Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4781/02

S15-4781-02

SCIENCE B

UNIT 1: Space, Energy and Life
HIGHER TIER

P.M. FRIDAY, 5 June 2015

1 hour 15 minutes

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

Section A 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 **2***(a)* and question **9***(b)*.

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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. 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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2. 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]

Turn over.

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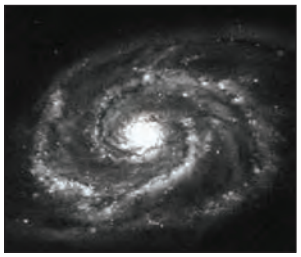
(b) Write down the class of each galaxy shown in the diagrams below. [3]

The first one has been done for you.

Class E0



Class .....

Class.....

Class .....

9

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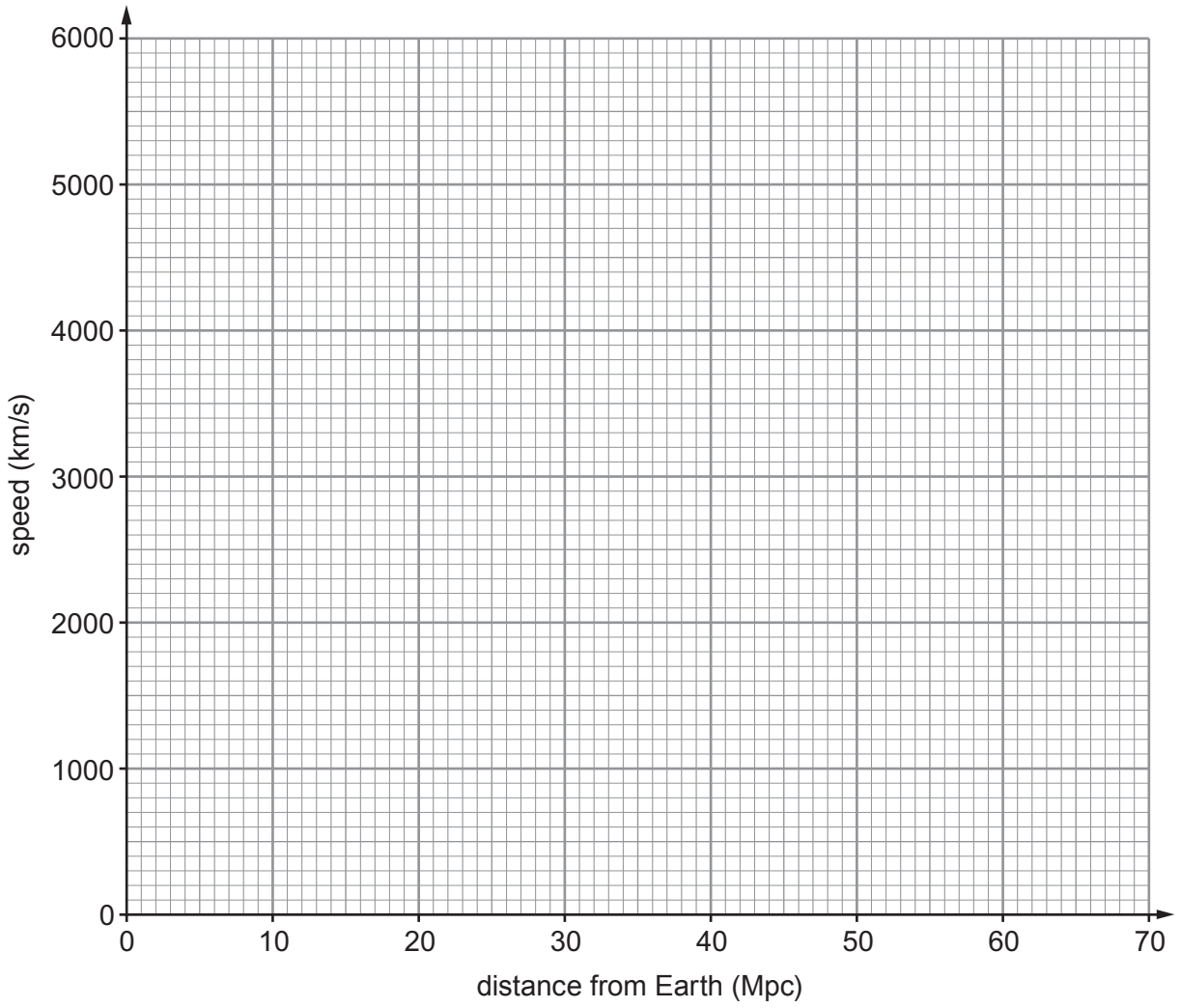
3. *(a)* Use the data in **Table 2** to plot a graph on the grid below.

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

4. 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]

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3

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SECTION B

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

5. The table shows what happens to the energy taken in each day by organisms in a food chain.

Organism	Energy (MJ) per day		
	As waste	Released during respiration	Used for growth
plant	18	12	8
caterpillar	14	22	4
bird	.....	26	4

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

Energy taken in = ... MJ

(ii) The bird releases 60% of its energy during respiration and for growth. Calculate how much energy is released in waste. [2]

Energy in waste = ... MJ

(iii) Explain why the amount of energy released during respiration changes as you move higher in the food chain shown in the table. [3]

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.....

(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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6. Reduce, reuse and recycle schemes promote sustainability. [5]

(i) State **one** impact of **reduce** schemes on obtaining new raw materials.

.....

.....

(ii) Explain the benefit of **reuse** schemes on landfill.

.....

.....

.....

(iii) Explain how **recycle** schemes affect energy demand.

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5

Turn over.

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7. Homeowners who generate electricity from solar power get paid for energy they produce under a scheme called 'Feed-in Tariff'.

They are paid for the energy they produce and use themselves. They are also paid for any electricity they produce and put into the grid. They will also see their energy bills fall slightly. The initial cost of installing solar panels is £7 800.

The total return for a typical **2.4 kW** household installation:

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

(a) Explain how the use of solar panels will impact on CO_2 emissions. [2]

.....

.....

.....

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

Payback time = ... years

(c) (i) Calculate how long it would take for a 2.4 kW installation of solar panels providing maximum power to produce enough electricity to save the homeowner £120. Use the equations: [3]

units used = power (kW) x time (h)
cost = units used x cost per unit

One unit of electricity costs 15p.

Time = ...

(ii) The power output from an installation of solar panels is only 1.2 kW. State how long this installation will take to save £120. [1]

.....

(iii) Explain why the power output from an installation of solar panels may be less than 2.4 kW during daylight hours. [2]

.....

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8. The wavelength of the infra-red (I-R) radiation from the Sun ranges from 2×10^{-7} to 4×10^{-6} m.

I-R radiation travels through space at a speed of 3×10^{8} m/s.

(a) Calculate the highest frequency of I-R radiation that arrives at Earth, using the equation: [4]

wavespeed = frequency x wavelength

Frequency = ... Hz

(b) (i) I-R radiation is one part of the electromagnetic (em) spectrum.

Complete the **first column only** to show the missing regions of the em spectrum in order of decreasing frequency. [2]

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

Highest frequency

Lowest frequency

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

4×10^{-2}	5×10^{-7}	1.5

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

(c) Explain how this incoming I-R radiation eventually leads to the greenhouse effect. [4]

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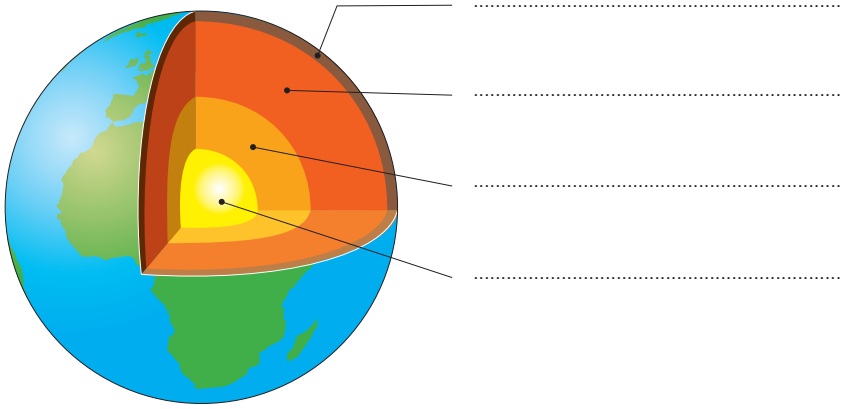
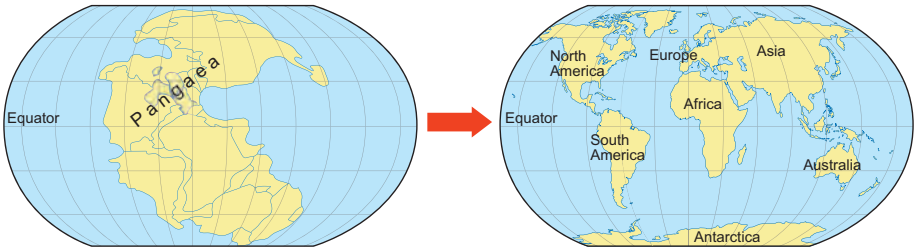
9. The diagram below shows the structure of the Earth.

(a) Label the **four** parts shown. [4]



(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

Account for the differences in surface appearance between 3 billion years ago and today. [6 QWC]

Include in your answer:

- a description of how the appearance of the surface has changed;
- an explanation of how these changes were brought about.

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END OF PAPER