Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4781/02

W15-4781-02

SCIENCE B

UNIT 1: Space, Energy and Life
HIGHER TIER

P.M. THURSDAY, 15 January 2015

1 hour 15 minutes

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**24**	
Section B	**2.**	**10**	
	3.	**9**	
	4.	**8**	
	5.	**12**	
	6.	**7**	
	Total	**70**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator, a pencil and a ruler.
You will also need a copy of the **Resource Folder** (Pre-Release Article) to answer **Section A**.

INSTRUCTIONS TO CANDIDATES

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

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 questions **1***(e)* and **5***(c)*.
Section A is based upon the **Pre-Release Article**.

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SECTION A

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

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

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

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

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

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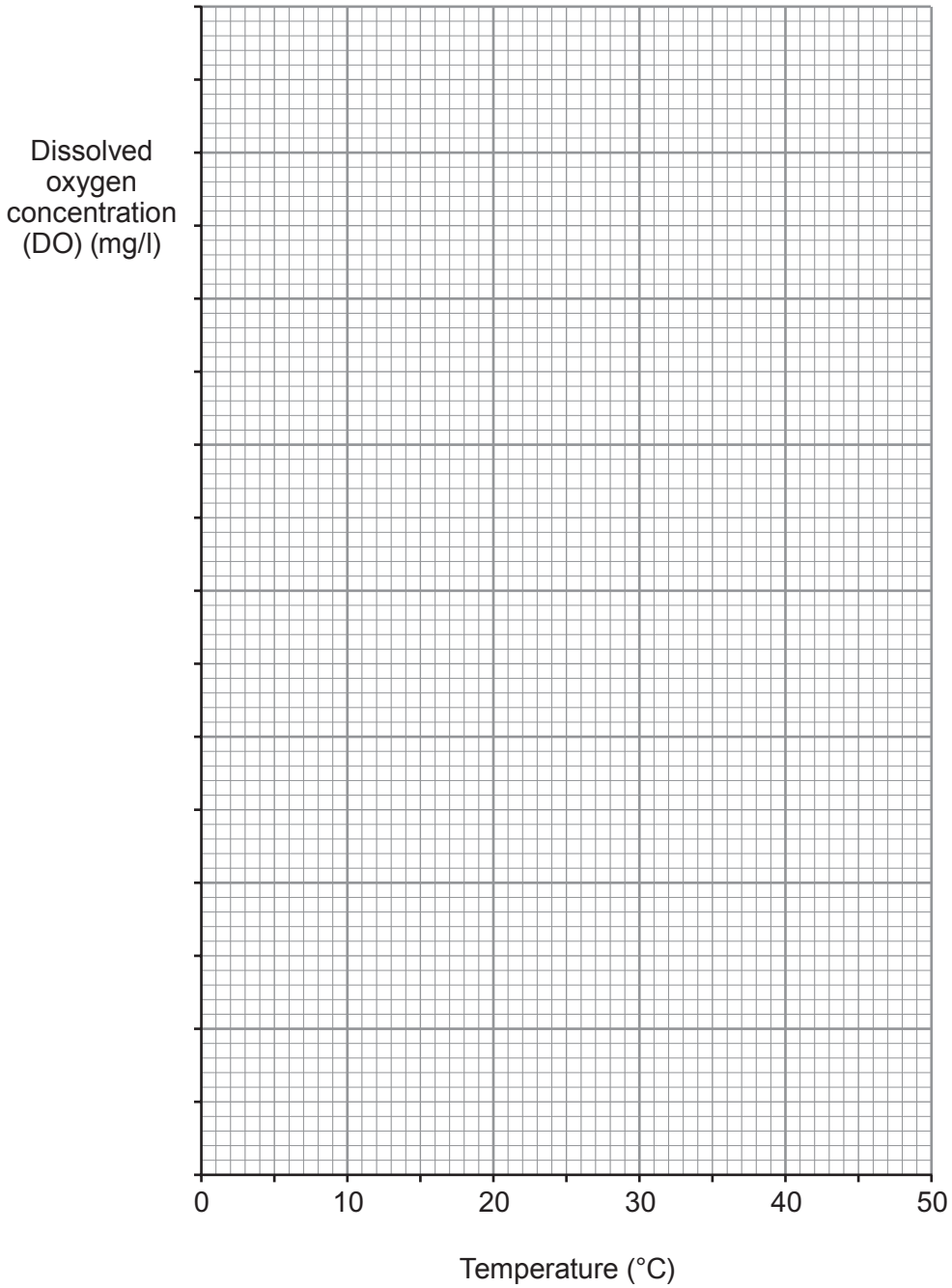
(c) (i) Use the information in **Table 1** to complete the table below and then plot a graph to show how the dissolved oxygen concentration varies with temperature. [5]

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



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

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(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]

24

Turn over.

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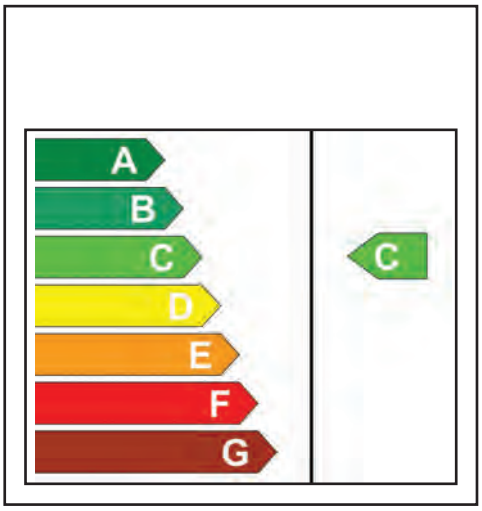
SECTION B

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

2. 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**.

Energy Rating
Dishwashers



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

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(b) Estimate the units of energy used per year by a dishwasher rated **C**. .....[1]

(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) The homeowner could have bought a dishwasher rated **A** that was £35 more than the one rated **D**. Explain why the dishwasher rated **A** would have been more cost effective. [2]

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(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. [3]

Use the equation:

units used = power (kW) x time (h)

Time = ... h

10

Turn over.

Examiner only

3. *(a)* 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.

(i) Explain why an increase in the population has been accompanied by a decrease in forest coverage. [2]

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(ii) Explain the effect on the environment of this reduced forest coverage. [2]

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(iii) Explain the importance of captive breeding programmes. [2]

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(b) Many people believe that intensive farming methods are needed to feed the growing population. Other people who prefer their food to be produced by organic farming oppose this view. Discuss the reasons for this difference of opinion. [3]

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4. The table below shows information about gases in the atmosphere on Venus and on Earth.

Gas	Venus	Earth
CO_2	>98 %	0.03 %
N_2	1 %	78 %
Ar	1 %	1 %
O_2	0.0 %	21 %
H_2O	0.0 %	0.1 %

(i) The early atmosphere on earth was very similar to that on Venus today. Describe how the Earth's atmosphere has changed over time. [2]

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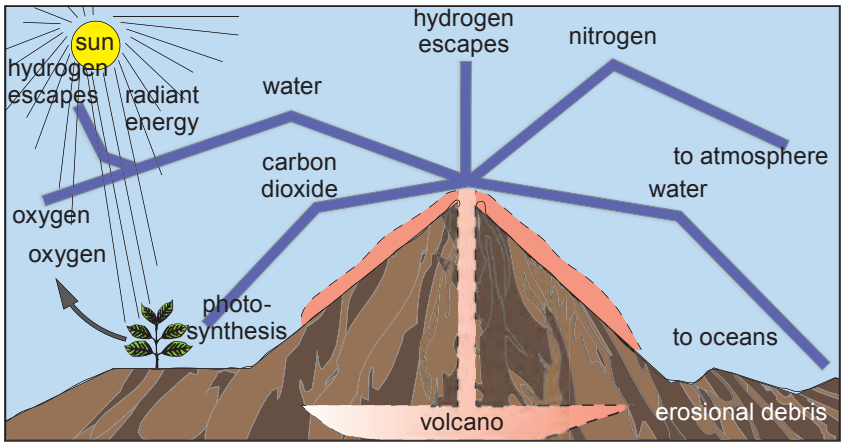
(ii) Use the information in the diagram to explain why the atmosphere of the Earth changed over millions of years. [3]



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(iii) Explain how the greenhouse effect occurs and why this effect is greater on Venus than on Earth. [3]

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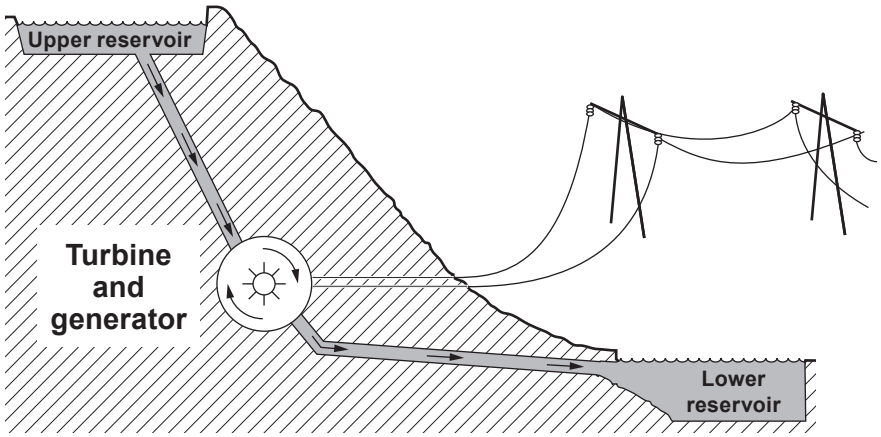
5. The diagram shows how electricity is generated in a hydroelectric power station.



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** non-environmental advantage of generating electricity in a hydroelectric power station. [1]

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

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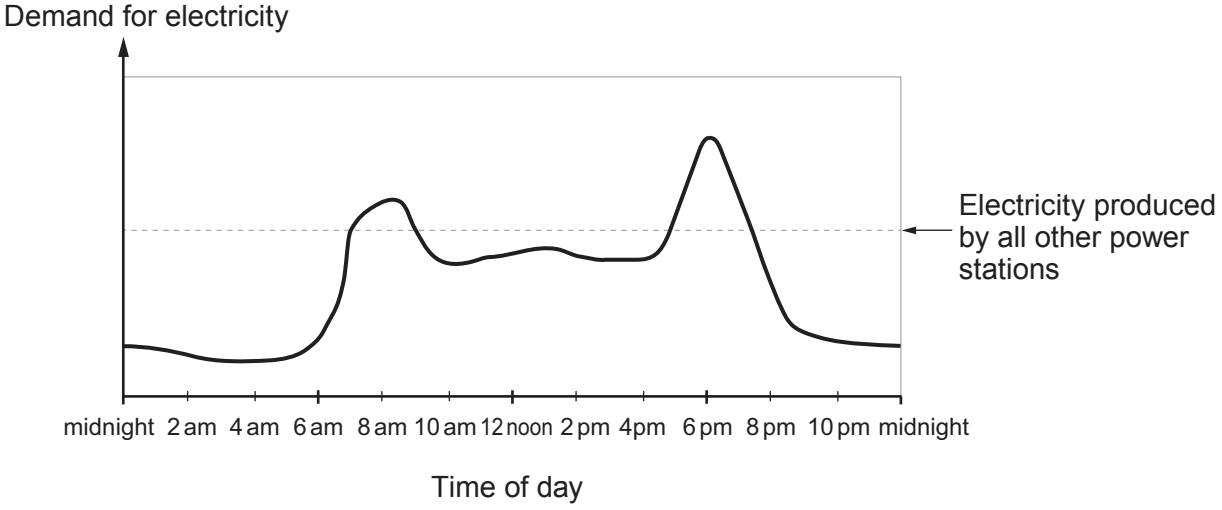
(b) The need for electricity changes in the way shown below.



(i) Between which times of day is demand for electricity greater than the supply from 'all other power stations'? [2]

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(ii) In the early hours of the morning, the water in the lower lake of this power station is pumped back up to the upper reservoir. By looking at the graph opposite, explain why it is done at this time. [2]

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(c) The electricity that is generated is transmitted through the National Grid to users. Explain the need for transformers in the transmission of electrical energy from the power station to users. [QWC 6]

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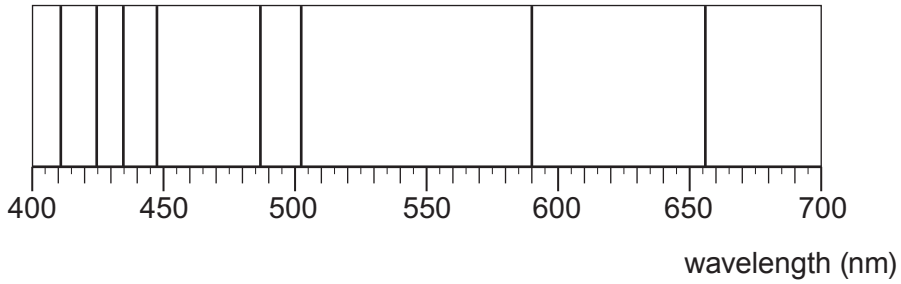
6. *(a)* The spectrum below is from a nearby star. It is crossed by dark lines. We know helium is present in the star because of the presence of dark lines at the wavelengths shown in the table.



Element	Wavelengths (nm)
helium	447 and 502

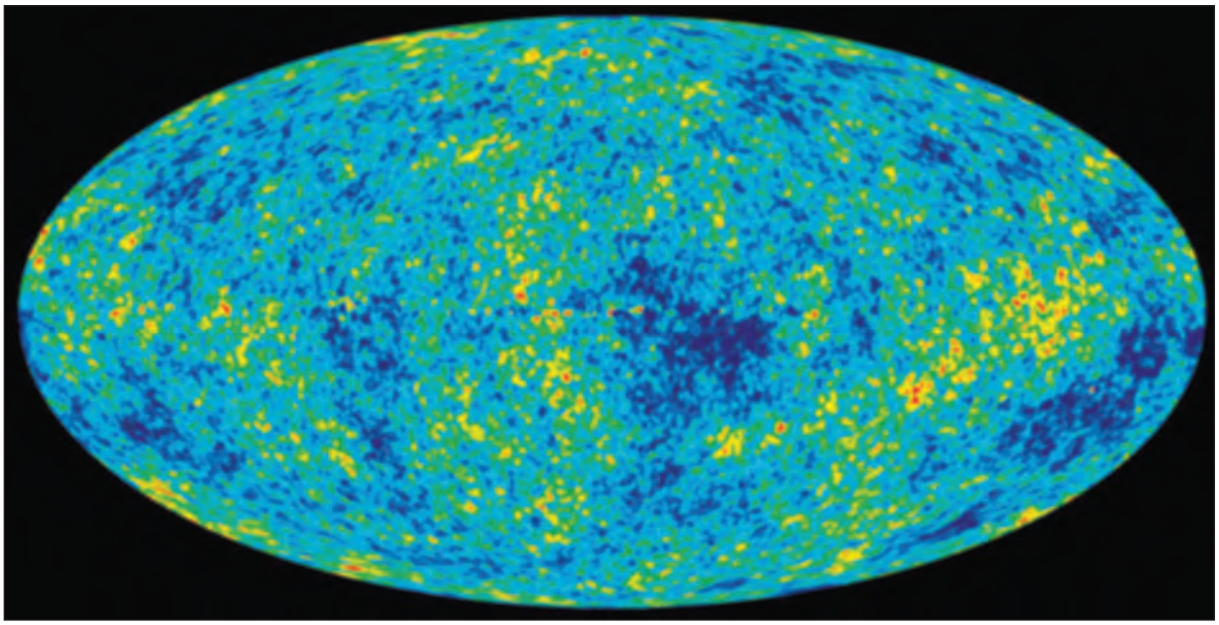
(i) **Label** the helium lines **X** and **Y** on the diagram above. [1]

(ii) When the spectrum from a more distant star is examined, it is found that these lines are red shifted by 5 nm. At what wavelengths do these dark lines now appear? [1]

Wavelengths = ... and ..... nm

Examiner only

(b) In 1965, **cosmic microwave background radiation (CMBR)** was found to be spread all over the universe. This CMBR is the remains of energy produced at the time of the Big Bang.



(i) Explain how the CMBR developed. [2]

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(ii) The intensity of CMBR reaches a maximum at a wavelength of 0.1 cm. Calculate the frequency at this maximum, using the equation:

wave speed = frequency x wavelength

The wave speed of electromagnetic waves is 3×10^8 m/s. [3]

Frequency = ... Hz

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