Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Astronomy

Unit 1: Understanding the Universe

Wednesday 15 May 2013 – 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 with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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P 4 1 3 4 3 A 0 1 3 2

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 (a) A group of astronomy students were planning to observe some constellations and planets in the night sky from the UK.

(i) In which direction would the students expect to look in order to observe Polaris?

(1)

☒ **A** East

☒ **B** North

☒ **C** South

☒ **D** West

(ii) In which part of the sky would they expect to observe a planet?

(1)

☒ **A** Goldilocks Zone

☒ **B** Kuiper Belt

☒ **C** Oort Cloud

☒ **D** Zodiacal Band

(iii) The students used computers, the internet and mobile phone applications to assist them.
Suggest **one** non-electronic **source** of information that would help them to find out which stars or planets would be visible.

(1)

.....

(b) The students used a torch fitted with a red filter to aid their observations.
Why did this help?

(1)

☒ **A** They could observe more red giant stars.

☒ **B** They could observe more faint stars.

☒ **C** Their eyes could remain dark-adapted.

☒ **D** Their eyes could remain relaxed.

(c) Figure 1 shows a sketch of the brightest stars in a constellation that one of the students made.

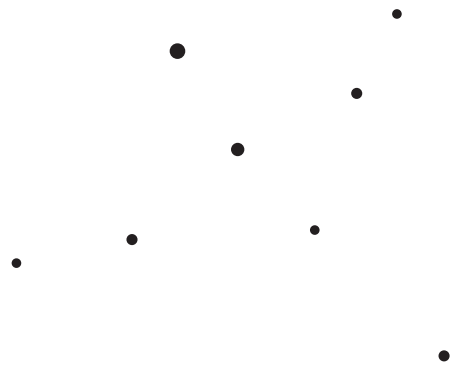

Figure 1

What is the name of the constellation shown in Figure 1?

(1)

☒ **A** Cassiopeia

☒ **B** Cygnus

☒ **C** Orion

☒ **D** Pegasus

(Total for Question 1 = 5 marks)

2 (a) In 2006, several members of the Solar System were reclassified.

(i) Which planet is furthest from the Sun?

(1)

☒ **A** Neptune

☒ **B** Pluto

☒ **C** Uranus

☒ **D** Venus

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

(1)

☒ **A** Ceres

☒ **B** Eris

☒ **C** Pluto

☒ **D** Varuna

(iii) Which planet orbits the Sun in between Mars and Saturn?

(1)

☒ **A** Earth

☒ **B** Jupiter

☒ **C** Mercury

☒ **D** Uranus

(iv) Between which two planets does Ceres orbit the Sun?

(1)

☒ **A** Mars and Jupiter

☒ **B** Jupiter and Saturn

☒ **C** Saturn and Uranus

☒ **D** Uranus and Neptune

(v) Between which two planets do most centaurs orbit the Sun?

(1)

☒ **A** Earth and Mars

☒ **B** Jupiter and Neptune

☒ **C** Mercury and Earth

☒ **D** Uranus and Neptune

(b) Which member of the Solar System was the first to be discovered:

(i) with the aid of a telescope

(1)

☒ **A** Ceres

☒ **B** Neptune

☒ **C** Pluto

☒ **D** Uranus

(ii) by using photographs?

(1)

☒ **A** Ceres

☒ **B** Neptune

☒ **C** Pluto

☒ **D** Uranus

(Total for Question 2 = 7 marks)

3 (a) Figure 2 shows parts of the constellations Pegasus and Andromeda.
Two stars, **P** and **Q**, are labelled.

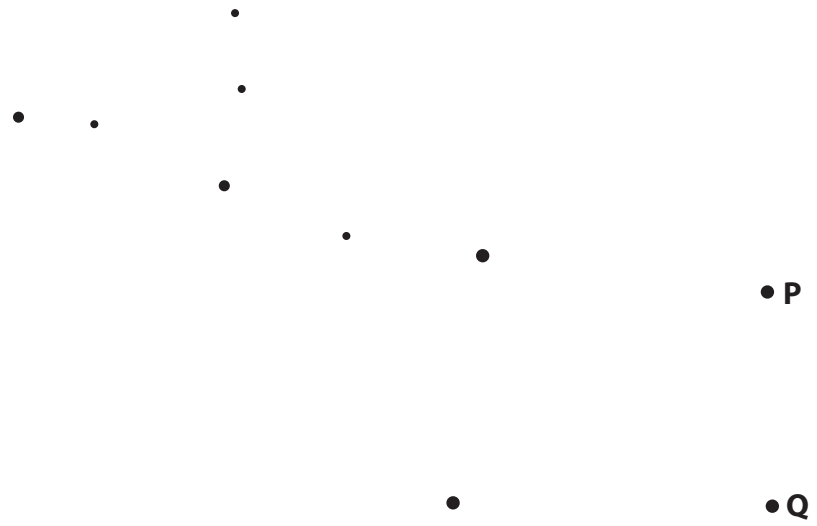

Figure 2

(i) Which bright star can be located using stars **P** and **Q**?

(1)

☒ **A** Arcturus

☒ **B** Fomalhaut

☒ **C** Polaris

☒ **D** Sirius

(ii) On Figure 2, use the letter **X** to locate the position of the Andromeda Galaxy.

(1)

(b) Stars in Orion's Belt can be used to locate Aldebaran and The Pleiades, an open cluster of stars. Figure 3 shows the star Aldebaran.

Figure 3

(i) Sketch the constellation Orion on Figure 3.

(2)

(ii) Indicate the position of The Pleiades on Figure 3 (use the letter **P**).

(1)

(c) Describe briefly the naked-eye appearance of an open cluster such as The Pleiades.

(1)

.....

.....

(Total for Question 3 = 6 marks)

4 (a) Which of the following is the longest interval of time?

(1)

☒ **A** one sidereal day

☒ **B** one solar day

☒ **C** the Moon's rotational period

☒ **D** the Moon's phase cycle

(b) How many minutes does it take for the Earth to spin on its axis through 1 degree?

(1)

.....

(c) Which of these parts of the Sun is the hottest?

(1)

☒ **A** chromosphere

☒ **B** corona

☒ **C** photosphere

☒ **D** sunspot

(d) What is the approximate temperature of the Sun's photosphere? Include the unit.

(1)

.....

(e) Which month of the year has the largest number of hours of daylight in the UK?

(1)

☒ **A** December

☒ **B** March

☒ **C** June

☒ **D** September

(f) In which month of the year do shadow sticks give the shortest shadows at noon in the UK?

(1)

.....

(Total for Question 4 = 6 marks)

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Turn over for Question 5

5 (a) Figure 4 shows a sketch of the Moon.

Figure 4

(i) What is the phase of the Moon in the sketch?

(1)

.....

(ii) Approximately how many days into the lunar cycle is this?

(1)

.....

(iii) In the space below, sketch the phase of the Moon as it would appear 7 days later.

(1)

(b) State the phase and coloured appearance of the Moon during a total lunar eclipse.

(2)

phase .....

colour .....

(c) Suggest why lunar eclipses can be observed more often than solar eclipses from a given latitude on Earth.

(1)

.....

.....

.....

(Total for Question 5 = 6 marks)

6 A class of astronomy pupils were observing the Milky Way on a clear night.

(a) Describe the naked-eye appearance of the Milky Way in the night sky.

(2)

.....

.....

(b) Sometimes the Milky Way is faint or barely visible because of light pollution.
Suggest **two** different **sources** of light pollution.

(2)

1 .....

2 .....

(Total for Question 6 = 4 marks)

7 (a) A student observed Polaris at an angle of elevation of 53° above the horizon.

(i) What was the latitude of the student?

(1)

.....

(ii) Later in the year, the student observed Polaris from a latitude of 5° further south. What was the elevation of Polaris from this new latitude?

(1)

.....

(b) With the aid of a diagram, explain how measurements using long exposure photographs of circumpolar stars can be used to determine the rotation period of the Earth.

(3)

.....

.....

.....

.....

.....

(Total for Question 7 = 5 marks)

8 *(a) One possible origin of water on Earth is from the impact of comets.

Describe how astronomers can test this experimentally.

(4)

(b) The Drake Equation is a mathematical equation that combines factors to estimate the number of planets in our Galaxy that might contain intelligent life.

State **two** factors in the Drake Equation.

(2)

1 .....

2 .....

(Total for Question 8 = 6 marks)

9 (a) Figure 5 shows a Butterfly Diagram for sunspots that were visible between the years 1910–1976.

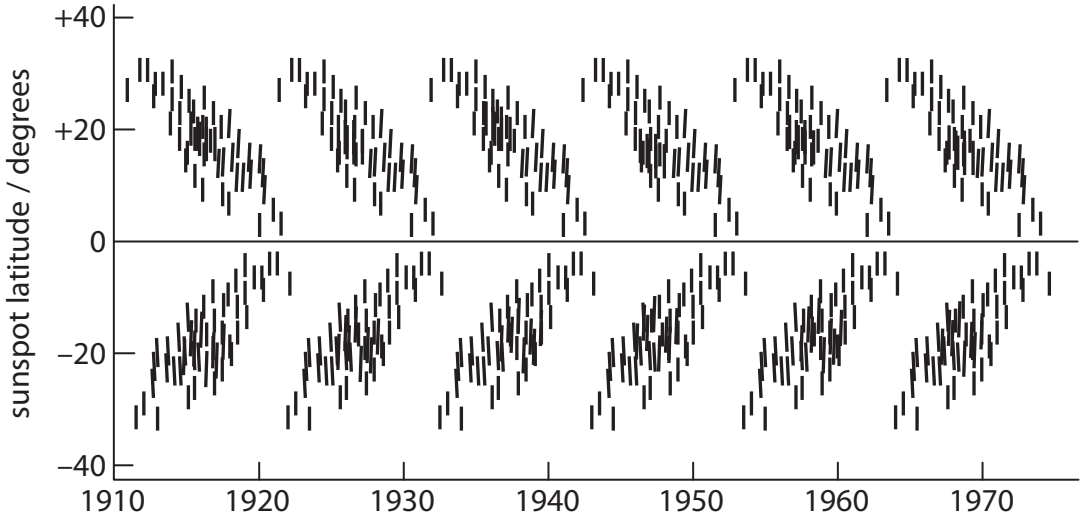

Figure 5

Use Figure 5 to estimate:

(i) the length of the solar cycle in years

(1)

.....

(ii) the next year (after 1976) in which a solar maximum occurred

(1)

.....

(iii) the approximate latitude of most sunspots at the beginning of the solar cycle.

(1)

.....

(b) The solar wind is responsible for the appearance of aurorae on Earth.

(i) Name **one** type of charged particle contained in the solar wind.

(1)

.....

(ii) Explain briefly how the solar wind causes aurorae.

(2)

.....

.....

.....

(Total for Question 9 = 6 marks)

10 Figure 6 shows the orbits of the Earth and Mars around the Sun.

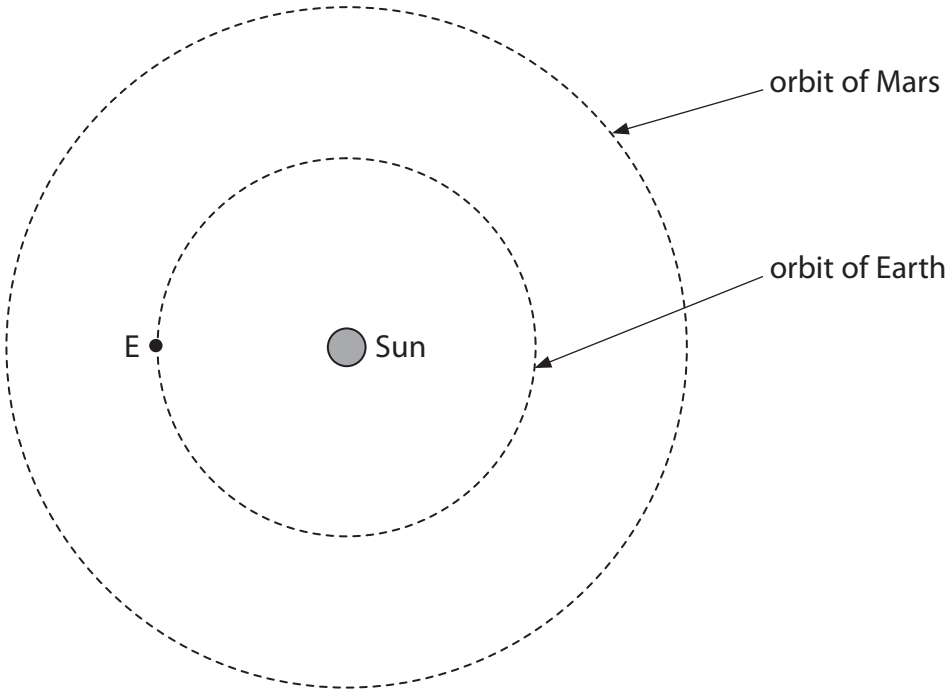

Figure 6

(a) Once a year the Earth is at position E. On Figure 6, indicate the position of Mars when it is at:

(i) conjunction (use the letter **C**)

(1)

(ii) opposition (use the letter **O**).

(1)

(b) The mean distance from Mars to the Sun is 1.5 AU.

(i) Calculate the orbital period of Mars and give the unit.

Use the equation $T^2 = r^3$

(2)

(ii) How far is Mars from the Earth when it is at opposition?

(1)

.....

(iii) Suggest **one** reason why Mars appears brightest at opposition.

(1)

.....

.....

(Total for Question 10 = 6 marks)

11 Table 1 lists the properties of 5 stars in a constellation.

star	apparent magnitude	spectral type	absolute magnitude
α	+0.2	F	+4.2
β	+0.5	G	+5.0
γ	+2.2	O	–7.8
δ	+4.2	B	–0.7
ε	+6.8	K	+6.9

Table 1

(a) How many times would star α appear brighter than γ?

(1)

.....

(b) Give the **Greek letter** of the faintest star that would be visible with the naked eye on a clear night.

(1)

.....

(c) Give the **Greek letter** of the star in the table that is:

(i) the hottest

(1)

.....

(ii) located furthest to the right on the H-R Diagram

(1)

.....

(iii) the most luminous.

(1)

.....

(Total for Question 11 = 5 marks)

12 (a) Figure 7 shows a sketch of a typical long-period comet with its nucleus labelled.

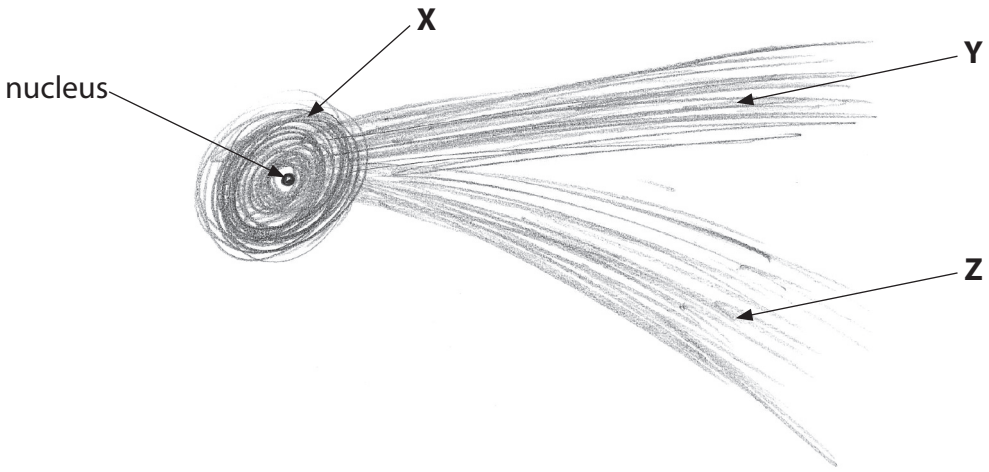

Figure 7

(i) Name the parts of the comet labelled **X**, **Y** and **Z**.

(3)

X .....

Y .....

Z .....

(ii) Where is the most likely origin of long-period comets?

(1)

.....

(iii) Why is the feature labelled **Z** slightly curved?

(1)

.....

.....

(b) The Sun's pull of gravity on a short-period comet is 16 times stronger when the comet is at perihelion compared with when the comet is at aphelion.

If the closest distance from the comet to the Sun is 1.2 AU, what is the distance from the Sun when the comet is furthest away?

(2)

.....

.....

(Total for Question 12 = 7 marks)

13 (a) Figure 8 shows *Apollo* astronauts setting up parts of the ALSEP that were used to study the lunar environment and interior.

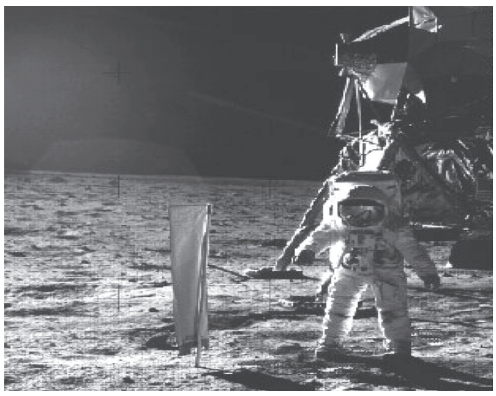

Figure 8

State the specific purposes of **two** instruments in the ALSEP.

(2)

1 .....

2 .....

(b) Figure 9 shows the near side of the Moon. The first successful landing of the *Apollo* programme was in 1969 when the lunar module of *Apollo 11* landed in the Sea of Tranquility.

Figure 9

On Figure 9, use an arrow to show the location of the Sea of Tranquility.

(1)

*(c) The Giant Impact Hypothesis can explain the origin of the Moon.
Describe briefly the Giant Impact Hypothesis.

(3)

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(Total for Question 13 = 6 marks)

14 (a) Figure 10 shows an incomplete 'Tuning Fork' diagram.

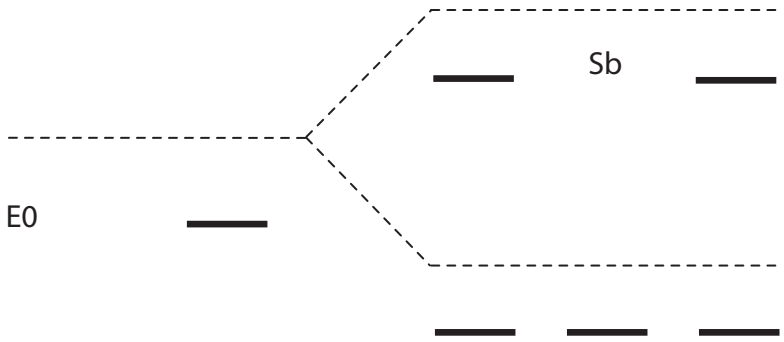

Figure 10

(i) Which astronomer was the first to classify galaxies in this way?

(1)

☒ **A** Neil Armstrong

☒ **B** Galileo Galilei

☒ **C** Edwin Hubble

☒ **D** Isaac Newton

(ii) On Figure 10, write the letters showing the type of galaxy on the six missing labels.

(3)

(iii) Which common type of galaxy is **not** shown on Figure 10?

(1)

(b) Figures 11 and 12 show two galaxies.

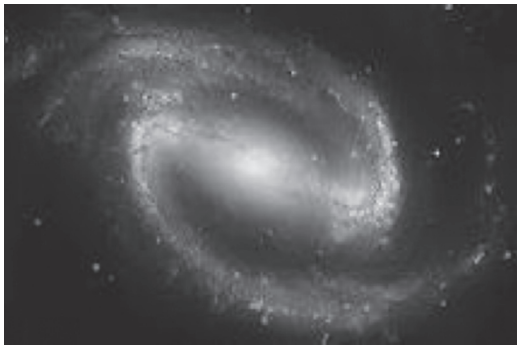

Figure 11

Figure 12

State the type of galaxy shown in:

(i) Figure 11

(1)

.....

(ii) Figure 12.

(1)

.....

(Total for Question 14 = 7 marks)

15 (a) Figure 13 shows how different wavelengths of electromagnetic radiation penetrate the atmosphere to various extents.

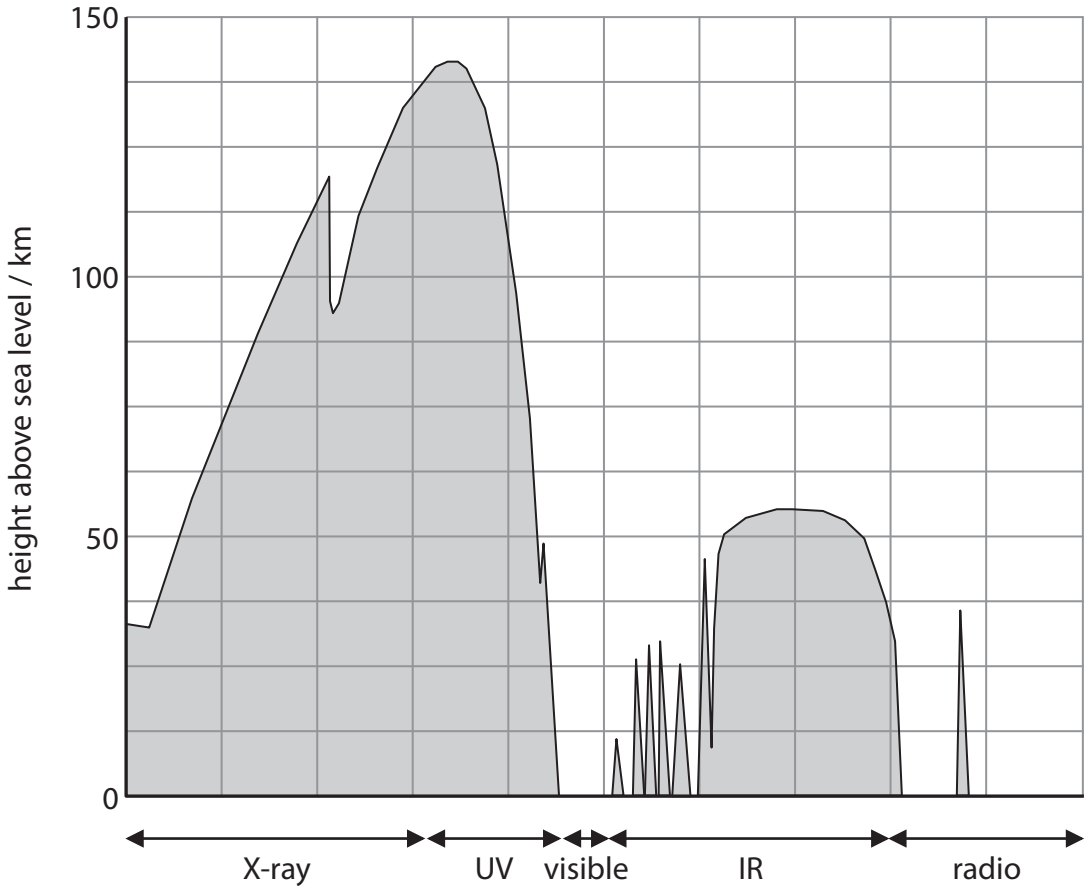

Figure 13

(i) Use Figure 13 to determine the type of radiation that is absorbed by our atmosphere **the most**.

(1)

.....

(ii) Use Figure 13 to determine **one** type of radiation that is able to penetrate to sea level.

(1)

.....

(b) Name **one** gas in the Earth's atmosphere that absorbs:

(i) ultraviolet radiation

(1)

(ii) infrared radiation.

(1)

(c) Beyond the Earth's atmosphere lie the Van Allen Belts.
Describe briefly how the Van Allen Belts were discovered.

(2)

(Total for Question 15 = 6 marks)

16 Table 2 lists the stellar coordinates of 5 stars in the constellation Leo.

star	Right Ascension	declination / °
α	10 h 08 min	+12
β	11 h 49 min	+15
γ	10 h 20 min	+20
δ	11 h 14 min	+21
ε	9 h 46 min	+24

Table 2

(a) Michelle observes the constellation Leo.
Give the **Greek letter** of the star that appears:

(i) highest in the sky

(1)

.....

(ii) furthest west.

(1)

.....

(b) Michelle records the culmination of star γ at 20:00 (on her watch).

(i) What is meant by the term **culmination**?

(1)

.....

(ii) At what time on her watch would star α culminate on the same night?

(1)

.....

(iii) At what time on her watch would star γ culminate 4 nights later?

(2)

.....

(Total for Question 16 = 6 marks)

17 (a) Name and describe **one** method used by astronomers to obtain evidence for exoplanets.

(3)

name .....

description of method .....

.....

.....

.....

(b) The Habitable Zone is a region in which the conditions on exoplanets might support life. With the aid of a diagram, show what is meant by a Habitable Zone and explain why astronomers expect the conditions could support life.

(3)

.....

.....

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.....

(Total for Question 17 = 6 marks)

18 (a) Most cosmologists agree that the Universe began in an event known as the Big Bang. Name and explain **one** piece of evidence that supports this.

(2)

name .....

explanation .....

.....

*(b) Some cosmologists have proposed different models for the past evolution of the Universe.
Name and describe **one** of these models.

(3)

name .....

description .....

.....

.....

.....

.....

(c) The terms **Dark Matter** and **Dark Energy** have been introduced by cosmologists. Describe briefly the significance of these terms in relation to the future evolution of the Universe.

(2)

Dark Matter .....

.....

.....

Dark Energy .....

.....

.....

(Total for Question 18 = 7 marks)

19 In the 1930s Edwin Hubble made observations of distant galaxies.
Using the Doppler principle, Hubble proposed the theory of an expanding Universe.

(a) Describe the Doppler principle.

(2)

.....

.....

.....

(b) An astronomer determines the wavelength of a spectral line in the spectrum of a distant galaxy to be 680 nm. The same spectral line at rest has a wavelength of 510 nm.

Use this data to determine the recession velocity of the galaxy and give the unit.
The speed of light is 300 000 km/s.

Use the formula

$$\frac{v}{c} = \frac{\lambda - \lambda_0}{\lambda_0}$$

(3)

.....

.....

.....

(c) The astronomer makes observations of another distant galaxy and calculates that its recession velocity is 150 000 km/s. If the value of the Hubble Constant is 75 km/s/Mpc, determine the distance to this galaxy and give the unit.

Use the formula

$v = H\,d$

(3)

.....

.....

.....

(Total for Question 19 = 8 marks)

20 (a) A star has an apparent magnitude of +1.8.

(i) How far away would the star be if its absolute magnitude was also +1.8? Include the unit.

(1)

.....

(ii) A second star has the same absolute magnitude but is twice as far away from us. Is the apparent magnitude of the second star smaller or larger than +1.8?

(1)

.....

(b) Two stars, α and δ, have the same absolute magnitude, but star δ is 4 times further away than α. If the apparent magnitude of α is –0.3, deduce the apparent magnitude of δ.

(3)

.....

.....

.....

(Total for Question 20 = 5 marks)

TOTAL FOR PAPER = 120 MARKS

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