</td></tr>
<tr><td>6</td><td>(i)</td><td>Mice/rabbits/gerbils</td><td>1</td></tr>
<tr><td></td><td>(ii)</td><td>Foxes/eagle owls/buzzards</td><td>1</td></tr>
<tr><td></td><td>(iii)</td><td>Carnivore</td><td>1</td></tr>
<tr><td></td><td>(iv)</td><td>Dense fur coat</td><td>1</td></tr>
<tr><td></td><td>(v)</td><td>Hairy soles</td><td>1</td></tr>
<tr><td></td><td>(vi)</td><td>White coat is camouflaged [1]
predators have difficulty in seeing them [1]</td><td>2</td></tr>
<tr><td></td><td>(vii)</td><td>Those eaten balanced by those born</td><td>1</td></tr>
<tr><td></td><td>(viii)</td><td>Do not eat crops/ They eat animals that feed on crops</td><td>1</td></tr>
<tr><td></td><td>(ix)</td><td>They eat animals that feed on crops</td><td>1</td></tr>
</table>

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SECTION B

Question			Marking detail	Mark
7	(a)	(i)	Venus	1
		(ii)	Venus	1
		(iii)	Mercury	1
	(b)		The bigger (the diameter) [1] the more moons around a planet [1]	2
	(c)	(i)	The further from the Sun the lower the temperature	1
		(ii)	Atmosphere is mainly carbon dioxide [1] which means there is a large global warming/greenhouse effect [1] *Second mark can only be awarded if it is coherently and correctly linked to the first marking point.*	2
	(d)	(i)	Accept value between -64 and -129°C	1
		(ii)	Accept value between 3 and 11 years	1
	(e)	(i)	Scales [1] points (+/- square) [2] curve [1]	4
		(ii)	(No) because line is curved (non-proportional)	1
	(f)	(i)	Surface covered in (thick)- clouds	1
		(ii)	Rings too faint	1
		(g)	Ellipse drawn (Not a circle, Sun not in the middle)	1

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Question	Marking detail	Mark
8	**Indicative content:** • by comparison ○ **terrestrial** or **rocky** planets: Mercury, Venus, Earth and Mars: • rock and metal • have relatively high densities, slow rotation solid surfaces, no rings and few satellites. ○ **jovian** or**, gas** planets: Jupiter, Saturn, Uranus and Neptune: • hydrogen and helium • generally have low densities, rapid rotation, deep atmospheres, rings and lots of satellites. • by size ○ **small** planets: Mercury, Venus, Earth, Mars. • diameters less than 13000 km. ○ **giant** planets: Jupiter, Saturn, Uranus and Neptune. • diameters greater than 48000 km. **Marking Bands** **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no relevant inclusions or significance omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6QWC

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GCSE SCIENCE B

Unit 1 Higher Tier

SECTION A

Question			Marking detail	Mark
1	(a)	(i)	Venus	1
		(ii)	Venus	1
		(iii)	Mercury	1
	(b)		The bigger (the diameter) [1] the more moons around a planet [1]	2
	(c)	(i)	The further from the Sun the lower the temperature	1
		(ii)	Atmosphere is mainly carbon dioxide [1] which means there is a large global warming/greenhouse effect [1] *Second mark can only be awarded if it is coherently and correctly linked to the first marking point.*	2
	(d)	(i)	Accept value between -64 and -129°C	1
		(ii)	Accept value between 3 and 11 years	1
	(e)	(i)	Scales [1] points (+/- square) [2] curve [1]	4
		(ii)	(No) because line is curved (non-proportional)	1
	(f)	(i)	Surface covered in (thick) clouds	1
		(ii)	Rings too faint	1
	(g)		Ellipse drawn	1

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Question	Marking detail	Mark
2	**Indicative content:** • by comparison ○ **terrestrial** or **rocky** planets: Mercury, Venus, Earth and Mars: • rock and metal • have relatively high densities, slow rotation, solid surfaces, no rings and few satellites. ○ **jovian** or**, gas** planets: Jupiter, Saturn, Uranus and Neptune: • hydrogen and helium • generally have low densities, rapid rotation, deep atmospheres, rings and lots of satellites. • by size ○ small planets: Mercury, Venus, Earth, Mars. • diameters less than 13000 km. ○ giant planets: Jupiter, Saturn, Uranus and Neptune. • diameters greater than 48000 km. **Marking Bands** **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no relevant inclusions or significance omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6QWC

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SECTION B

Question			Marking detail	Mark
3	(a)		Teeth - “two front teeth”.	1
			Feet - the second and third digits of the feet are (completely) fused together, except for the claw.	1
	(b)	(i)	The order	1
		(ii)	Avoids confusion form common names	1
		(iii)	Phascolarctos cinereus	1
		(iv)	Macropodidae [1] Macropus rufus [1]	2
	(c)		Increase in logging/agriculture/urban development [1] which has decreased the koala’s habitat/reduced food source[1] *Second mark can only be awarded if it is linked to first marking point.*	2

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Question			Marking detail	Mark
4	(a)	(i)	Substitution [1], answer = 900 W [1]	2
		(ii)	Substitution (ecf from i) [1] answer = 3.9 A [1]	2
	(b)		Conversion 900 W (allow ecf) to 0.9 kW [1] answer = 9 kWh [1]	2
	(c)		Indicative content: • savings every day on average would be 45p. • payback time is £10 000/0.45 which is 22 222.2 days (60.8 years) • if electricity costs rise the payback time would decrease. • payback time will also depend on weather since the mean daily energy production will be affected by the amount of sunshine. The sunnier the weather the higher the mean energy production and the greater the daily savings. • No electricity at night. Depends upon the direction of roof. House consumption > 3 KWh **Marking Bands** **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. the candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6QWC

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Question		Marking detail	Mark
5	(i)	Less energy used in production, use and disposal [1], Lower natural gas consumption in replacing heat lost through the window [1] Less coal and oil used in production and/or painting [1]	3
	(ii)	Water eutrophication effect /phosphates greater for wooden windows [1] causes excessive growth of algae in water [1] depletes the water of oxygen causing the death of fish [1] *Third mark can only be awarded if it is correctly and coherently linked to either of other marking points.*	3
	(iii)	Recycling reduces need to use new resources [1] Recycling also reduces waste [1] so less rubbish in landfill/ so natural resources last longer [1] *Three marks can only be awarded if it points correctly and coherently linked*	3
6	(i)	"Steady state" is based upon unchanging universe/ Big bang is based upon expanding universe [1] CMBR is the remains of energy created during the Big Bang [1] gamma rays stretching to microwaves due to expansion of universe [1] *Third mark can only be awarded if it is correctly and coherently linked to other marking points.*	3
	(ii)	Red shift [1] caused due to the wavelength increase of light/movement of spectral lines to red end of spectrum [1] because galaxies moving apart [1] *Third mark can only be aw*arded if it is *linked to either of other marking points.*	3
	(iii)	The further away a galaxy the faster [1] it moves away [1]	2
7	(a)	Depends on plant growing season [1]. during the season rate of plant photosynthesis increase [1] so more carbon dioxide is removed from the atmosphere [1]. *Third mark can only be awarded if it is linked to either of other marking points.*	3
	(b) (i)	Carbon dioxide levels over time are increasing [1] at an increasing rate [1]	2
	(ii)	Any **three** from: Burn less fossil fuels, less deforestation, plant more trees, carbon capture	3

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4781/01

SCIENCE B

UNIT 1: Space, Energy and Life
FOUNDATION TIER

P.M. WEDNESDAY, 5 June 2013

1¼ hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**4**	
3.	**12**	
4.	**8**	
5.	**6**	
6.	**7**	
7.	**5**	
8.	**24**	
Total	**70**	

4781
010001

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 B**.

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 B 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 **8***(e)*.

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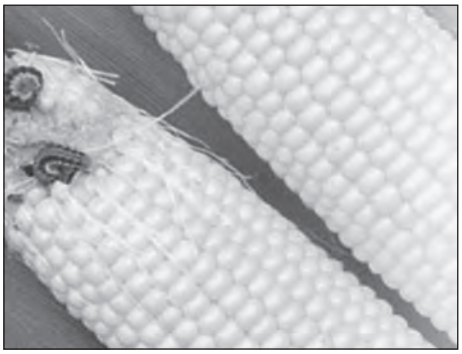
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SECTION A

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

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



For each statement below, tick (✓) a box to show if it is an advantage **or** disadvantage of using this crop. [4]

	Advantage	Disadvantage
The farmer no longer uses insecticide to kill insects	☐	☐
No build up of insecticides to toxic levels in food chains	☐	☐
The insects can become resistant to the poison	☐	☐
Other insects are at risk of being killed	☐	☐

☐

4

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2. Complete the sentences below.

(i) The surface of the Earth is changing because of the movement of tectonic

..... . [1]

(ii) Earthquakes and ..... occur most often at the boundaries between the ..... . [2]

(iii) The sudden jerking movements of plates cause ..... . [1]

4

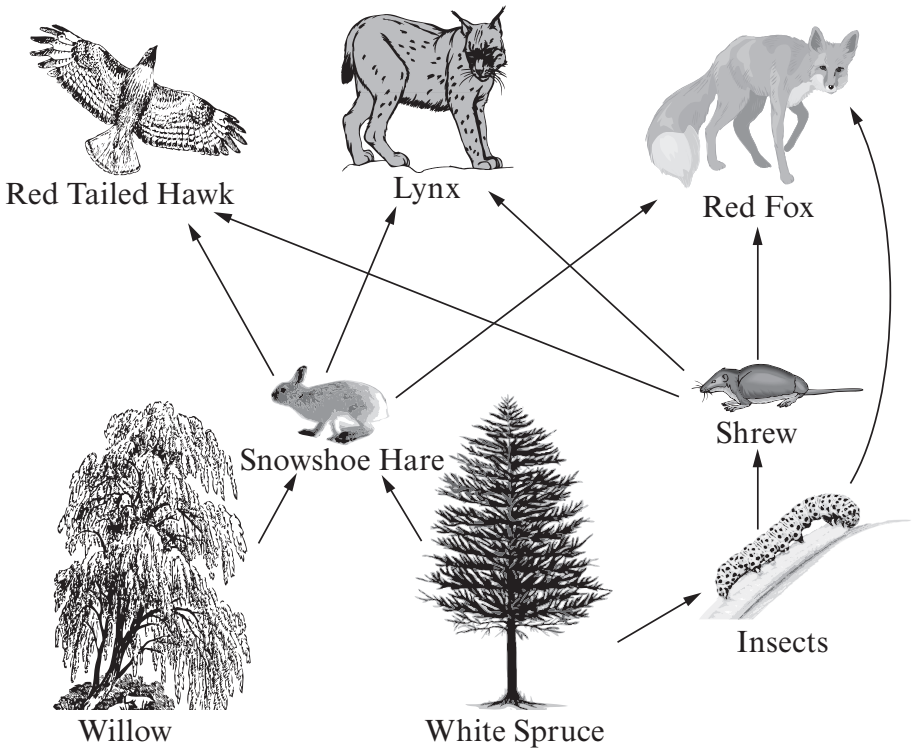
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3. The diagram below shows a food web.



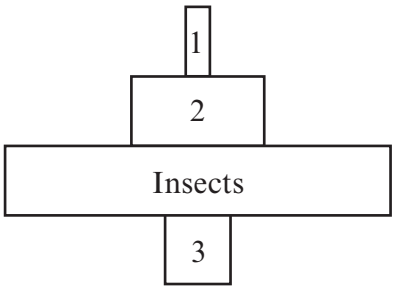
(a) Use information in the food web to answer the questions that follow.

(i) Name the prey of the shrew. ..... [1]

(ii) Name **one** producer. ..... [1]

(iii) Name **one** carnivore. ..... [1]

(iv) Complete the labelling of the pyramid of numbers below, using names from the food web above. *One part has been done for you.* [3]



1. .....

2. .....

Insects

3. .....

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

1. .....

2. .....

3. .....

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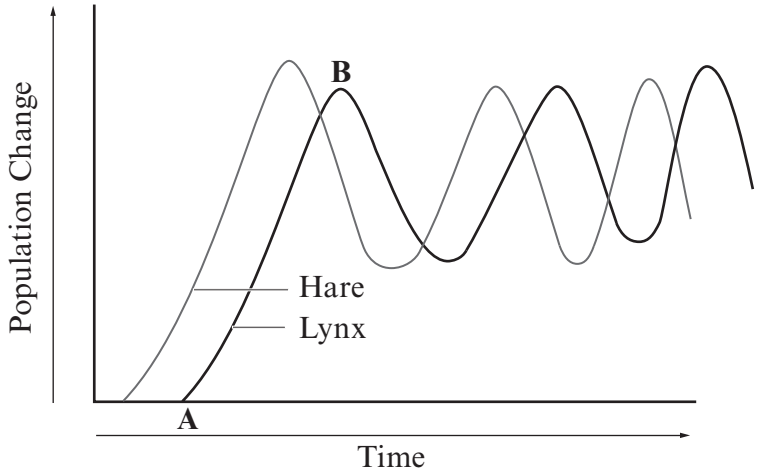
(c) In the natural habitat, the lynx is a predator of the snowshoe hare.



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

.....

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



Use only the information in the graph to answer the following questions.

I. Give **one** reason why the lynx population increases from **A** to **B**. [1]

.....

II. Give **one** reason why the lynx population decreases after **B**. [1]

.....

12

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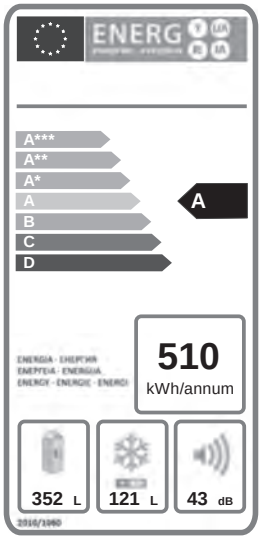
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4. A homeowner is shopping for a refrigerator.

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	0.69	158	0.158	305	.....

(a) (i) Calculate the amount of time the model **A** uses electricity during the year using the equation:

$$\text{time (h)} = \frac{\text{units used (kWh)}}{\text{power (kW)}}$$

Time = ... h [2]

(ii) **Complete** the **gaps** in the table for model **B** using the equation:

$$\text{power} = \text{voltage} \times \text{current}$$ [3]

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(iii) Calculate the annual cost of running model **D** using the equation: [2]

annual cost = cost of one unit (12p) × units used in a year

Total cost = ...

(b) Model **C** was £5 more expensive to buy than model **B**. Give **one** reason why you would still recommend that the homeowner buys model **C**. [1]

.....

.....

8

5. *(a)* (i) Explain why burning fossil fuels affects the Earth's climate. [2]

.....

.....

.....

(ii) Explain why destroying forests to clear land affects the climate. [2]

.....

.....

.....

(b) State **two** effects global warming has on the Earth. [2]

1. .....

2. .....

6

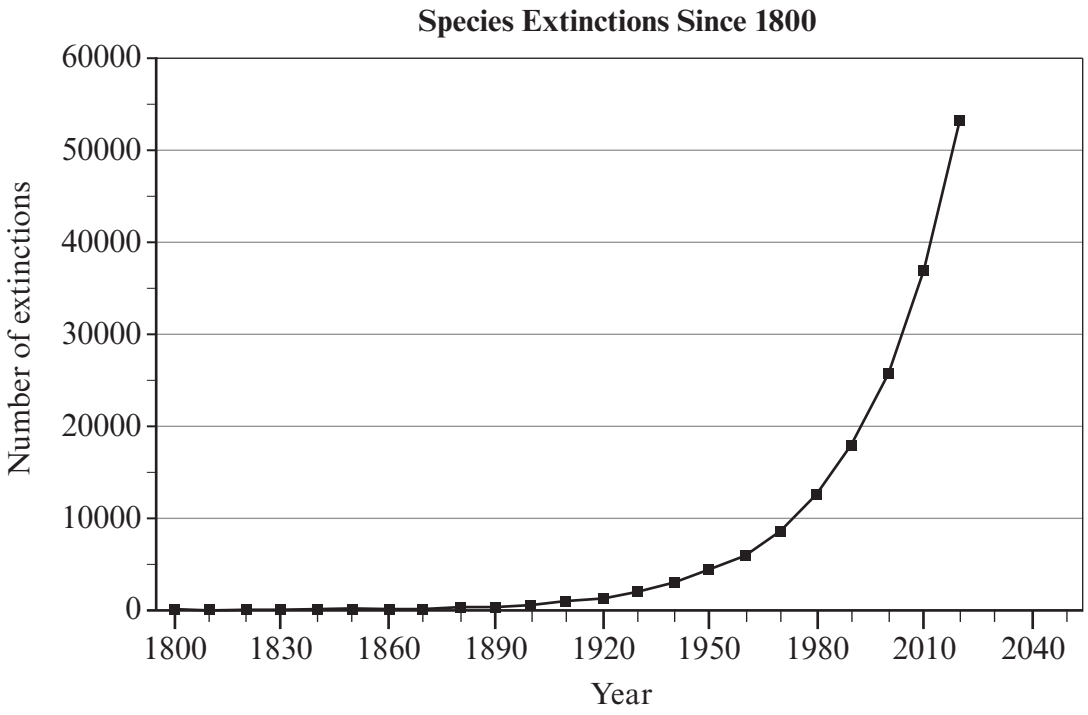
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6. *(a)* The graph below shows how the number of extinctions of different species has changed over time.



Describe the trend shown by the graph. [2]

.....

.....

.....

(b) One animal in danger of becoming extinct is the giant panda. Only about 1,600 remain in the wild.



Giant pandas live in a few mountain ranges in central China. They once lived in lowland areas, but are now restricted to the mountains. Giant pandas live in forests with a plentiful supply of bamboo for them to eat.

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(i) State **two** reasons why an increase in the human population requires the use of more land. [2]

1. .....

2. .....

(ii) Explain why an increase in the human population has threatened the survival of giant pandas. [2]

.....

.....

.....

(iii) State **one** way the extinction of giant pandas can be prevented. [1]

.....

7

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Turn over.

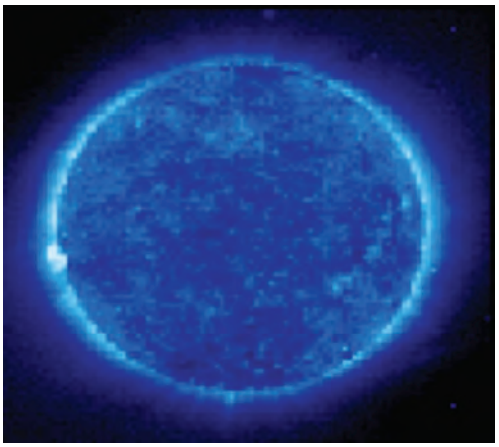
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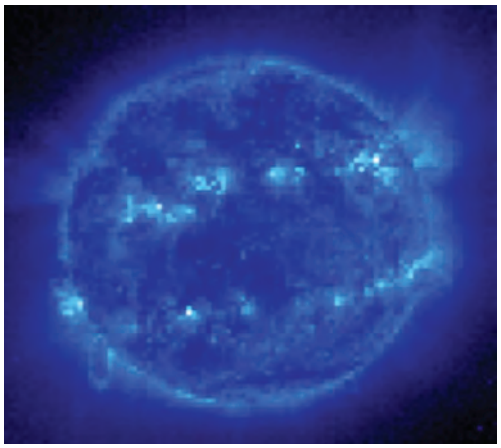
7. In February 2010 NASA's Solar Dynamics Observatory (SDO) was launched into space. SDO has sent back millions of stunning images of the Sun.

(a) (i) Two X-ray images of the Sun are shown below.

1



2

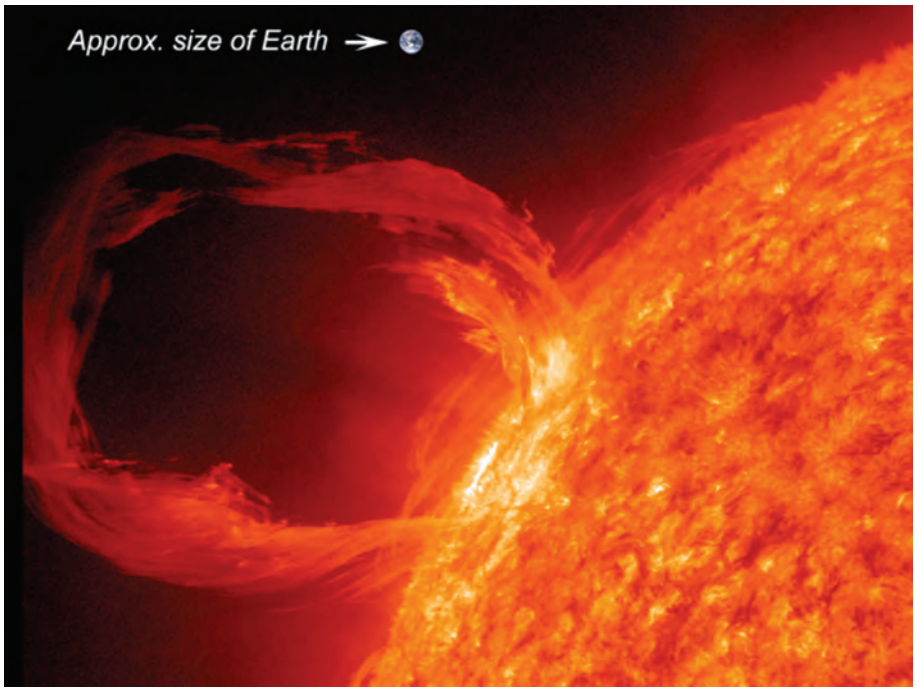


State the difference in the activity of the Sun shown in the pictures **1** and **2**. [1]

.....

.....

(ii) The picture below was taken in UV light.



Describe what the picture shows is happening on the surface of the Sun. [1]

.....

.....

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(iii) State **one** advantage of taking these pictures from NASA's SDO rather than from an Earth based observatory. [1]

.....

(b) Both X-rays and UV light are parts of the electromagnetic (em) spectrum. The diagram below shows the parts of the em spectrum.

Radio waves	**A**	**B**	Visible light	**C**	**D**	Gamma rays

(i) To which part of the spectrum, **A**, **B**, **C** or **D** do X-rays belong? ..... [1]

(ii) To which part of the spectrum, **A**, **B**, **C** or **D** does UV light belong? ..... [1]

5

Images: NASA

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SECTION B

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

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

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

.....

.....

.....

(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 = ...

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

(i) Calculate the swept area of the blades. [2]

Swept area = ... m^2

(ii) The turbine is placed at an altitude of 160 m.
Calculate the mean kinetic energy/second delivered to the turbine. [2]
(Use (wind speed)^3 = 1300 m^3/s^3)

Mean kinetic energy/second = ... J/s

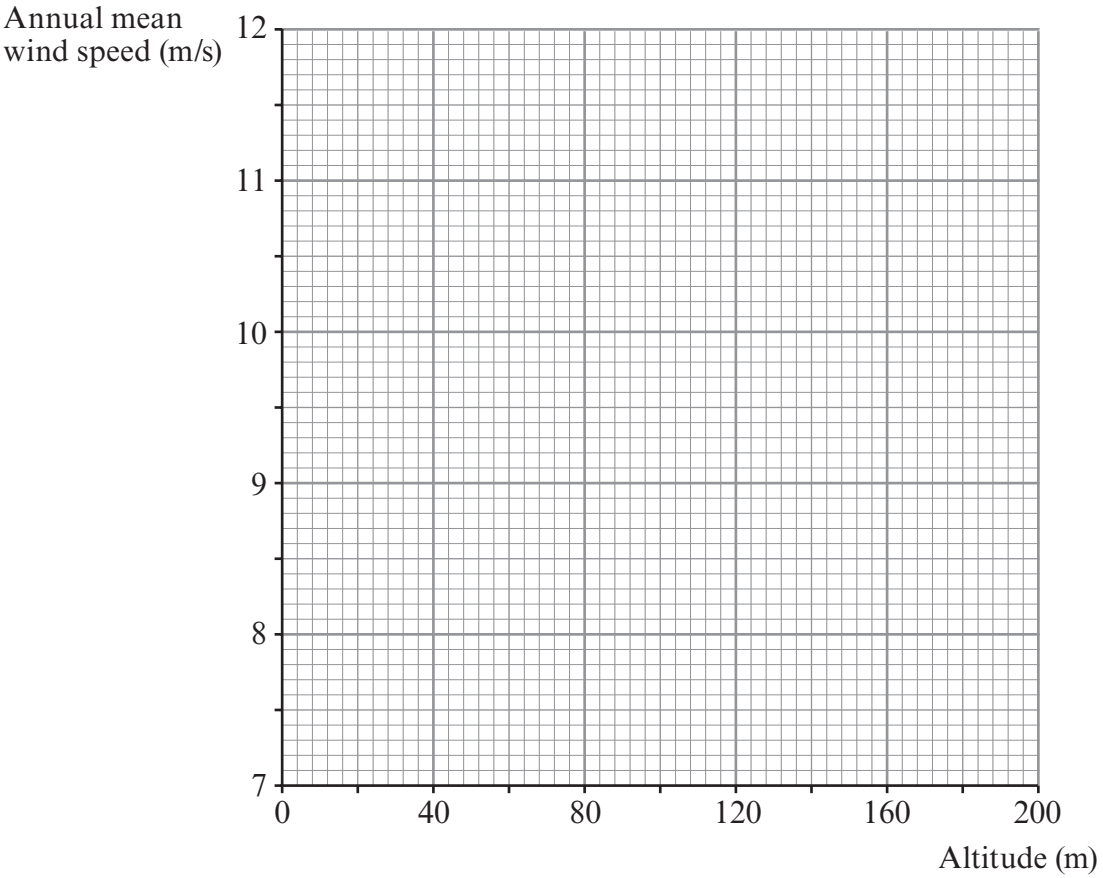
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(d) (i) Use the information in **Table 2** to answer the questions below.

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]

.....

.....

.....

(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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(e) Evaluate the benefits and drawbacks of meeting more of the electricity demand with wind power in the future. [6 QWC]

.....

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24

END OF PAPER

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GCSE MARKING SCHEME

SCIENCE B

SUMMER 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCSE SCIENCE B. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
Unit 1 - Foundation Tier	1
Unit 1 - Higher Tier	5
Unit 2 - Foundation Tier	11
Unit 2 - Higher Tier	14

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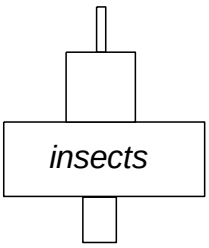
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GCSE SCIENCE B

SUMMER 2013 - MARKSCHEME

UNIT 1 - FOUNDATION TIER

SECTION A

Question	Answer	Marks
1.	**One** mark for **each** correct answer. **Advantages** / **Disadvantages** The farmer no longer uses insecticide to kill insects. ✓ (Advantages) No build- up of insecticides to toxic levels in food chains. ✓ (Advantages) The insects can become resistant to the poison. ✓ (Disadvantages) Other insects are at risk of being killed. ✓ (Disadvantages)	1 1 1 1
2. (i)	Plates.	1
(ii)	Volcanoes, plates.	2
(iii)	Earthquakes / tsunamis (accept tidal wave)	1
3. (a) (i)	Insects.	1
(ii)	Willow or white spruce.	1
(iii)	Red tailed hawk / lynx / red fox / shrew.	1
(iv)	One mark for each correct label.  1. red tailed hawk/ lynx/red fox 2. shrew 3. white spruce	3
(b)	Any three of: Disease (Competition for) light Number of grazing animals (Amount of) nutrients or water (in soil)	3
(c) (i)	Camouflage/ blend in.	1
(ii)	I. More food / hare (not hair) / prey available. II. Food / prey supply is decreasing / less hare.	1 1

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Question			Answer	Marks
4.	(a)	(i)	Subs: time (h) = 310 / 0.161 (1), answer 1925.46 (h) - accept 1925 or 1925.5. (Allow use of data for **C** and **D**) 1925.4 - No workings but incorrect rounding give 1 mark	1+1
		(ii)	Power = 230 x 0.78 (1) 179.4 - accept 179 (W) conversion to 0.179 (kW). (allow ecf)	1+1 1
		(iii)	Total cost = 12p x 305 3660p or (£)36.60	1 1
	(b)		Save more (than £5) in running costs in first year / more than £5 cheaper to run (Do not accept just 'cheaper')	1
5.	(a)	(i)	Production of carbon dioxide. Adds to greenhouse effect/global warming. Two points must be coherently and correctly linked for 2 marks	1 1
		(ii)	Less trees / forest. to absorb carbon dioxide/less photosynthesis. Two points must be coherently and correctly linked for 2 marks	1 1
	(b)		• Rising sea levels / melting ice caps • Climate change / extreme weather conditions/rising temperature.	
6.	(a)		Number of extinctions increases over time (1) at an increasing rate / speeds up / gets faster (or wte) (1)	2
	(b)	(i)	Any two from: More land for housing / building / room to live. More land for food production. More land for energy crops (Allow: more land for waste disposal).	2
		(ii)	Less habitat therefore less food Two points must be coherently and correctly linked for 2 marks	2
		(iii)	(Captive) breeding programmes / protected areas / protected species / no hunting (or however expressed).	1
7.	(a)	(i)	Sun more active in picture 2 / more flares in 2	1
		(ii)	(Solar) flare.	1
		(iii)	Less interference from atmosphere / atmosphere not blocking signals / no light pollution / better image	1
	(b)	(i)	D	1
		(ii)	C	1

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SECTION B

Question			Answer	Marks
8.	(a)		Different shape surfaces / one side is more curved / flatter which causes difference in air pressure. Two points must be coherently and correctly linked for 2 marks.	1 1
	(b)	(i)	6 – 25 (m/s).	1
		(ii)	1520 (m^2).	1
		(iii)I	900 (kW).	1
		II	Subs of 900 / 1500 %Efficiency = 60.	1 1
	(c)	(i)	Calculation of radius 40 m.	1
			Answer = 5027.2 m^2 / accept 5027. Use of π in calculator gives 5024 Accept range 5024-5027 Use of πr^2 to give 20096 Accept range 20096- 20109	1
		(ii)	Extraction of air density value 1.173. Subs ½ x 1.173 x 5027 (allow ecf) x 1300. Answer of 3 832 836 shown gets both marks.	1 1
	(d)	(i) I	Plots (tolerance +/- 0.5 square) All correct (2), 4 correct (1) Line of best fit (not point to point)	2 1
		II	Power output of a wind turbine depends on wind speed and air density. Both vary with altitude. Points must be correctly and coherently connected for 2 marks.	1 1
		(ii)	Power output varies with air density. which depends on temperature. Points must be correctly and coherently connected for two marks	1 1

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Question	Answer	Marks
(e)	**Indicative content:** **Benefits** include references to no fuel costs, renewable resource, no air pollution, no effect on climate. **Drawbacks** include references to variable wind speed, low power outputs, noise pollution, visual pollution. Benefits or drawbacks only max of 3. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

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UNIT 1 - HIGHER TIER

SECTION A

Question			Answer	Marks
1.	(a)		Different shape surfaces / one side is more curved / flatter. which causes difference in air pressure. Two points must be coherently and correctly linked for 2 marks.	1 1
	(b)	(i)	6 – 25 (m/s).	1
		(ii)	1520 (m^2).	1
		(iii)I	900 (kW).	1
		II	Subs of 900 / 1500 %Efficiency = 60.	1 1
	(c)	(i)	Calculation of radius 40 m. Answer = 5027.2 m^2 / accept 5027. Use of π in calculator gives 5024 Accept range 5024-5027 Use of πr^2 to give 20096 Accept range 20096- 20109	1 1
		(ii)	Extraction of air density value 1.173. Subs ½ x 1.173 x 5027 (allow ecf) x 1300. Answer of 3 832 836 shown gets both marks.	1 1
	(d)	(i) I	Plots (tolerance +/- 0.5 square) All correct (2), 4 correct (1) Line of best fit (not point to point)	2 1
		II	Power output of a wind turbine depends on wind speed and air density. Both vary with altitude. Points must be correctly and coherently connected for 2 marks.	1 1
		(ii)	Power output varies with air density. which depends on temperature. Points must be correctly and coherently connected for two marks	1 1

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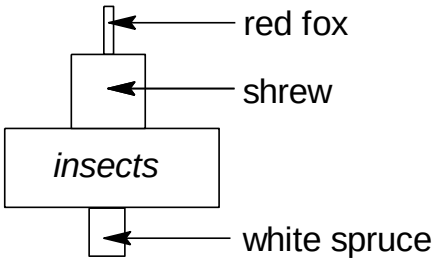
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Question	Answer	Marks
(e)	**Indicative content:** **Benefits** include references to no fuel costs, renewable resource, no air pollution, no effect on climate. **Drawbacks** include references to variable wind speed, low power outputs, noise pollution, visual pollution. Benefits or drawbacks only max of 3. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology an some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

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SECTION B

Question	Answer	Marks
2. (a) (i)	Sun(light)	1
(ii)	Pyramid shape for top three layers Narrow box at bottom Correctly labelled	1 1 1
		
(b)	**Any 3 of:** Disease (Competition for) light Number of grazing animals (Amount of) nutrients or water (in soil)	3
(c) (i)	Camouflage/blend in	1
(ii)	If the population of prey increases, there will be more food so predator population will increase. As the population of predators increases more food is needed so eventually the population of prey will decrease. Less food for the predators so their population falls again Three from above. Must be correctly and coherently connected points to get 3 marks.	3

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<table>
<tr><th colspan="2">Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3. (a) (i)</td><td></td><td>Subs time (h) = 310/0.161,
Ans 01925.46(h) - accept 1925 or 1925.5 (Allow for data for C and D)
1925.4 – No workings but incorrect rounding give 1 m</td><td>1
1</td></tr>
<tr><td></td><td>(ii)</td><td>
<table>
<tr><th>Model</th><th>Voltage (V)</th><th>Current (A)</th><th>Power (W)</th><th>Power (kW)</th><th>Units used in one year (kWh)</th><th>Annual Cost (£)</th></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td>179 (2)</td><td>0.179 (1)</td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td>320 (1)</td><td></td></tr>
<tr><td>5</td><td></td><td>0.69 (1)</td><td></td><td></td><td></td><td>36.60 (1)</td></tr>
</table>
</td><td>6</td></tr>
<tr><td></td><td>(b) (i)</td><td>Model C has lower running costs (1)
Thereby saving the homeowner <u>more than £5</u> in the first year (1)
Two statements must be coherently and correctly connected for 2 marks</td><td>2</td></tr>
<tr><td></td><td>(ii)</td><td>Environmental benefit due to less electricity used / less electricity needs to be produced / less pollution caused / less effect on climate
(Not: help the environment)</td><td>1</td></tr>
</table>

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Question	Answer	Marks
4.	**Indicative content:** **Carbon capture** involves trapping the carbon dioxide at its emission source, transporting it to a storage location (usually deep underground) and isolating it. The pressure found deep underground causes CO_2 to behave more like a liquid than a gas. Because it can seep into the spaces in porous rocks, a great amount of CO_2 can be stored in a relatively small area. The focus is all wrong. They argue that we should be coming up with ways to wean ourselves off fossil fuels instead of spending time and money on ways to continue using fossil fuels. Current CC technologies actually require a lot of energy to implement and run. What happens if the carbon dioxide leaks out in the ocean? Excess CO_2 in the water increases acidity. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

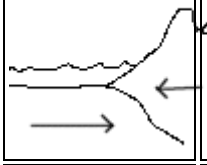
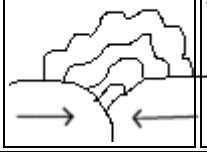
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<table>
<tr><th colspan="2">Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5.</td><td>(i)</td><td>The farmer no longer has to use insecticide / pesticide on insects
so the surrounding environment is no longer exposed to large amounts of harmful insecticide
therefore no build-up of insecticides to toxic levels in food chains
Statements must be coherently and correctly connected for 3 marks</td><td>1
1

1</td></tr>
<tr><td></td><td>(ii)</td><td>This type of genetically modified corn will poison the insects over a longer period than the farmer who would spray the crops once or twice.
In this way the insects can become accustomed (or resistant) to the poison.
A variety of insects are at risk of being killed / It might be predatory insects that eat the harmful ones or, perhaps attractive insects such as butterflies.
Statements must be coherently and correctly connected for 3 marks</td><td>1

1

1</td></tr>
<tr><td>6.</td><td>(a)</td><td>
<table>
<tr><th>Type of Plate Boundary</th><th>Diagram</th><th>Description</th></tr>
<tr><td>Destructive</td><td></td><td>Oceanic plate(1) forced under (1) continental plate (1)
If: one plate forced under another (2)</td></tr>
<tr><td>Constructive</td><td></td><td>Two plates move apart (1)</td></tr>
<tr><td>Collision</td><td></td><td>Two continental plates (1) move towards each other (1)</td></tr>
</table>
</td><td>6</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Destructive <u>and</u> collision boundaries</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>All</td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Destructive <u>and</u> constructive boundaries</td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any three of: weathering, erosion, meteorite impact, volcanic eruptions</td><td>3</td></tr>
</table>

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Surname	Centre Number	Candidate Number
Other Names		0

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New GCSE

4781/01

SCIENCE B
UNIT 1: Space, Energy and Life
FOUNDATION TIER

P.M. THURSDAY, 17 January 2013

1¼ hours

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**8**	
	2.	**9**	
	3.	**6**	
	4.	**9**	
	5.	**5**	
	6.	**9**	
Section B	**7.**	**24**	
Total		**70**	

4781 010001

ADDITIONAL MATERIALS

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

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 B 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 **7***(a)*.

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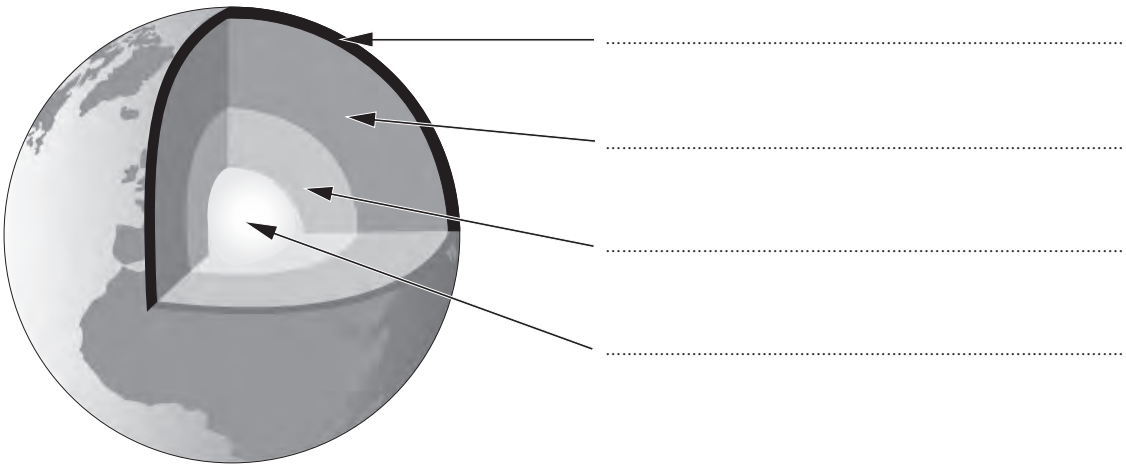
SECTION A

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

1. *(a)* The diagram below shows the structure of the Earth.

Use terms from the box to label the diagram. [4]

solid iron core	molten iron outer core	mantle	crust	plate



(b) The surface of the Earth changes due to geological processes. For example, Iceland was formed because the Earth is made of plates that move.

(i) Complete the sentences below.

The Earth's crust is made up of huge slabs of rock called ..... plates. [1]

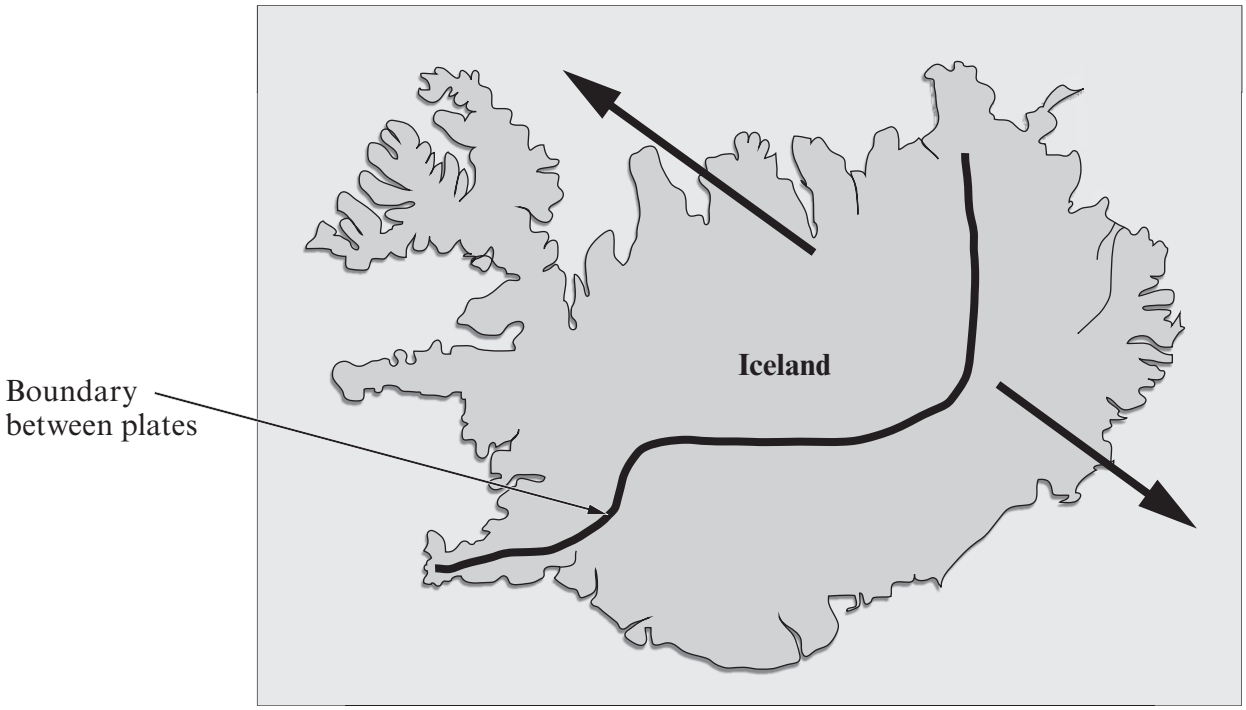
The movement of these plates is known as ..... drift. [1]

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(ii) Iceland sits on the boundary between two of these plates, which are moving in the direction shown by the arrows.



State **two** natural disasters that could be caused by these moving plates. [2]

1. .....

2. .....

8

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2. Homeowners who generate electricity using solar panels on their houses get paid for the energy they produce. Their energy bills also fall slightly.

The cost of installing a 2.5 kW solar panel is £9 000.

The homeowner saves £1 200 a year.

(a) State **one** reason why the use of solar power benefits the **environment**. [1]

.....

(b) (i) Use the information above to calculate the payback time of the cost of installing the solar panel. [2]

Payback time = ... years

(ii) What is the effect on payback time if the weather becomes sunnier over longer periods of time during a year? [1]

.....

(iii) What is the effect on payback time if the cost of buying electricity from the National Grid increases? [1]

.....

(c) (i) Calculate the number of units produced by the 2.5 kW solar panel in 300 hours of sunlight using the equation: [2]

Units used = power (kW) × time (h)

Units used = ... kWh

(ii) Calculate the cost of buying this number of units from the National Grid using the equation: [2]

Cost = units used × cost per unit

One unit of electricity costs 12p

Cost = ...

9

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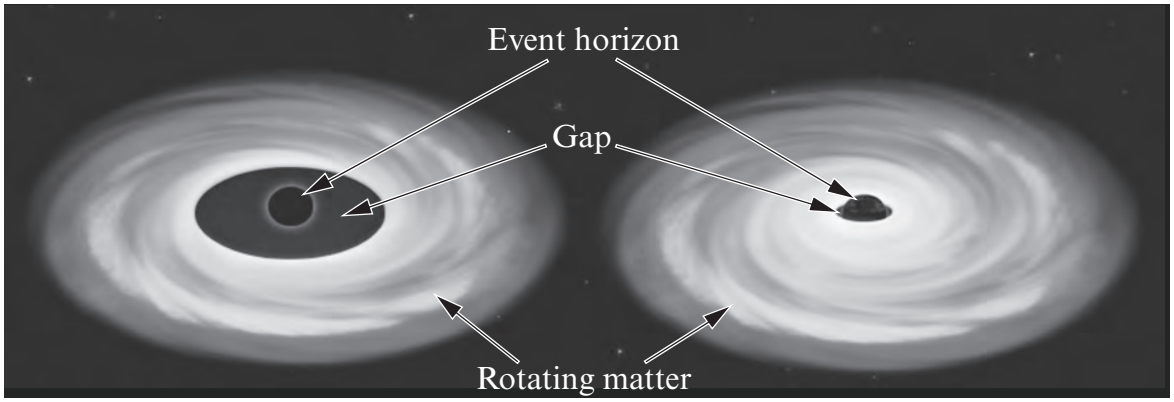
3. Images of objects in space are collected using different parts of the Electromagnetic Spectrum.

(a) State **one** advantage and **one** disadvantage of space-based telescopes compared to Earth-based telescopes when producing these images. [2]

Advantage: .....

Disadvantage: .....

(b) The diagram below shows images of **two** black hole systems taken by a space based telescope.



(i) State **one** similarity and **one** difference between the two images. [2]

Similarity: .....

Difference: .....

(ii) Name **two** parts of the Electromagnetic Spectrum that can be used to take images of objects in space. [2]

1. .....

2. .....

6

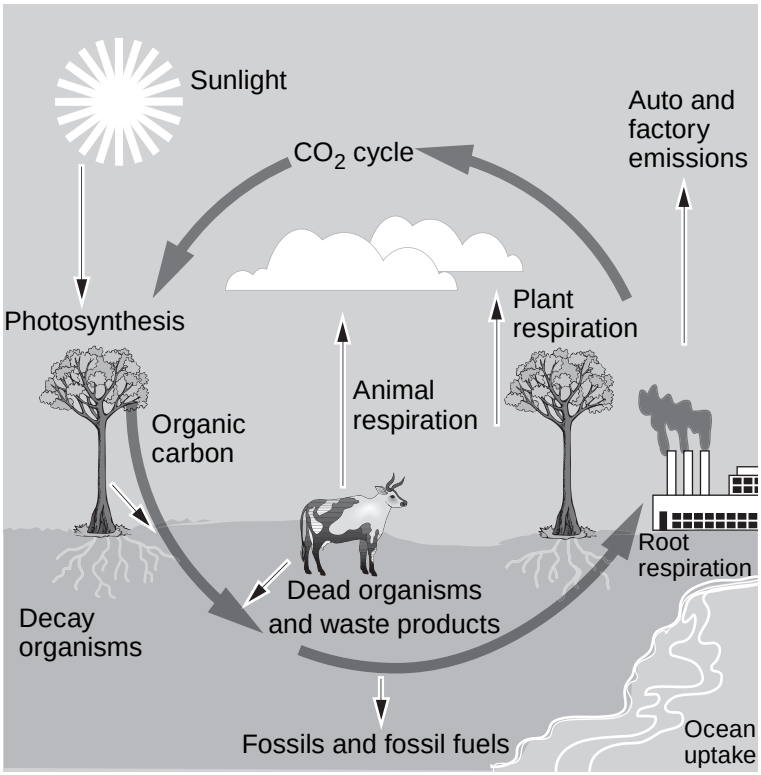
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4. *(a)* This diagram represents the carbon cycle.



Use the information in the diagram to answer the following questions.

(i) Name **two** processes that add carbon dioxide (CO_2) to the atmosphere. [2]

1. .....

2. .....

(ii) Name **one** process that removes carbon dioxide away from the atmosphere. [1]

.....

(b) During the past 200 years, the amount of carbon dioxide in the atmosphere has been steadily rising. One factor that contributes to this increase is people travelling to work.

(i) Give **two** other reasons for the rise in carbon dioxide levels. [2]

.....

.....

(ii) How will rising carbon dioxide levels affect the Earth's climate? [1]

.....

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(c) 100 people travelling 40 km produce:

- 1.60 tonnes of carbon dioxide travelling by car
- 0.20 tonnes of carbon dioxide travelling by coach
- 0.36 tonnes of carbon dioxide travelling by train.

Use this information to answer the following questions.

(i) What is the amount of carbon dioxide produced when 100 people travel 40 km from home to work by car?

..... tonnes [1]

(ii) How much carbon dioxide would be saved if they made this journey by coach instead?

..... tonnes [1]

(iii) Would it be better for the environment if they made their journey by train rather than by coach? Give **one** reason for your answer. [1]

.....

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5. The peppered moth exists as a light form and a dark form.

Light form



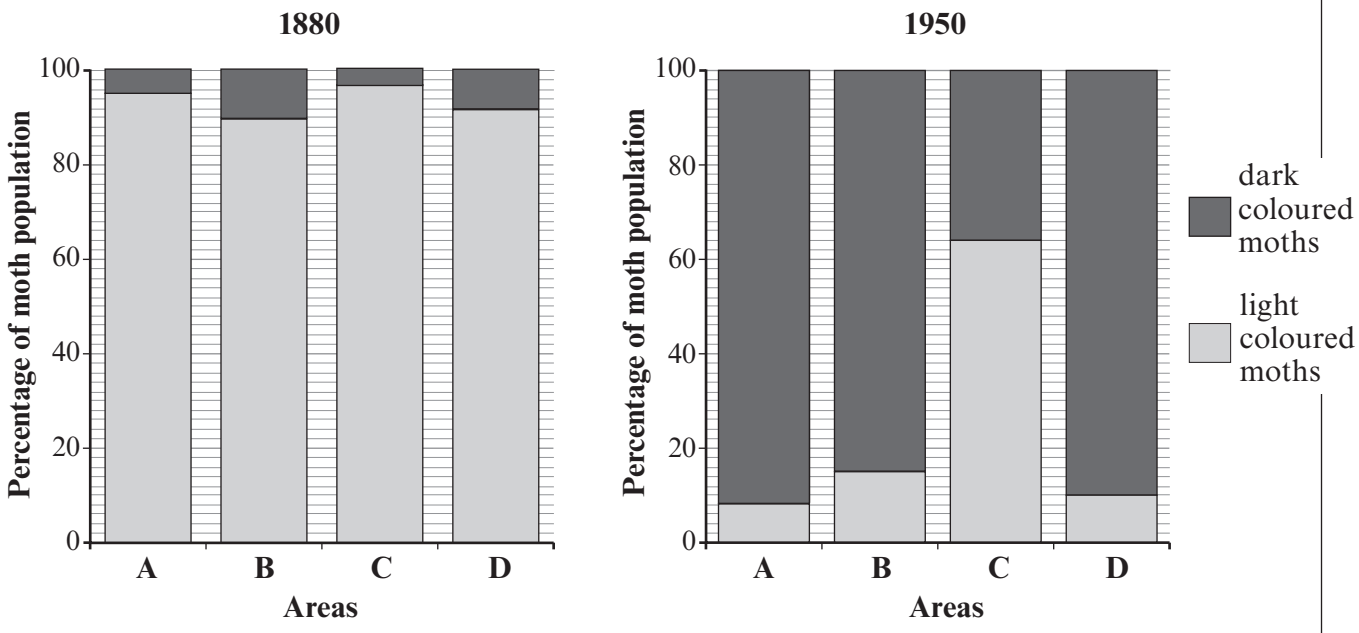
Dark form



Peppered moths are eaten by birds.

In areas affected by air pollution, the trees on which moths land are covered by dark, sooty deposits.

The graphs show the percentages of dark and light forms of moth in the same four areas of Britain **A**, **B**, **C** and **D** in 1880 and 1950.



(a) (i) Explain how you can tell from the graphs that there was more air pollution in 1950. [2]

.....

.....

.....

(ii) Which area was least affected by air pollution in 1950? [1]

.....

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(b) Since the Clean Air Act of 1956, air pollution has reduced. Explain why the number of light coloured moths has increased. [2]

.....

.....

.....

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6. The table shows how lions and tigers are classified by zoologists.

Classification group	Feature of classification group	Lion	Tiger
Kingdom	moves in search of its food	Animalia	Animalia
Phylum	have a vertebral column	Chordata	Chordata
Class	feed young on milk	Mammalia	Mammalia
Order	canine teeth with jaws that move only up and down	Carnivora	Carnivora
Family	can sheath their claws	Felidae	Felidae
Genus	roaring cats over 3 m long	*Panthera*	*Panthera*
Species	produce fertile offspring when they breed	*leo*	*tigris*

(a) (i) **Name** the **Class** to which lions belong. ..... [1]

(ii) **Name** the **Order** to which tigers belong. ..... [1]

(iii) What information shows that lions and tigers both belong to the Kingdom Animalia? [1]

.....

(iv) Why are lions and tigers both in the Phylum Chordata? [1]

.....

(v) The scientific name for a tiger is *Panthera tigris*. What is the scientific name for a lion? [1]

.....

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(b) Hyenas are meat-eating vertebrates that feed their young on milk. They have the scientific name *Crocuta crocuta*. Use this information to complete the table below for hyenas. [4]

Classification group	Hyenas
Kingdom	Animalia
Phylum	.....
Class	.....
Order	.....
Family	Hyaenida
Genus	.....
Species	.....

9

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SECTION B

You need to refer to the resource folder to answer questions in this section.

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

7. Water pollution can be monitored using invertebrate animals as indicators.

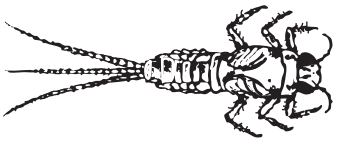
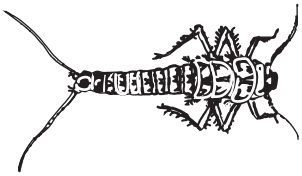
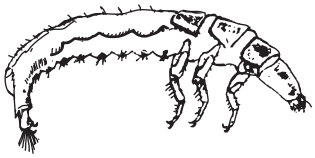
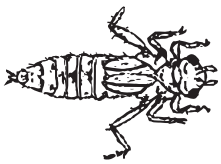
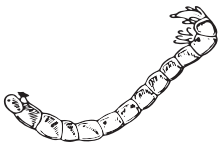
(a) Describe how you would carry out an investigation into monitoring water pollution using invertebrates. [6 QWC]

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(b) This table shows the results of invertebrates identified in three parts of a stream **A**, **B** and **C** obtained during an investigation.

			Total biomass in sample (g)		
	Photograph of invertebrate	**Species**	**A**	**B**	**C**
1		.....	50	0	4
2		.....	65	0	0
3		Caddisfly larva	0	0	30
4		.....	0	4	34
5		.....	0	45	10
6		.....	0	100	2

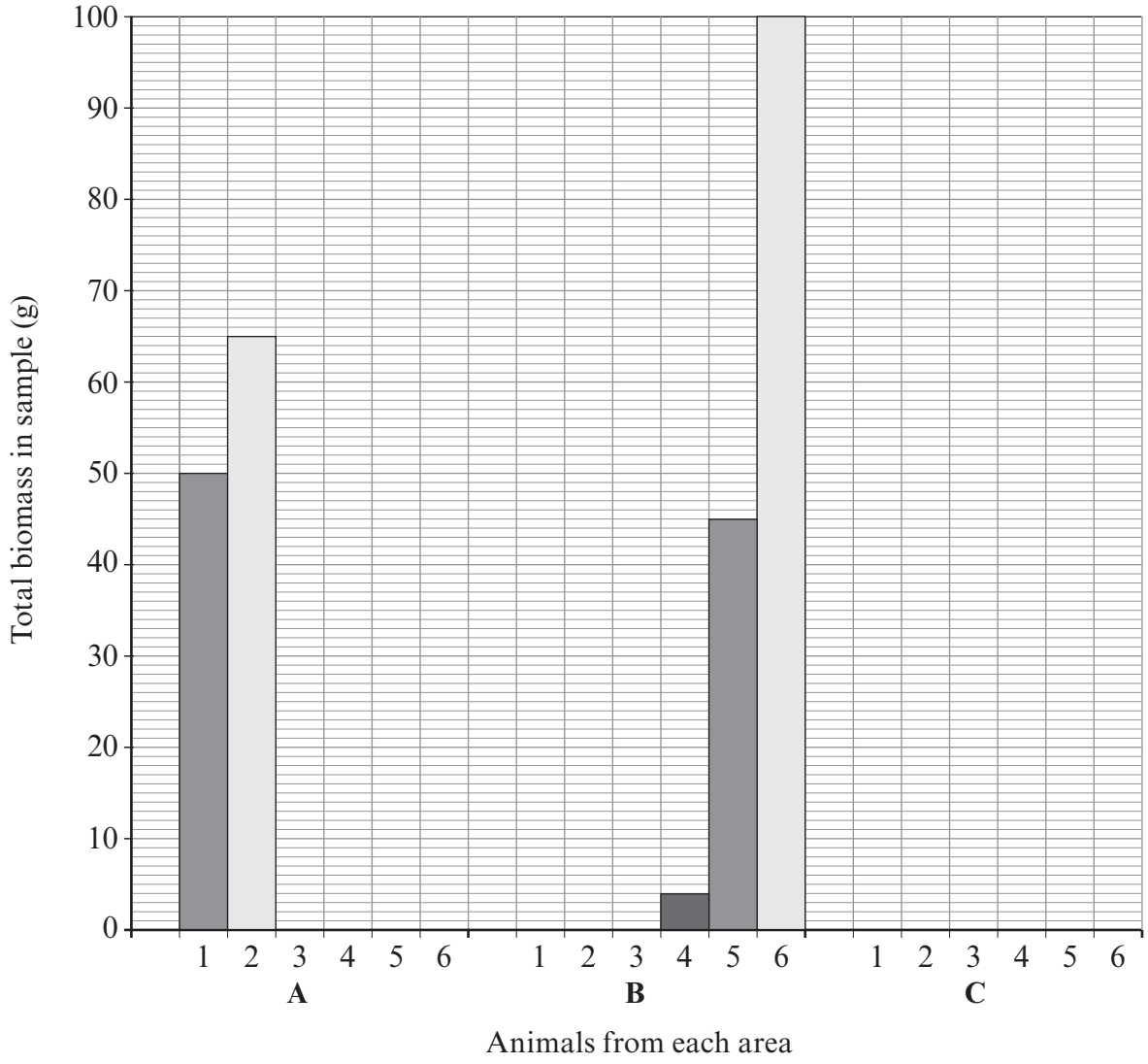
(i) Use the information in the resource folder to identify each invertebrate and complete the table. One has been completed for you. [5]

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(ii) Plot the results for part **C** of the stream as a bar chart on the grid below. The data for parts **A** and **B** in the stream have already been plotted for you. [3]



(iii) Use the information in the resource folder and the results of the investigation to describe how the quality of water (pollution level) changes from part **A** of the stream, as it flows to parts **B** and **C**. [3]

.....

.....

.....

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(iv) Explain how the results to the investigation support your answer to (iii). [3]

.....

.....

.....

.....

(c) During the investigation, any water boatmen collected were not counted. Explain why they were ignored. [2]

.....

.....

.....

(d) How could the repeatability of the data collected be improved? [2]

.....

.....

.....

24

END OF PAPER

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GCSE MARKING SCHEME

SCIENCE B

JANUARY 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE SCIENCE B. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
UNIT1 - FOUNDATION TIER	1
UNIT 1 - HIGHER TIER	5
UNIT 2 - FOUNDATION TIER	11

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GCSE SCIENCE B – UNIT 1 (FOUNDATION TIER)

SECTION A

Question	Answers	Marks
1 (a)	Top down: Crust, mantle, molten iron outer core, solid iron core	4
(b) (i)	Tectonic, continental	2
(ii)	Earthquakes, volcanoes, (accept tsunami)	2
2 (a)	Any 1 of: • less power stations / less land used • less impact on habitats • less fossil fuels burned • less greenhouse gases / reduced global warming • less acid rain	1
(b) (i)	9000/1200, = 7.5 years	2
(ii)	Decreases	1
(iii)	Decreases	1
(c) (i)	2.5 x 300 (1) Calculation of units = 750 (1)	2
(ii)	750 (allow ecf) x 12 (1) Answer = 9000p or £90 (1)	2
3 (a)	Signals not absorbed / blocked by atmosphere (1) Earth based cheaper (1)	2
(b) (i)	Similar pattern of circulating matter (1) larger gap between event horizon and rotating matter (1)	2
(ii)	Any 2 of gamma, X rays, UV, visible, IR, microwaves, radiowaves.	2
4 (a) (i)	Any 2 of: burning, respiration, decay	2
(ii)	Photosynthesis / ocean uptake	1
(b) (i)	Any 2 of: Deforestation, more demand for electricity, more use of fossil fuels, more industry, more animals bred for providing food, more transport	2
(ii)	Global warming	1
(c) (i)	1.6 (tonnes)	1
(ii)	1.4 (tonnes)	1
(iii)	No – bigger carbon footprint or wte	1

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Question	Answers	Marks
5 (a) (i)	*1 mark for the following point:* dark coloured moths increase *The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above.* so more trees must have been covered in soot	2
(ii)	C	1
(b)	*1 mark for the following point:* less sooty deposits *The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above:* so light coloured moths are better camouflaged	2
6 (a) (i)	Mammalia	1
(ii)	Carnivora	1
(iii)	Move in search of food	1
(iv)	Both have vertebral column	1
(v)	Panthera leo	1
(b)	Down: Chordata, Mammalia, Carnivora (1), Crocuta (1), crocuta (1)	3
	1 mark for correct use of bold capital letters.	1

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SECTION B

Question	Answers	Marks
7 (a)	Indicative content • Collect some water in your large tray. • Use the same technique each time you collect a sample – holding the net in the same way for the same length of time. • Scoop up some of the material from the bottom of the stream, or stir the bottom material and place the net downstream to catch it. • Try to identify the animals against the indicator chart. • Count the animals. • Pour the water gently back into the pond or stream. • Repeat at different times / different sections of the stream. 5-6 marks The candidate constructs an articulate, integrated account correctly linking relevant points such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. 3-4 marks The candidate constructs an account correctly linking some relevant points such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. 1-2 marks The candidate makes some relevant points such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. 0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.	6

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Question	Answers	Marks
(b) (i)	In descending order: • Mayfly Nymph • Stonefly Nymph • *(Caddis fly larva)* • Dragonfly Nymph • Bloodworm • Bristleworm	5
(ii)	5/6 correct (3) 3/4 correct (2) 1/2 correct (1)	3
(iii)	A - good water quality B – polluted C – becoming cleaner / low levels of pollution	3
(iv)	Quotes examples of preferred water quality for the invertebrates (x3), e.g. Mayfly Nymph – pollution intolerant / large numbers indicate good water quality. Explanation must coherently and correctly connect points to achieve 3 marks.	3
(c)	*1 mark for the following point:* adults breathe surface air. *The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above:* so do not indicate water quality.	2
(d)	Collect more than one sample at each location, Collect samples in the same way	2

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GCSE SCIENCE B – UNIT 1 (HIGHER TIER)

SECTION A

Question	Answers	Marks
1 (a)	**Indicative content** • Collect some water in your large tray. • Use the same technique each time you collect a sample – holding the net in the same way for the same length of time. • Scoop up some of the material from the bottom of the stream, or stir the bottom material and place the net downstream to catch it. • Try to identify the animals against the indicator chart. • Count the animals. • Pour the water gently back into the pond or stream. • Repeat at different times / different sections of the stream. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	**6**

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Question	Answers	Marks
(b) (i)	In descending order: • Mayfly Nymph • Stonefly Nymph • *(Caddis fly larva)* • Dragonfly Nymph • Bloodworm • Bristleworm	**5**
(ii)	5/6 correct (3) 3/4 correct (2) 1/2 correct (1)	**3**
(iii)	A - good water quality B – polluted C – becoming cleaner / low levels of pollution	**3**
(iv)	Quotes examples of preferred water quality for the invertebrates (x3), e.g. Mayfly Nymph – pollution intolerant / large numbers indicate good water quality. Explanation must coherently and correctly connect points to achieve 3 marks.	**3**
(c)	*1 mark for the following point:* adults breathe surface air. *The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above:* so do not indicate water quality.	**2**
(d)	Collect more than one sample at each location, Collect samples in the same way	**2**

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SECTION B

Question	Answers	Marks
2 (a)	Top down: crust, mantle, molten outer (iron) core, solid/ iron/ inner core	**4**
(b) (i)	Tectonic, continental	**2**
(ii)	Earthquakes, volcanoes.(accept tsunami)	**2**
3 (a)	*Any **two** points from:* • need less power from national grid / less power stations / burn less fossil fuels • burning fossil fuels releases CO_2 / less CO_2 formed • and acid(ic) gases / less acid gases formed *In each case, the third mark can be awarded if the conclusion correctly and coherently follows from the main point. Any of the following:* • therefore less greenhouse gases / reduced global warming • therefore less acid rain • therefore less impact on habitats.	**3**
(b) (i)	Total return = £1200 (1), 9000/1200 = 7.5 years (1)	**2**
(ii)	Cost of electricity could change, so each unit generated saves different amount (2) **OR** sunlight varies, so different amount exported to grid(2) **OR** feed in tariff changes, so different income for generating electricity (2) *In each case, the conclusion must correctly and coherently follow from the main point to achieve 2 marks.*	**2**
(c)	Convert £90 to 9000p **OR** 12p to £0.12 (1) Calculation of units = 750 (1) Time = 258.6/259/260(h)((1)	**3**

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Question	Answers	Marks
4 (a)	Earth based cheaper (1) but signals absorbed / blocked by atmosphere (1). Accept converse.	**2**
(b) (i)	Similar pattern of circulating matter (1) larger gap between event horizon and circulating matter (1)	**2**
(ii)	Non-spinning - Any 2 of: narrower spectrum, higher peak or converse, peak at same frequency	**2**
(iii)	Value from graph = 7 x $\underline{10^{16}}$ Hz (1) Substitution/manipulation (1) Answer = 4.3 x 10^{-9} m (1)	**3**
(c)	Any 3 of: • sharing cost • scientific expertise • technology • equipment / facilities / locations	**3**
5 (a)	Any 3 of: (Pollution has increased). Dark moths are at an advantage / well camouflaged (or converse) (1) less predation on black forms / fewer black moths eater (1) more predation on light forms / more light moths eaten (1) more black forms survive (1) to breed / pass on genes (1)	**3**
(b) (i)	*1 mark for the following point:* less sooty deposits / cleaner surfaces *The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above:* so light moths should increase	**2**
(ii)	Increases chances of survival if environment changes	**1**

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Question	Answers	Marks
6 (a)	**Indicative content:** • Carbon is recycled via photosynthesis, food chains and respiration. • The role of microbes, bacteria and fungi in transferring carbon by feeding on waste materials from organisms and dead plants and animals. • These microbes respire and release carbon dioxide into the atmosphere. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	**6**
(b)	Values for 40 km are: car 1.6 coach 0.2 (1) Difference 1.4 (1) Double values 2.8 (table for 100 people) (1) 10 journeys so saving = 28 (Tonnes) (1)	**4**

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Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4781/01

SCIENCE B

UNIT 1: Space, Energy and Life

FOUNDATION TIER

A.M. TUESDAY, 12 June 2012

1¼ hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**12**	
3.	**9**	
4.	**6**	
5.	**7**	
6.	**7**	
7.	**24**	
Total	**70**	

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010001

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 B**.

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 B 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 **7***(c)*.

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SECTION A

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

1. *(a)* The beaks of birds have developed so they can compete for food.

Draw lines to match **each** bird with its description. [3]



Long, flat bill which is used like a shovel



Spear-like beak to catch fish in water



Large bill which stretches to hold fish



Uses its beak like a drill to bore through bark of trees

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(b) Below is a picture of a hawk.



Explain how its beak is adapted for feeding. [2]

.....

.....

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2. The supply and demand of electrical energy, to and from the National Grid, is monitored by engineers.

The table shows how the amount of electrical energy generated by renewable sources has changed between 2000 and 2010.

Renewable Source	Energy generated (GWh) in each year			
	2000	2004	2008	2010
Wind: Onshore	945	1736	5792	7137
Wind: Offshore	1	199	1305	3046
Solar photovoltaic	1	4	17	33
Hydroelectricity	214	1636	2494	1821
Biomass	3042	6393	8057	10321
Total renewable generation	**4203**	**9968**	**17665**	**22358**

(a) (i) Calculate the increase in **total renewable generation** between 2000 and 2010. [1]

Increase = ... GWh

(ii) Explain why the use of these renewable sources has increased over this time. [3]

.....

.....

.....

(iii) One of the above renewable forms of energy is only generated during the day. How much energy was generated in 2010 by this source? [1]

..... GWh

(b) (i) Name **one** source of biomass. ..... [1]

(ii) Name the renewable source in the table that involves burning material.

..... [1]

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(c) There is a debate about whether our future electrical energy needs will be met from renewable sources alone or whether nuclear power will also be needed. The table below compares a wind turbine with a nuclear power station.

	Wind	Nuclear
Overall cost of generating electricity (p/kWh)	5.4p	2.8p
Maximum power output (MW)	3.5	3 500
Lifetime	15 years	50 years
Waste produced	none	radioactive substances, some remain dangerous for thousands of years
Lifetime carbon footprint (g of CO_2/kWh)	4.64 g/5.25 g (onshore/offshore)	5 g

Adapted from *www.guardian.co.uk*

Use the information in the table above to answer the following questions.

(i) How many wind turbines are needed to produce the same amount of electricity as a nuclear power station? [1]

.....

(ii) Which method of power generation has the longer lifetime? ..... [1]

(iii) Which method of power generation has the largest carbon footprint?

..... [1]

(iv) State **one** advantage of offshore wind turbines. [1]

.....

(d) Give **one** reason why wind power is unreliable. [1]

.....

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3. Surveyors produce energy certificates for houses that are for sale. They examine information about energy usage and the insulation installed.
The table shows the energy loss from different parts of a house. It shows how these figures change as improvements are made.

House part	Insulation	Energy loss per second (J/s)
Cavity walls	None	650
	Foam	190
	Energy saved	**460**
Windows	Single glazed	410
	Double glazed	200
	Energy saved	.....
Loft	None	780
	Fibre glass	250
	Energy saved	**530**

(a) (i) Complete the table. [1]

(ii) Use the data in the table to decide which type of insulation the surveyor would advise the homeowner to install first. [1]

.....

(iii) Give **one** reason for your answer. [1]

.....

.....

(b) A homeowner installs **loft insulation** and **cavity wall insulation**.

(i) Using the figures in the table, find the heat energy savings achieved **each second**. [1]

Energy savings = ... J/s

(ii) Write down the homeowner's power savings including the unit in your answer.

..... [2]

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(c) (i) The electrical heating is used 10 hours a day. During this time, assume the homeowner saves 1.5 kW of electrical power used to heat the home by installing insulation.

Calculate the number of units saved each day using the equation: [1]

Units used (kWh) = power (kW) × time (h)

Units saved = ... kWh

(ii) The cost per unit is 12p. Calculate the savings made every day using the equation: [2]

Cost = units used × cost per unit

Money saved per day = ... p

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4. During the last 100 years, the increase in the world's population has resulted in more land being used to produce food.

(a) (i) What effect does this have on the amount of land covered by forests? [1]

.....

(ii) Explain how this affects wildlife. [2]

.....

.....

.....

(b) There are pressures to increase the use of intensive farming methods to meet the demand for food.

(i) Tick (✓) **two** methods of intensive farming in the list below. [1]

Farming method	Tick (✓) **two** methods
Using artificial fertilisers	
Using a tractor	
Using crop rotation	
Using artificial insecticides	

(ii) State **two** reasons why intensive farming produces food cheaper than organic farming. [2]

1. .....

2. .....

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5. The table gives information about the planets in the solar system.

	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Distance from the Sun (AU)	0.39	0.72	1	1.52	5.20	9.53	19.19	30.06
Orbit time (years)	0.24	0.62	1	1.88	11.86	.....	84.01	164.79
Orbital speed (km/s)	47.89	35.04	29.79	24.14	13.06	.....	6.81	5.43
Equatorial radius (km)	2439	6052	6378	3397	71490	60268	25559	25269
Polar radius (km)	2439	6052	6357	3380	66854	54360	24973	24340
Mass of planet (Earth=1)	0.06	0.82	1		317.89	95.18	14.53	17.14
Number of moons	0	0	1	2	28	30	24	8

(i) **Estimate** values to complete the table for Saturn. [2]

(ii) **Estimate** the distance from the Sun to the asteroid belt. ..... AU [1]

(iii) Give **one** reason why it is difficult to estimate the mass of Mars. [1]

.....

.....

(iv) Planets are circular/spherical if their polar radius and equatorial radius are the same.

Name **one** planet that is spherical. ..... [1]

(v) It is thought that the larger the mass of a planet the more moons will orbit around it. Explain whether the information supports this hypothesis. [2]

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Examiner only

6. *(a)* Underline the correct word or phrase in each bracket in the following paragraph. [3]

The Universe was created by the Big Bang about 13.5 (thousand / million / thousand million) years ago. The Universe continues to (expand / shrink / stay the same) as shown by red shift measurements. Other evidence for the Big Bang theory is the Cosmic (Infra-red / Microwave / Ultra-violet) Background Radiation.

(b) Electromagnetic waves are used to make observations of space.

(i) Complete the diagram of the electromagnetic spectrum in the correct order. [2]

Gamma rays	X-rays	.....	Visible light	.....	Microwaves	Radio waves

(ii) Explain the advantage of space based telescopes over Earth based telescopes. [2]

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SECTION B

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

This section is based upon the Pre-Release Article which is found in the separate resource folder.

7. National Trust wardens monitor the wildlife living in woodland.

(a) Use the information in **Table 1** of the pre-release article to construct a **food web** below for the woodland habitat. [6]

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(b) Give **one** example, from this food web, of a woodland organism that is: [6]

(i) at more than one trophic level; .....

(ii) a primary consumer; .....

(iii) a secondary consumer; .....

(iv) a tertiary consumer; .....

(v) a herbivore; .....

(vi) a carnivore. .....

(c) The government has announced that badger culls (killing) will be allowed. The Mammal Society is against this policy since badgers could disappear in certain areas. This would affect woodland habitats. Explain how the killing of badgers could affect the other organisms living in the woodland habitat shown in Table 1. [6] QWC

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Turn over for next question.

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(d) (i) Complete the table below for one food chain in the woodland habitat. [1]

Organism	Number in chain	Average mass of each organism (g)	Total mass (g)
Leaves	100	0.5	.....
Aphids	500	0.01	.....
Ladybirds	10	0.1	.....

(ii) Draw on the grid below, a pyramid of biomass to scale, for the food chain shown in the table above. [3]

(e) The table shows information about the energy transfer through the trophic levels of the woodland habitat.

Trophic level	Energy (J/m^2/year)	Efficiency of energy transfer to next level
1	25 000	15.0%
2	3 750	12.3%
3	460	.....
4	23	

Calculate the value missing from the table. [2]

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GCSE MARKING SCHEME

SCIENCE B

SUMMER 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE B. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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GCSE Science B Unit 1 (Foundation Tier)

SECTION A

Q.1 (a) All correct 3 marks; 2/3 correct 2 marks; 1 correct 1; 0 correct 0 marks

(b) One mark can be awarded for making a correct point:
hook like beak (1)

The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above.
which can tear/rip flesh (1)

Q.2 (a) (i) 22358-4203 = 18155 (1)

(ii) 2 marks can be awarded for making 2 correct points:

Less dependent on fossil/non-renewable fuel use (1) because of the greenhouse effect (1) and reducing resources (1)

The third mark can only be awarded if the candidate coherently and correctly link points.

(iii) 33 GWh (1)

(b) (i) Plants/animal waste (1)

(ii) Biomass (1)

(c) (i) 1000 (1)

(ii) Nuclear (1)

(iii) Offshore wind (1) (NOT: weather changes)

(iv) No waste

(d) Variable wind speed/no wind (1)

Q.3 (a) (i) 210 (J/s) (1)

(ii) Loft/fibre glass (1)

(iii) Biggest energy saving (1) (or comparison showing different energy saving)

(b) (i) 990 (J/s) (1)

(ii) 990 (1) allow ecf W or J/s (1)

(c) (i) 15 kWh (1)

(ii) Subs 15 x 12 (1) 180p (1) 180 p only (2)

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Q.4 (a) (i) (As population increases forest land) decreases/ less land (1)

(ii) One mark can be awarded for making a correct point:
habitat has been removed/ less food (1)

The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above.
therfore there will be **less** wildlife (1)

(b) (i) Two correct ticks – artificial fertilisers, artificial insecticides (1)

(ii) Larger output / less land used / less labour costs/ grows quicker – any 2 x 1

Q.5 (i) Time between 12 and 83 (1) velocity between 12 and 7 (1)

(ii) Between 2 and 4.5 (1)

(iii) No pattern (1)

(iv) Mercury or Venus (1)

(v) One mark can be awarded for making a correct point:
No (1) because e.g.

The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above.

Neptune more massive than Uranus but has less moons (1)
Accept appropriate statement about 2 other planets

Q.6 (a) Thousand million, expands, microwave (3)

(b) (i) UV, IR (2)

(ii) One mark can be awarded for making a correct point:

Telescope is above the atmosphere/ less light pollution (1)

The second mark can only be awarded if the candidate coherently and correctly links the conclusion to the statement above.

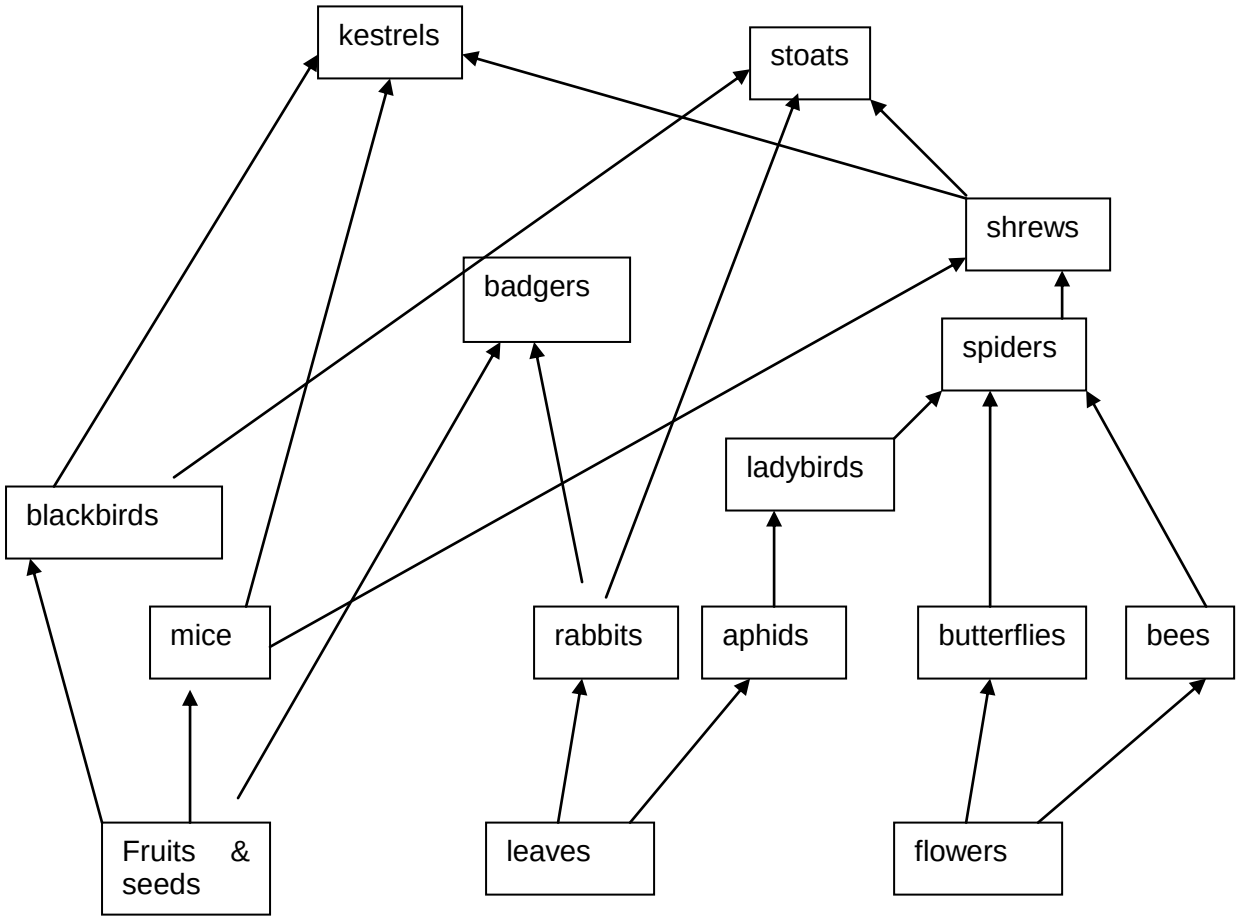
So less absorption of signals/therefore better signals/so can observe different parts of the em spectrum/better picture (1)

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SECTION B

Q.7 (a)



Producers at start of each chain within food web (1)
Badgers, kestrels & stoats at end of a chain within web (1)
Flowers to butterflies/bees to spiders to shrews to kestrels/stoats (1)
Leaves to aphids to ladybirds to spiders (1)
Leaves to rabbits to badgers/stoats (1)
Fruits & seeds to badgers (1)
Fruits & seeds mice to shrews/kestrel (1)
Fruits & seeds to blackbirds to kestrels/stoats (1)
Maximum of 5 if arrows not put in.

(b) (i) Badgers/spiders kestrels/stoats/spiders (1)

(ii) Blackbirds/mice/rabbits/aphids/butterflies/bees/badgers (1)

(iii) Kestrels/badgers/ladybirds/spiders/stoats (1)

(iv) Spiders/shrews (1)

(v) Blackbirds/mice/rabbits/aphids/butterflies/bees (1)

(vi) Kestrels/spiders/ladybirds/shrews/stoats (1)

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(c) **Indicative Content**

Up to five of:

- Organisms that badgers feed on (rabbits, fruits & seeds) will become more plentiful
- more availability of fruits & seeds will cause an increase in herbivores that feed on them (mice & blackbirds)
- more food available for kestrels & stoats could increase their numbers
- rabbit population will increase lower supply of leaves so aphids may decrease
- result in decrease in ladybirds
- spiders will depend more on butterflies & bees so their numbers will decrease.

5 – 6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 – 4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit.

(d) (i) 50, 5, 1 all correct (1)

(ii) Correct height (1)
Correct shape (1)
Correct ratio (1) (50 – 5 – 1) (3)

(e) Substitution of values (23/460), answer 5% (2)

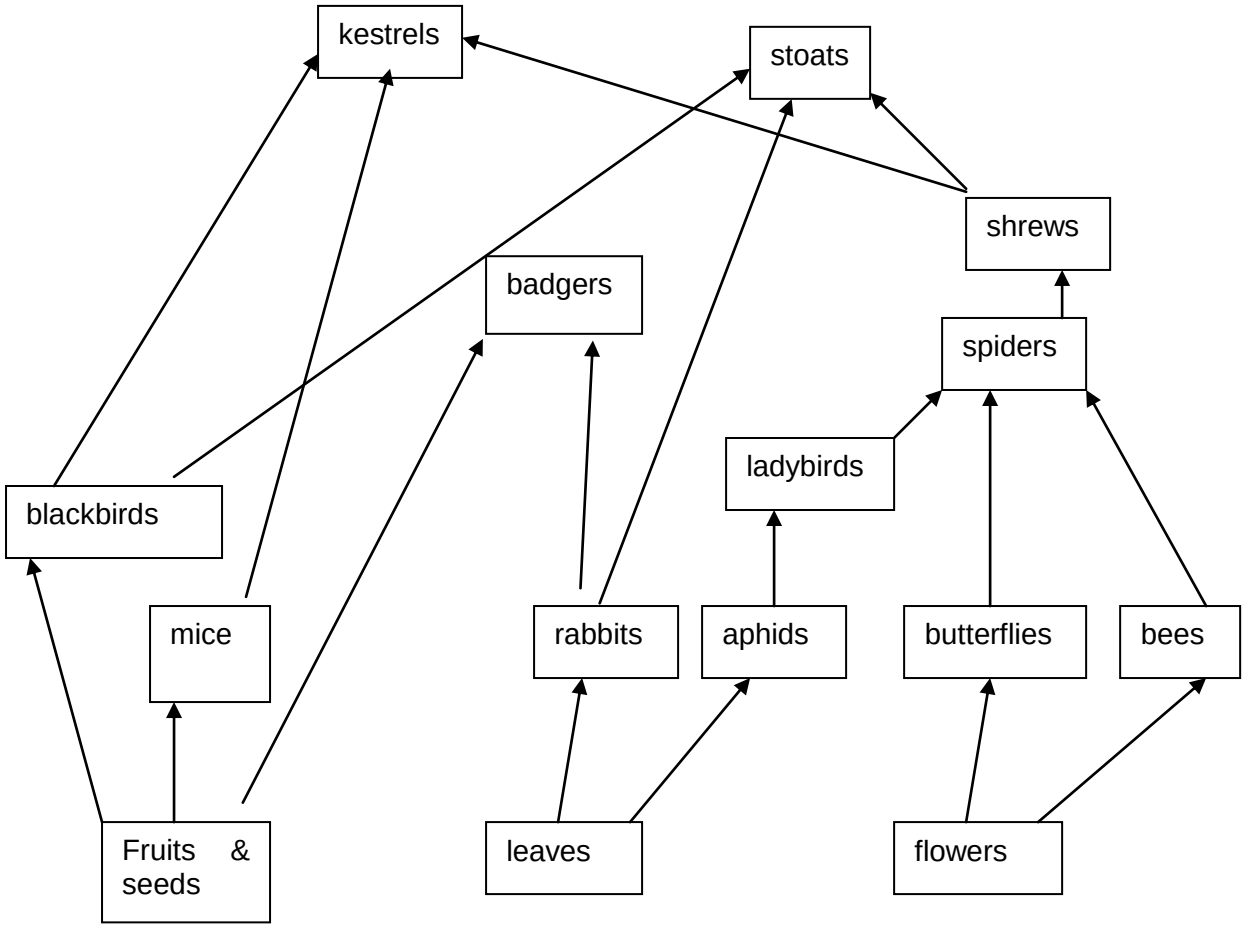
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GCSE Science B Unit 1 (Higher Tier)

SECTION A

Q.1 (a)



Producers at start of each chain within food web (1)
Badgers, kestrels & stoats at end of a chain within web (1)
Flowers to butterflies/bees to spiders to shrews to kestrels/stoats (1)
Leaves to aphids to ladybirds to spiders (1)
Leaves to rabbits to badgers/stoats (1)
Fruits & seeds to badgers (1)
Fruits & seeds to mice to kestrel (1)
Fruits & seeds to blackbirds to kestrels/stoats (1) Any 6 x 1 for 6 max.

(b) (i) Badgers/spiders/ kestrels/ stoats/spiders (1)

(ii) Blackbirds/mice/rabbits/aphids/butterflies/bees (1)

(iii) Kestrels/badgers/ladybirds/spiders/stoats (1)

(iv) Spiders/shrews (1)

(v) Blackbirds/mice/rabbits/aphids/butterflies/bees (1)

(vi) Kestrels/ spiders/ ladybirds/shrews/ stoats (1)

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(c) **Indicative Content**

Up to five of:

- Organisms that badgers feed on (rabbits, fruits & seeds) will become more plentiful
- more availability of fruits & seeds will cause an increase in herbivores that feed on them (mice & blackbirds)
- more food available for kestrels & stoats could increase their numbers
- rabbit population will increase lower supply of leaves so aphids may decrease
- result in decrease in ladybirds
- spiders will depend more on butterflies & bees so their numbers will decrease.

5 – 6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 – 4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit.

(d) (i) 50, 20, 2 all correct (1)

(ii) Each level of the pyramid must be of equal height, appropriate scale, correct ratio between levels (25 – 10 – 1) (3)

(e) Substitution of values (23/460), answer 5% (2)

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SECTION B

Q.2 (a) (i) Calculation of totals for 2000 – 4203 & for 2010 – 22358 (1) the subtraction to give 21550 but allow e.c.f. for their totals (1)

(ii) *Either:*

1 mark can be awarded for identifying:
offshore wind (alternative acceptable answer biomass) (1)

The second mark can only be awarded if the candidate can coherently and correctly link their identification to the data, since this shows the biggest percentage increase (1) (reasoning for biomass - biggest difference per year) (1)

(b) **Indicative Content:**
Disadvantages of wind – *Three of:* overall cost more, less power output, shorter lifetime, larger carbon footprint for offshore wind;
Advantages –*Two of:* no waste, lower carbon footprint for onshore.

5 – 6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 – 4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit.

Q.3 (a) (i) Loft insulation (1)

(ii) Causes biggest saving in energy lost (1)

(b) (i) Differences calculated – 28270 & 34980 (1) total savings 63250J (1)

(ii) Conversion of 1 minute to 60s (1) answer 63250/60 = 1054W (1) allow e.c.f. from (i)

(c) (i) To gain full credit there must be a multiple of 7 used somewhere in the answer (1)
Subs into units = 1.5 x 10 (1) (x 7) = 15 or 105
Subs into cost = 15 x 12 (1) = 180p/£1.80 (180x7 = 1260p/£12.60)
/105 x 12 = 1260p/£12.60 ans & unit (1)

(ii) 1600/12.60 (ecf) = 126.9/127 weeks (1)

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Q.4 (a) Rotating cloud of interstellar dust and gas began separating into rings. (1) Successively larger fragments collided with one another and became larger objects ultimately becoming protoplanets (1) (Earth was one).

(b) (i) Earth spun and flattened so quickly (1) that it ejected a large piece of material which eventually became the moon (1)

(ii) Ring of dust around the earth slows the moon (1), which has already formed somewhere else allowing it to be captured into the earth's gravitational field. (1)

(iii) When a planetesimal the size of mars struck the earth ejecting large volumes of matter from the earth (1) disk of orbiting material ejected from the collision eventually condensed to form our moon (1)

Q.5 (a) (i) One mark can be awarded for making a correct point:
As population increases forest land decreases (1)

The second mark can only be awarded if the candidate coherently and correctly connects reasons the connection between the two trends because forests are cleared for - wood as a raw material for building/more housing/ agriculture to grow more food (1)

(ii) Removal of habitats affects wildlife (1) reduction in photosynthesis and effect of carbon dioxide concentration in the atmosphere (1)

(b) Reference to animal well being (1), impact of fertilisers – eutrophication (1), impact of pesticides – bioaccumulation (1), compare yield to feed increasing population (1) cost of food – is it affordable (1)

Q.6 (a) Movement of spectral lines (1) to red end of spectrum (1)

(b) (i) Attempt at finding gradient (1), e.g. 190000/3100 (1) 61.3 (1)

(ii) One mark can be awarded for making a correct point:
It is possible to draw a different line of best fit (1) which would have a different gradient (therefore giving a different H_o value) (1)

The second mark can only be awarded if the candidate coherently and correctly connects the two points.

(iii) Distance = 3100 Mpc, (1) 3100 x 333.26 = 1 033 106 light years (1)

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