

Write your name here

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**Pearson**  
**Edexcel GCSE**

Centre Number

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Candidate Number

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# Astronomy

## Unit 1: Understanding the Universe

Wednesday 4 June 2014 – Afternoon  
**Time: 2 hours**

Paper Reference

**5AS01/01**

**You must have:**  
Calculator, ruler

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*

### Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed  
– *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**PEARSON**

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Figure 1 shows a sketch of an asterism.

Three stars are labelled X, Y and Z.



Figure 1

(a) What is the name of this asterism?

(1)

(b) To which bright star do Y and Z point?

(1)

- A Arcturus
- B Fomalhaut
- C Polaris
- D Sirius

(c) Through a small pair of binoculars star X is actually two stars that appear very close together.

What is the name of this type of star?

(1)

- A binary star
- B double star
- C eclipsing star
- D neutron star



(d) When observed from the UK, the stars in Figure 1 never set below the horizon.

What name do astronomers use for such stars?

(1)

- A** circumpolar stars
- B** meridian stars
- C** pointer stars
- D** shooting stars

**(Total for Question 1 = 4 marks)**

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2 (a) Which planet has an orbit between those of Jupiter and Uranus?

(1)

- A Mercury
- B Mars
- C Neptune
- D Saturn

(b) Which planet contains the Great Red Spot?

(1)

- A Jupiter
- B Mars
- C Uranus
- D Venus

(c) Which of the following is equal to the mean distance between the Earth and the Sun?

(1)

- A 1 AU
- B 1 ly
- C 1 pc
- D 1 Mpc

(d) Which dwarf planet is closest to the Sun?

(1)

- A Ceres
- B Eris
- C Makemake
- D Pluto



(e) Where is the likely origin of most short-period comets?

(1)

- A** Asteroid Belt
- B** Kuiper Belt
- C** Oort Cloud
- D** Zodiacal Band

(f) In which region of the sky might an astronomer observe a planet?

(1)

- A** Asteroid Belt
- B** Milky Way
- C** Oort Cloud
- D** Zodiacal Band

**(Total for Question 2 = 6 marks)**

---



3 (a) What type of galaxy is the Milky Way? (1)

- A elliptical
- B irregular
- C lenticular
- D spiral

(b) Which of the following does **not** belong to our Local Group of galaxies? (1)

- A M31, the Andromeda Galaxy
- B The Large Magellanic Cloud
- C The Small Magellanic Cloud
- D NGC 4151, a Seyfert galaxy

(c) Which of these objects is furthest away from the Earth? (1)

- A 3C 273, a quasar
- B M31, the Andromeda Galaxy
- C The Large Magellanic Cloud
- D M15, a globular cluster

(d) What lies at the centre of an Active Galactic Nucleus (AGN)? (1)

- A a neutron star
- B a supercluster
- C a super-massive black hole
- D a globular cluster

(e) What is the name given to the observed increase in the wavelengths of light from distant galaxies? (1)

---

**(Total for Question 3 = 5 marks)**

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**Question 4 is on the next page**



P 4 3 2 9 2 A 0 7 4 0

4 (a) How long is the lunar phase cycle?

(1)

- A 27.3 days
- B 28.0 days
- C 29.5 days
- D 31.7 days

(b) In the space below, sketch a **gibbous** Moon.

(1)

(c) From which of the following locations are aurorae most likely to be observed?

(1)

- A Equator
- B South Pole
- C Tropic of Cancer
- D Tropic of Capricorn

(d) Which part of the Sun is only visible by eye during a total solar eclipse?

(1)





(e) Although the Sun is much larger than the Moon, they appear to be the same size in the sky.

In the space below, draw a labelled diagram to explain this.

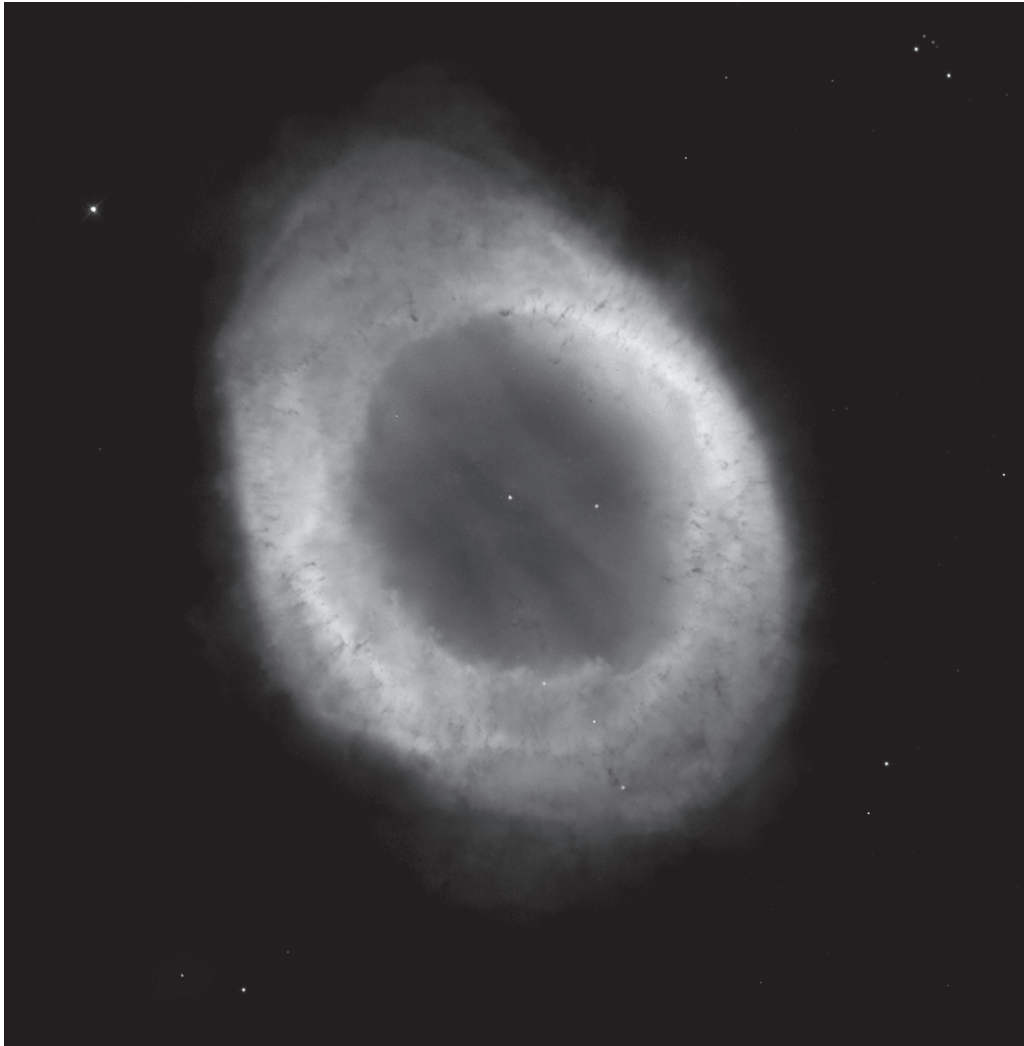
(2)

**(Total for Question 4 = 6 marks)**

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5 (a) Figure 2 shows the Ring Nebula, a planetary nebula.



(Source: NASA)

**Figure 2**

(i) Which type of star lies at the centre of a planetary nebula? (1)

.....  
(ii) What is the size of this type of star compared with the Sun? (1)

.....  
(iii) Which stage of stellar evolution is shown in Figure 2? (1)



(b) Figure 3 shows the Horsehead Nebula, an absorption nebula.



(Source: NASA)

**Figure 3**

Which stage of stellar evolution is shown in Figure 3?

(1)

(c) Which principal part of the electromagnetic spectrum do astronomers use to detect:

(i) neutron stars;

(1)

(ii) black holes?

(1)

**(Total for Question 5 = 6 marks)**



6 Figure 4 shows the Moon's near side.



(Source: NASA)

**Figure 4**

(a) What is the name of the large:

(i) dark grey areas;

(1)

(ii) light grey areas?

(1)

(b) What evidence is there that the dark grey areas are younger in age?

(1)



(c) The Moon does not possess an atmosphere.

Why is this?

(1)

---

(d) Rilles and wrinkle ridges are features on the surface of the Moon.

(i) Describe briefly the nature of rilles.

(1)

---

(ii) State **one** way in which a wrinkle ridge is different from a rille.

(1)

---

**(Total for Question 6 = 6 marks)**



7 (a) Which astronomer was the first to propose that the Sun, and not the Earth, was at the centre of the known Universe?

(1)

- A Copernicus
- B Kepler
- C Newton
- D Tycho Brahe

(b) In 1609 Galileo made some important discoveries to confirm that the Earth was **not** at the centre of the known Universe.

State **two** of these discoveries.

(2)

1 .....

2 .....

(c) Which astronomer was the first to **explain** planetary motion in terms of an inverse square law?

(1)

.....

**(Total for Question 7 = 4 marks)**



8 A group of students was planning a naked-eye observing session.

They made a list of some equipment they would need:

warm clothes

torches fitted with red filters

planispheres

(a) Why did the students plan to use red filters with their torches?

(1)

(b) State **two** key pieces of information that the students would obtain from their planispheres.

(2)

1 .....

2 .....

(c) The students also referred to the Messier Catalogue to aid their planning.

State **two** different **types** of astronomical object contained in the Messier Catalogue.

(2)

1 .....

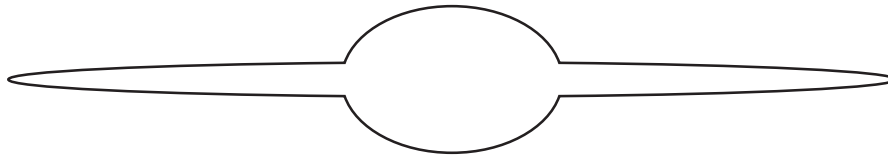
2 .....

**(Total for Question 8 = 5 marks)**



9 A student sketched a side view of the Milky Way galaxy.

This is shown in Figure 5.



**Figure 5**

(a) (i) On Figure 5, indicate the approximate location of the Sun. Use the letter **S**. (1)

(ii) On Figure 5, draw about 10 **small circles** to show the distribution of globular clusters. (1)

(b) What is the approximate diameter of the Milky Way galaxy? (1)

- A** 15 kpc
- B** 15 Mpc
- C** 30 kpc
- D** 30 Mpc





(c) Name the part of the Milky Way Galaxy where:

(i) young stars are located;

(1)

(ii) dust is found.

(1)

(d) (i) Which region of the electromagnetic spectrum do astronomers use to map the spiral arms?

(1)

- A** radio waves
- B** sound waves
- C** ultraviolet
- D** X-rays

(ii) Why is it not possible to map the spiral arms using visible light?

(1)

**(Total for Question 9 = 7 marks)**



10 (a) A student observed the Perseid meteor shower in August 2012 and drew some meteor trails on a star chart, as shown in Figure 6.

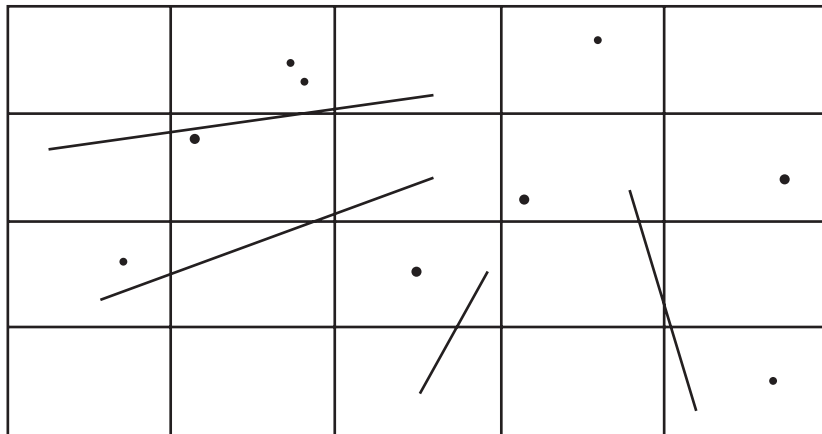


Figure 6

(i) On Figure 6, mark the position of the radiant.  
Use the letter **X**.

(1)

(ii) Why is the Perseid meteor shower so-named?

(1)

(iii) Why does this meteor shower occur every August?

(2)



(b) There have been recent concerns about Potentially Hazardous Objects (PHOs).

(i) Sketch a labelled diagram showing the orbit of a PHO. Include the Sun and Earth on your diagram.

(2)

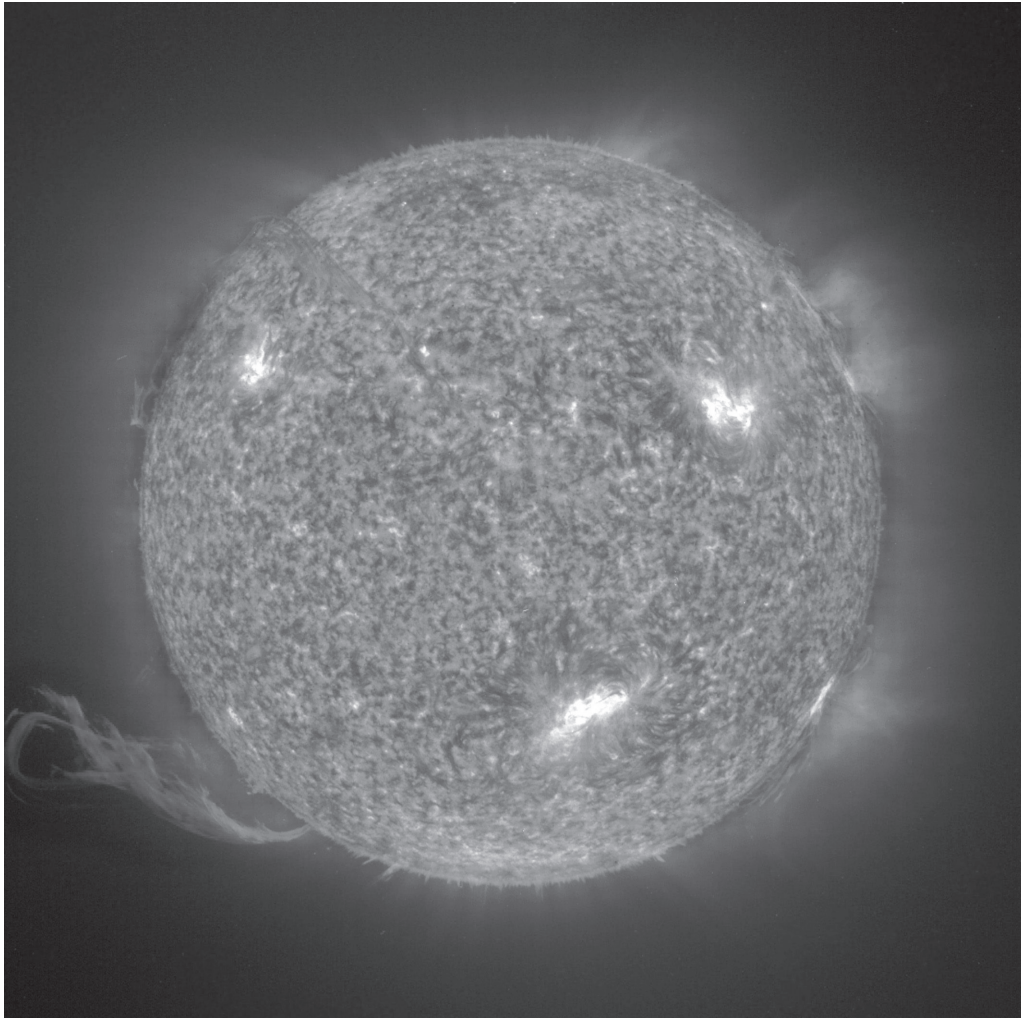
(ii) Why is it important to monitor the motion of PHOs?

(1)

**(Total for Question 10 = 7 marks)**



11 (a) Figure 7 shows an X-ray image of the Sun.



(Source: NASA)

**Figure 7**

(i) Where should X-ray telescopes be located?

(1)

(ii) On Figure 7 some white patches are visible.

What is the **significance** of these?

(1)



(b) A group of students observed the Sun with the aid of a H-alpha filter fitted to their telescope.

(i) Why does the H-alpha filter improve observations of the Sun?

(1)

(ii) Name **one** feature in the solar atmosphere that the students might observe using this filter.

(1)

**(Total for Question 11 = 4 marks)**



12 (a) Despite the recent interest in space travel, manned exploration of the Solar System has so far been restricted to the Moon.

(i) Explain why radio communication between astronauts and Earth would be a major problem on a space mission to Mars.

(2)

.....

.....

.....

(ii) Describe **two** further problems that astronauts might encounter on such a space mission.

(2)

1 .....

.....

.....

2 .....

.....

.....

(iii) Why would Venus be an unsuitable destination for manned exploration?

(1)

.....

.....

.....



\* (b) Describe some of the methods used to obtain evidence for extraterrestrial life in the Solar System.

(3)

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.....

**(Total for Question 12 = 8 marks)**



**13** Lucy carried out a simple experiment in which she noted the length of the shadow cast by a small vertical stick at different times.

Table 1 gives her results.

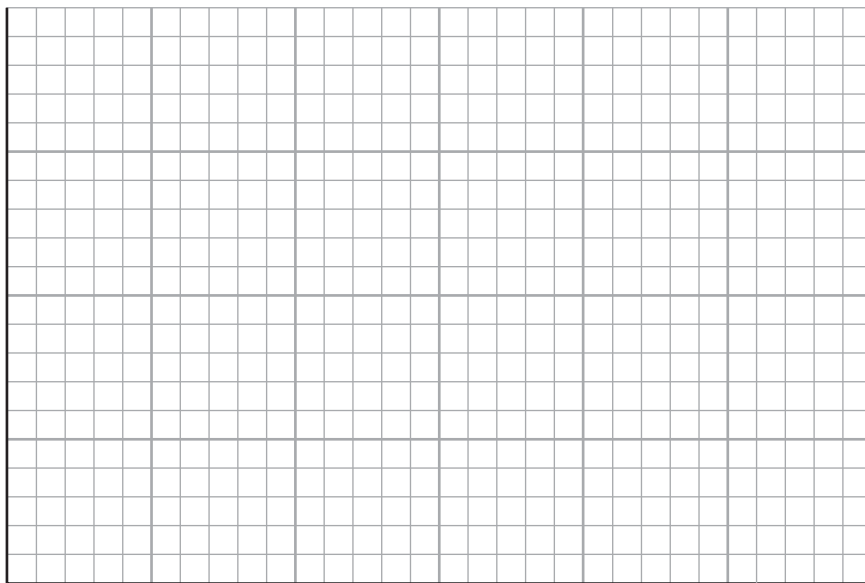
<u>time (GMT)</u>	<u>shadow length / mm</u>
11:52	110
11:56	90
12:00	80
12:04	75
12:08	80
12:12	93

**Table 1**

(a) Use Lucy's data to plot a suitable graph of shadow length against time.

Label the axes and draw a smooth line-of-best-fit through the data.

(3)



(b) Use the graph to determine the time (GMT) of local noon to the nearest minute.

Show clearly on the graph how you determined the time of local noon.

(2)

Time = .....





(c) On the date that Lucy carried out her experiment, the Equation of Time was +2 min.

Determine Lucy's longitude.

Use the formula:

$$\text{Equation of Time} = \text{Apparent Solar Time} - \text{Mean Solar Time}$$

(3)

.....

.....

.....

.....

**(Total for Question 13 = 8 marks)**



14 (a) What is the value of the mean diameter of the Earth?

(1)

- A 6500 km
- B 7500 km
- C 13 000 km
- D 15 000 km

(b) Give **two** pieces of evidence that show that the Earth is not flat.

(2)

1 .....

2 .....

(c) Describe how the circumference of the Earth was first calculated by the Greek mathematician Eratosthenes.

You may use a diagram if you wish.

(3)

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(Total for Question 14 = 6 marks)



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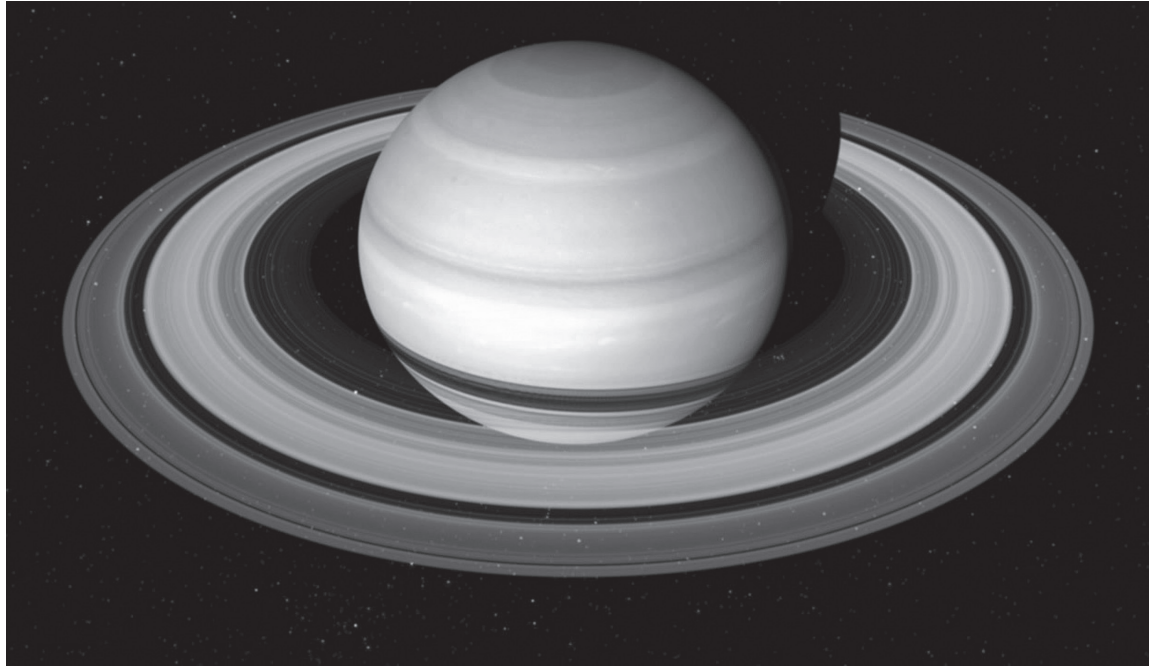
15 Most planets in our Solar System possess a system of natural satellites or moons.

(a) Name **two** planets that do **not** possess moons.

(1)

..... and .....

(b) Figure 8 shows the planet Saturn and its magnificent rings.



(Source: NASA)

**Figure 8**

Describe the physical nature and chemical composition of the rings.

(2)

Physical nature

.....  
.....

Chemical composition

.....  
.....



(c) Contrast possible origins of the moons of Mars and Neptune.

(2)

.....

.....

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.....

**(Total for Question 15 = 5 marks)**



16\*(a) Describe how the Cosmic Microwave Background (CMB) radiation was discovered.

(3)

.....

.....

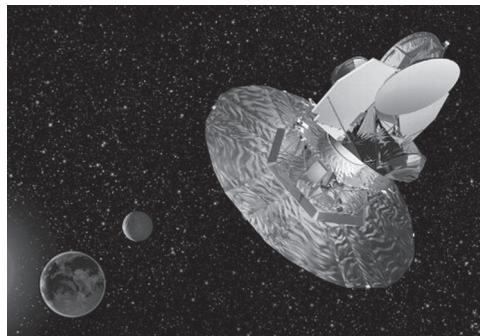
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(b) Figure 9 shows an artist's impression of the Wilkinson Microwave Anisotropy Probe (WMAP) which was launched in 2001 to study the CMB radiation.



(Source: NASA)

**Figure 9**

(i) Describe the specific purpose of WMAP.

(1)

.....

.....

(ii) Explain the significance of WMAP's observations to cosmologists.

(2)

.....

.....

.....

.....

**(Total for Question 16 = 6 marks)**



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**Question 17 is on the next page**



17 (a) Define the **parsec**.

(2)

.....

.....

.....

(b) (i) With the aid of a diagram, describe how distances to nearby stars are determined using heliocentric parallax.

(3)

.....

.....

.....

.....

.....





(ii) Why is this method only suitable for nearby stars?

(1)

.....

.....

.....

(c) Some data for a galaxy are given below:

absolute magnitude = -22.0

distance = 10 Mpc

Use this data to calculate the apparent magnitude of this galaxy.

Use the formula  $M = m + 5 - 5 \log d$

(2)

.....

.....

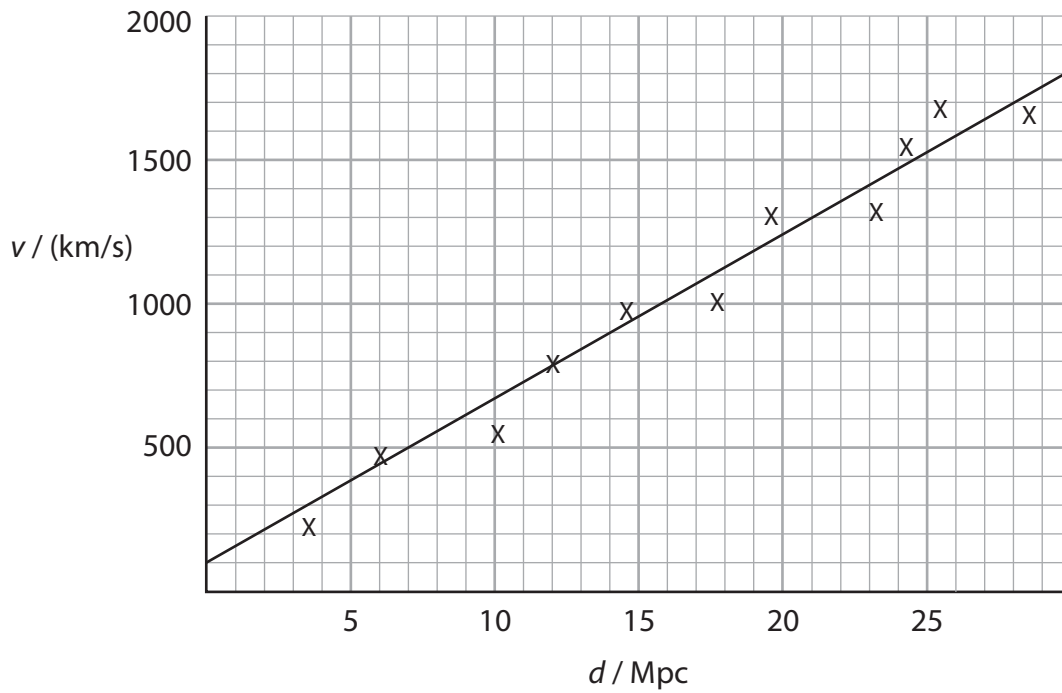
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**(Total for Question 17 = 8 marks)**



18 (a) Maxwell plotted a graph of radial velocity of some distant galaxies ( $v$ ) against their distance from Earth ( $d$ ) and drew a line-of-best-fit.

Figure 10 shows Maxwell's graph.



**Figure 10**

Use the graph to determine the Hubble Constant.

Write the value correct to **two** significant figures and give the unit.

Show clearly on the graph how you determined the Hubble Constant.

(4)

.....

.....

.....

.....

Hubble Constant = .....



(b) Which important quantity can be deduced from the Hubble Constant?

(1)

- A age of the Earth
- B age of the Solar System
- C age of the Sun
- D age of the Universe

**(Total for Question 18 = 5 marks)**

**19** (a) State **three** pieces of information that astronomers can obtain by studying the spectrum of a star.

(3)

- 1 .....
- 2 .....
- 3 .....

\*(b) Explain how astronomers use the spectrum of a star to classify its spectral type.

(3)

- .....
- .....
- .....
- .....
- .....
- .....
- .....
- .....

**(Total for Question 19 = 6 marks)**



20 Figure 11 shows a star chart with some of the stars in the constellation Pisces.

Some stars are labelled with Greek letters.

The dashed line represents the ecliptic.

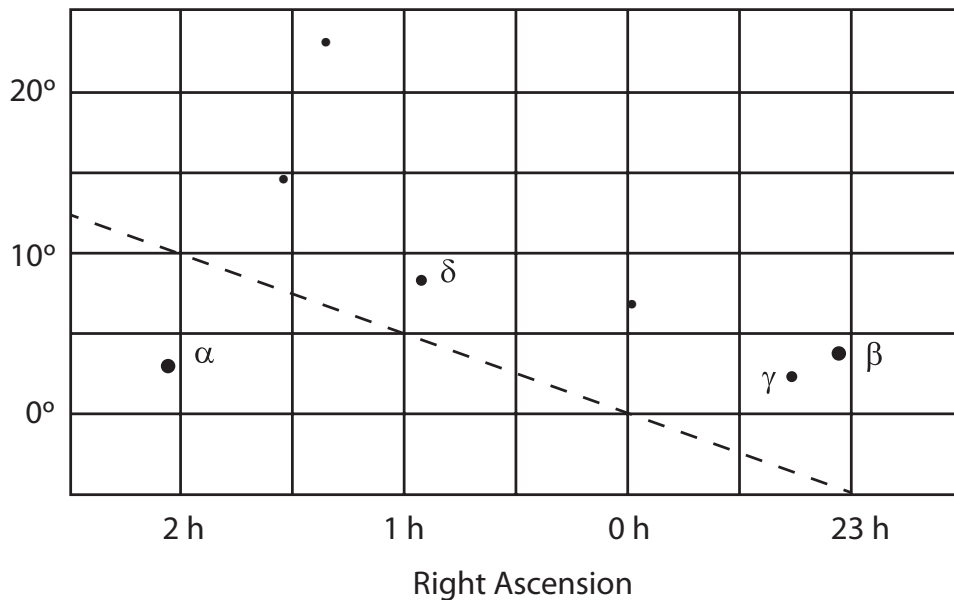


Figure 11

(a) Which quantity is represented on the vertical axis?

(1)

- A declination
- B elongation
- C elevation
- D opposition

(b) (i) What is the significance of the Greek letters  $\alpha$ ,  $\beta$  etc?

(1)

(ii) What is the significance of the ecliptic on a star chart?

(1)

(iii) Indicate on Figure 11 the position of the Sun on March 21st.

Use the letter **S**.

(1)



(c) (i) An observer at longitude  $3^{\circ}\text{E}$  observes the culmination of star  $\delta$  at 01:20 GMT.

At what time would an observer at longitude  $1^{\circ}\text{W}$  observe the culmination of  $\delta$ ?

(2)

---

(ii) Estimate the latitude, to the nearest degree, from which star  $\alpha$  could be observed at an observer's zenith.

(2)

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**(Total for Question 20 = 8 marks)**

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**TOTAL FOR PAPER = 120 MARKS**

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