Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Astronomy

Unit 1: Understanding the Universe

Monday 28 May 2012 – Afternoon
Time: 2 hours

Paper Reference
5AS01/01

You must have:
Calculator

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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PEARSON

Answer ALL questions.

Some questions must be answered with a cross in the 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) Which planet is closest to the Sun?

(1)

☒ **A** Earth

☒ **B** Mars

☒ **C** Mercury

☒ **D** Venus

(b) Which planet has the largest diameter?

(1)

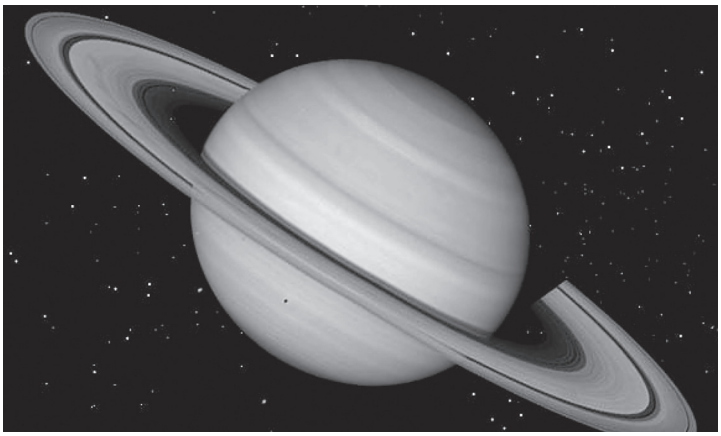
☒ **A** Jupiter

☒ **B** Mars

☒ **C** Neptune

☒ **D** Saturn

(c) Figure 1 shows a planet with a prominent ring system.



(Source: NASA)

Figure 1

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

(1)

☒ **A** Jupiter

☒ **B** Mercury

☒ **C** Saturn

☒ **D** Uranus

(d) Which dwarf planet lies between the orbits of Mars and Jupiter?

(1)

☒ **A** Ceres

☒ **B** Eris

☒ **C** Pluto

☒ **D** Varuna

(e) Which planet has two small moons that astronomers think are captured asteroids?

(1)

.....

(f) Which planet was the first to be discovered using a telescope?

(1)

.....

(Total for Question 1 = 6 marks)

2 (a) Figure 2 shows the brightest stars in a constellation.

Two stars are labelled **V** and **W**.

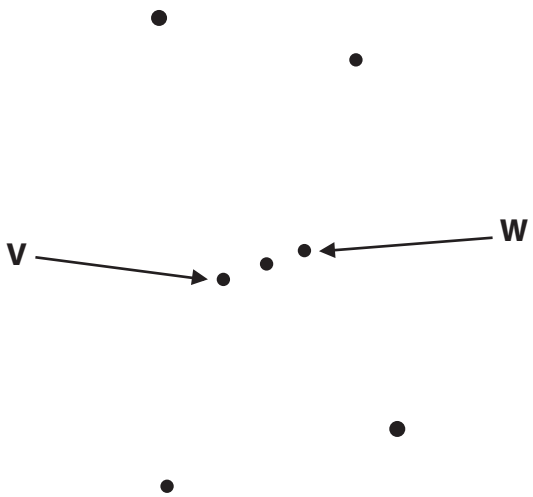


Figure 2

(i) What is the name of the constellation shown in Figure 2?

(1)

.....

(ii) What is the name of the asterism containing stars **V** and **W**?

(1)

.....

(iii) Name **one** bright star that can be found by using **V** and **W** as pointers.

(1)

.....

(b) Figure 3 shows an asterism.

Three stars are labelled **X**, **Y** and **Z**.

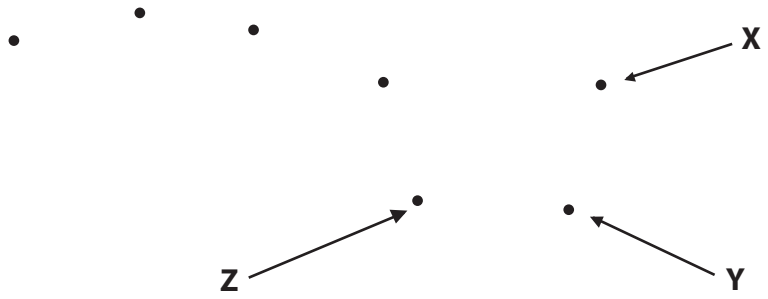


Figure 3

(i) What is the name of the asterism shown in Figure 3?

(1)

.....

(ii) Which **two** letters refer to stars that point to Polaris, the Pole Star?

(1)

..... and .....

(iii) On Figure 3, show with an arrow how stars can point to the bright star Arcturus.

(1)

(Total for Question 2 = 6 marks)

3 Figure 4 shows a galaxy.

(Source: NASA)

Figure 4

(a) What type of galaxy is shown in Figure 4?

(1)

☒ **A** Barred spiral

☒ **B** Elliptical

☒ **C** Irregular

☒ **D** Spiral

(b) What type of galaxy is the Milky Way?

(1)

☒ **A** Elliptical

☒ **B** Irregular

☒ **C** Lenticular

☒ **D** Spiral

(c) Which diagram can be used to classify galaxies?

(1)

☒ **A** Bar Chart Diagram

☒ **B** Butterfly Diagram

☒ **C** Hertzsprung – Russell Diagram

☒ **D** Tuning Fork Diagram

(d) The Andromeda Galaxy is a member of our Local Group.

When astronomers study light from this galaxy, it is blueshifted.

(i) What is meant by the 'Local Group'?

(1)

.....

.....

(ii) What does blueshifted light tell astronomers about the Andromeda Galaxy?

(1)

☒ **A** The Andromeda Galaxy is expanding

☒ **B** The Andromeda Galaxy is moving away from the Milky Way

☒ **C** The Andromeda Galaxy is moving towards the Milky Way

☒ **D** The Andromeda Galaxy will shortly explode

(Total for Question 3 = 5 marks)

4 (a) What is the approximate diameter of the Earth?

(1)

☒ **A** 3500 km

☒ **B** 5600 km

☒ **C** 13 000 km

☒ **D** 26 000 km

(b) What is the approximate distance from the Earth to the Moon?

(1)

☒ **A** 48 000 km

☒ **B** 95 000 km

☒ **C** 190 000 km

☒ **D** 380 000 km

(c) What is the approximate temperature of the Sun's photosphere?

(1)

☒ **A** 1800 K

☒ **B** 5800 K

☒ **C** 8800 K

☒ **D** 11 800 K

(d) How long does it take the Earth to spin on its axis through one degree?

(1)

☒ **A** 1 minute

☒ **B** 4 minutes

☒ **C** 15 minutes

☒ **D** 40 minutes

(e) Which line in the table gives the correct orbital period and rotational period of the Moon?

(1)

	Moon's orbital period / days	Moon's rotational period / days
☒ **A**	27.3	27.3
☒ **B**	27.3	29.5
☒ **C**	29.5	27.3
☒ **D**	29.5	29.5

(Total for Question 4 = 5 marks)

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Turn over for Question 5

5 Figure 5 shows the Moon's orbit around the Earth.

Rays of light from the Sun are shown by arrows.

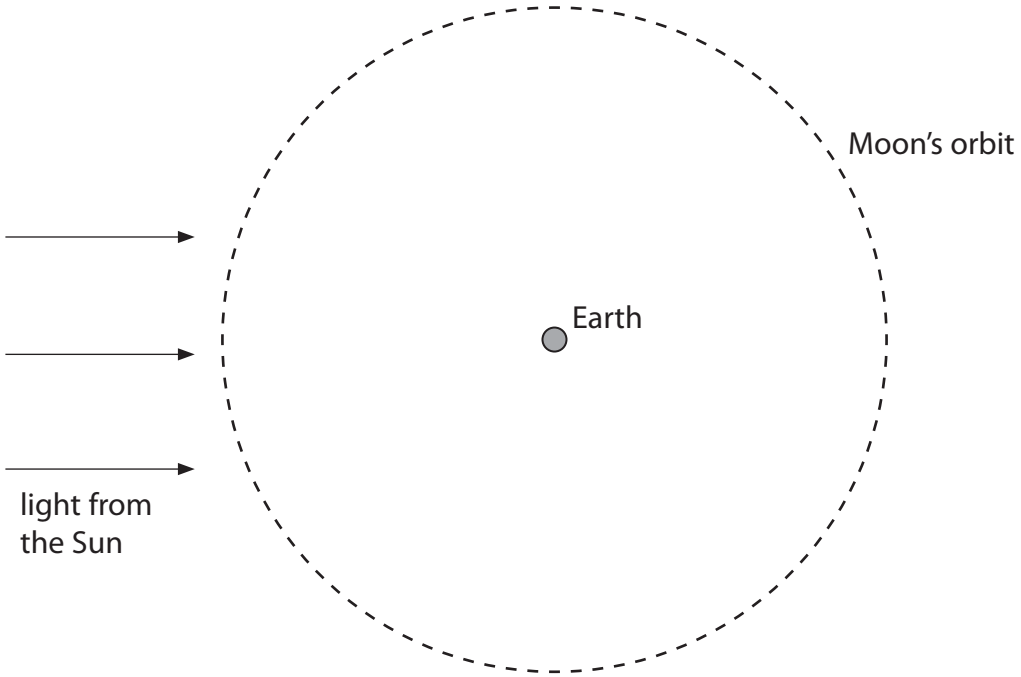

Figure 5

(a) On Figure 5, indicate the position of the Moon:

(i) during a solar eclipse.

Use the letter **S**.

(1)

(ii) at the time of a full Moon.

Use the letter **F**.

(1)

(b) In the space below, sketch the appearance of the Sun during a partial **solar** eclipse.

(1)

(c) Describe the appearance of the Moon during a total **lunar** eclipse.

(2)

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(Total for Question 5 = 5 marks)

6 Figure 6 shows an incomplete Hertzsprung – Russell Diagram.

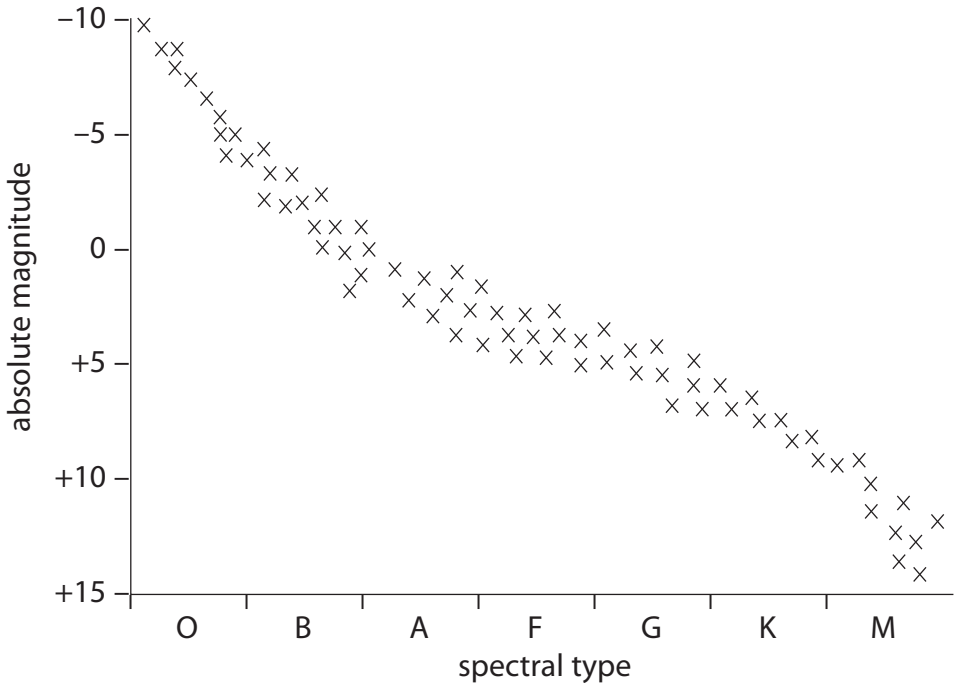


Figure 6

(a) (i) What is the name of the diagonal band running from top-left to bottom-right?

(1)

.....

(ii) One axis shows spectral type.

Which other quantity is often used on this axis?

(1)

☒ **A** Distance

☒ **B** Luminosity

☒ **C** Magnitude

☒ **D** Temperature

(b) On Figure 6, indicate the positions of:

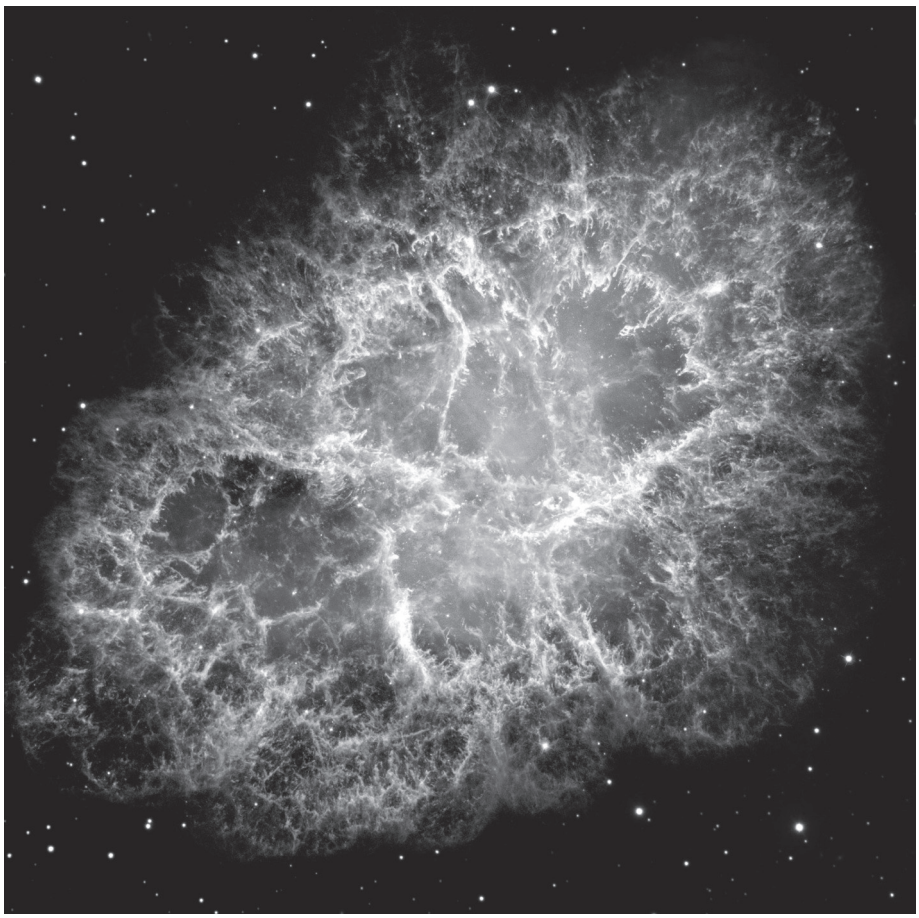
(i) a red giant star. Use the letter **R**.

(1)

(ii) a white dwarf star. Use the letter **W**.

(1)

(c) Figure 7 shows the Crab Nebula, a supernova remnant.



(Source: NASA)

Figure 7

Circle **two** types of object that might be present at the centre of a supernova remnant.

(2)

black hole **neutron star** **quasar** **red dwarf** **white dwarf**

(d) Describe briefly how astronomers observe neutron stars.

(2)

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.....

(Total for Question 6 = 8 marks)

7 (a) What is the name of a very bright meteor?

(1)

- ☒ **A** Comet
- ☒ **B** Fireball
- ☒ **C** Flare
- ☒ **D** Radiant

(b) Where is the proposed origin of most long-period comets?

(1)

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

(c) What are Potentially Hazardous Objects (PHOs)?

(1)

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.....

(d) Why are PHOs regarded as hazardous?

(1)

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.....

(e) A PHO has an elliptical orbit that takes it between 0.04 AU and 0.20 AU from the Earth.

How many times greater is the Earth's pull of gravity on the PHO when it is closest to Earth compared with when it is furthest from Earth?

(2)

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(Total for Question 7 = 6 marks)

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Turn over for Question 8

8 (a) Figure 8 shows some stars in a constellation.

The apparent magnitudes of two stars are given.

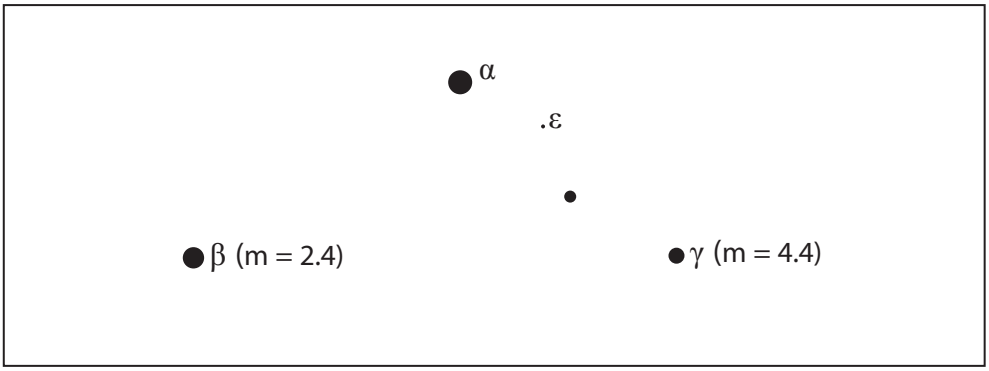

Figure 8

(i) What is the significance of the letters α, β, γ and ε?

(1)

.....

(ii) How many times brighter does β appear compared with γ?

(1)

.....

(iii) A fifth star (not labelled) appears slightly dimmer than γ.

With what Greek letter should it be labelled?

(1)

.....

(iv) The absolute magnitude of star ε is –4.5 and its distance from Earth is 1000 pc.

Calculate the apparent magnitude of ε.

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

(2)

.....

.....

.....

(b) At what distance is the apparent magnitude of a star equal to its absolute magnitude?

(1)

.....

(c) The method of heliocentric parallax can be used to determine the distance to a nearby star.

Describe this method with the aid of a diagram.

(2)

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.....

(Total for Question 8 = 8 marks)

9 Figure 9 shows the near side of the Moon.

(Source: NASA)

Figure 9

(a) What name is given to the

(i) large dark grey areas

(1)

.....

(ii) large light grey areas?

(1)

.....

(b) Which of these two areas is younger in age?

(1)

.....

(c) The far side of the Moon is not visible from Earth.

(i) How do astronomers know what the far side is like?

(2)

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.....

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.....

(ii) State **one** way in which the far side of the Moon is different from the near side.

(1)

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(d) Most astronomers believe that the Moon was formed when a large astronomical object collided with the Earth (the Giant Impact Hypothesis).

State **one** piece of evidence that allowed astronomers to develop this theory.

(1)

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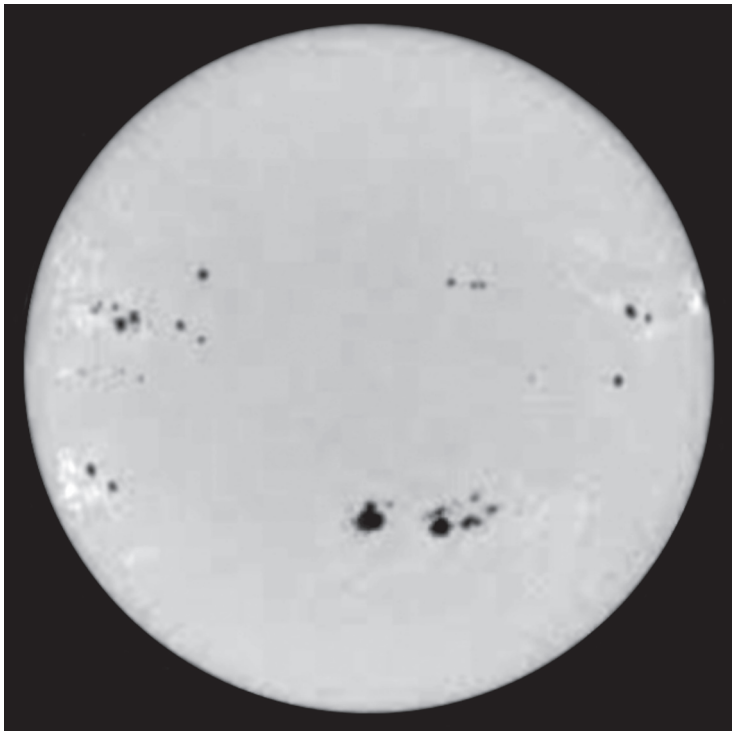
(Total for Question 9 = 7 marks)

10 Figure 10 shows a number of sunspots on the Sun's photosphere.



(S*ource: NASA)*

Figure 10

(a) In the space below, sketch and label a typical sunspot.

(2)

(b) Explain briefly how astronomers use observations of sunspots to determine the Sun's rotation.

(2)

.....

.....

.....

(c) At its equator, the Sun rotates in approximately 25 days.

How long does it take for the Sun to rotate once, close to its poles?

(1)

☒ **A** 1 day

☒ **B** 14 days

☒ **C** 25 days

☒ **D** 36 days

(Total for Question 10 = 5 marks)

11 (a) Which astronomer provided observations of planets that allowed Kepler to deduce his three laws of planetary motion?

(1)

☒ **A** Copernicus

☒ **B** Galileo Galilei

☒ **C** Edwin Hubble

☒ **D** Tycho Brahe

(b) Figure 11 shows the Sun and an elliptical orbit.

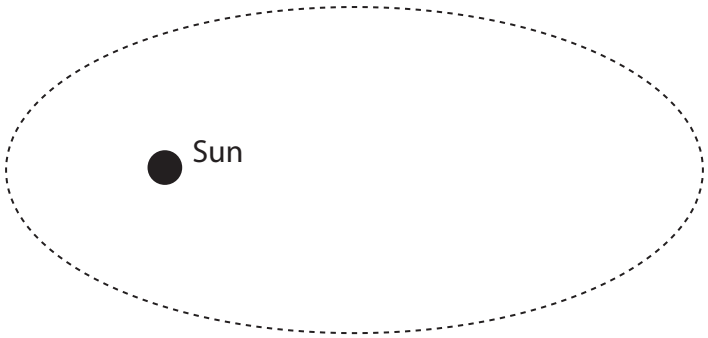


Figure 11

Complete Figure 11 to illustrate Kepler's second law of planetary motion.

(2)

(c) A planet orbits the Sun at a mean distance of 19 AU.

Calculate its orbital period and give the unit.

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

(2)

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.....

(Total for Question 11 = 5 marks)

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Turn over for Question 12

12 Figure 12 shows the Danish 1.5 m reflecting telescope at the European Southern Observatory in Chile.

(Source: ESO)

Figure 12

(a) (i) State **one** important difference between the structure of a reflecting telescope and a refracting telescope.

(1)

.....

.....

(ii) Why are the world's largest telescopes reflectors rather than refractors?

(1)

.....

.....

(b) Some astronomers use X-ray telescopes.

(i) Explain why it would not be sensible for astronomers to use an X-ray telescope at sea-level.

(1)

.....

.....

(ii) Where should an X-ray telescope be located?

(1)

.....

.....

(iii) Give an example of an astronomical object that an X-ray astronomer might observe.

(1)

.....

.....

(Total for Question 12 = 5 marks)

13 (a) State **two** key facts about quasars.

(2)

1 .....

2 .....

*(b) Describe briefly how quasars were discovered.

(4)

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(Total for Question 13 = 6 marks)

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Turn over for Question 14

14 (a) What is meant by the term 'astronomical unit'?

(2)

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(b) Figure 13 shows the orbits of the Earth and an inferior planet around the Sun.

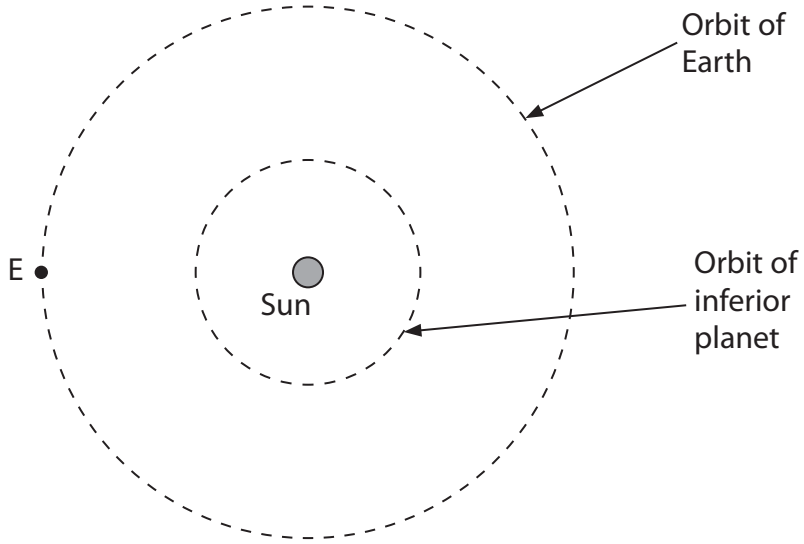

Figure 13

(i) When the Earth is at point **E**, label the position of an inferior planet when it might undergo a transit of the Sun.

Use the letter **T**.

(1)

(ii) Name the **two** planets that might undergo a transit of the Sun as seen from Earth.

(1)

..... and .....

(c) Figure 14 shows the orbit of the Earth and a superior planet around the Sun.

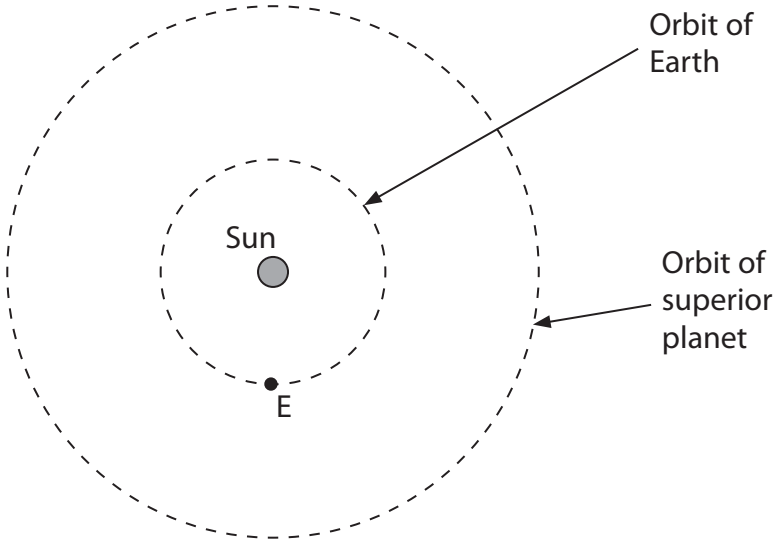

Figure 14

(i) When the Earth is at point **E**, indicate the position of the superior planet when it is at conjunction.

Use the letter **C**.

(1)

(ii) At conjunction, the superior planet is 6.2 AU from the Earth.

How far is the superior planet from the Earth when it is at opposition?

(1)

.....

(Total for Question 14 = 6 marks)

15 (a) Sketch an **edge on view** of the Milky Way galaxy.

(2)

(b) On your sketch, indicate the location of:

(i) a site of stellar formation. Use the letter **S**.

(1)

(ii) a typical globular cluster. Use the letter **G**.

(1)

(c) The diameter of the Milky Way is 30 kpc.

How far is the Sun from the galactic centre?

(1)

☒ **A** 5 kpc

☒ **B** 10 kpc

☒ **C** 15 kpc

☒ **D** 20 kpc

*(d) Astronomers use radio waves with a wavelength of 21 cm rather than visible light to study how our Galaxy rotates.

Explain the reason for this.

(2)

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.....

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.....

(Total for Question 15 = 7 marks)

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Turn over for Question 16

16 (a) A student observes the main stars in the constellation Cassiopeia from a latitude of 58°N.

(i) Sketch the constellation Cassiopeia.

(1)

(ii) From the student's latitude, all the stars in Cassiopeia are circumpolar.

Explain the term 'circumpolar'.

(1)

.....

.....

(iii) What is the smallest declination of a star that will be circumpolar from the student's latitude?

(1)

☒ **A** +32°

☒ **B** +42°

☒ **C** +48°

☒ **D** +58°

(b) A student uses a planisphere and the Messier Catalogue to plan some observations of the northern sky.

What information will the student obtain from

(i) the planisphere

(2)

(ii) the Messier Catalogue?

(2)

(Total for Question 16 = 7 marks)

17 (a) Cosmic Microwave Background (CMB) radiation was discovered in 1965 by Arno Penzias and Robert Wilson.

Describe briefly how CMB radiation was discovered.

(2)

(b) What is the cosmological significance of CMB radiation?

(1)

(c) Recent observations by instruments on spacecraft such as COBE and WMAP have discovered small fluctuations, or 'ripples', in the CMB.

What is the significance of these fluctuations?

(2)

(Total for Question 17 = 5 marks)

18 (a) Describe briefly an astronomical theory which could explain the origin of water on Earth.

(2)

(b) With the aid of a diagram, explain what is meant by a Goldilocks Zone.

(3)

(Total for Question 18 = 5 marks)

19 Yoshimi and Robert observe the sky from two different locations in the northern hemisphere.

Yoshimi's longitude is 6°W and Robert's is 18° further east.

(a) What is Robert's longitude?

(1)

.....

(b) Yoshimi sees the culmination of the star Rigel at 17:30 GMT.

When this occurs, Rigel is 28° above the southern horizon.

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

(1)

.....

(ii) At what time (GMT) does Robert observe the culmination of Rigel?

(2)

.....

(iii) Robert's latitude is 10° further south than Yoshimi's.

How far above the horizon is Rigel when Robert sees it culminate?

(1)

.....

(c) Yoshimi faces north and observes the star Polaris.

Her latitude is 55°N.

(i) State the declination of Polaris.

(1)

.....

(ii) At what angle above the northern horizon will Yoshimi observe Polaris?

(1)

.....

(Total for Question 19 = 7 marks)

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Turn over for Question 20

20 (a) An astronomer obtained some values for the radial velocity (v) of some distant galaxies and their distance (d) from us.

Figure 15 shows a graph of the astronomer's results.

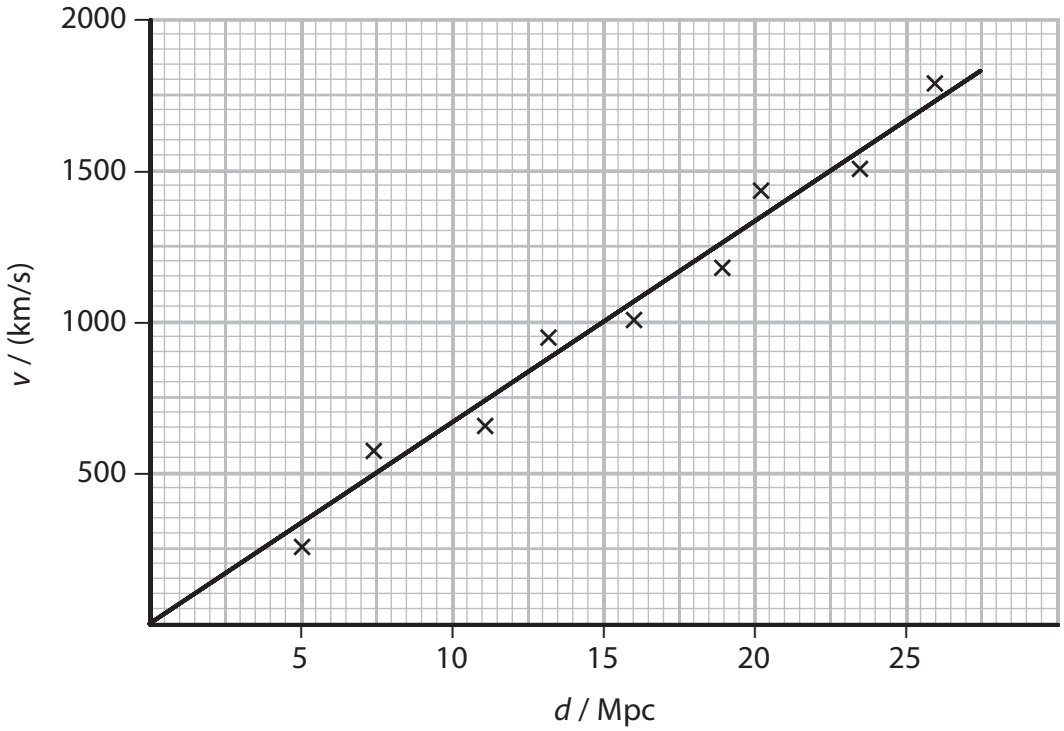

Figure 15

(i) How can the Hubble constant be determined from the graph?

(1)

.....

.....

(ii) Use the graph to calculate the value of the Hubble constant.

Include the unit.

(3)

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.....

(b) Explain how the value of the Hubble constant can be used to estimate the age of the Universe in years.

(2)

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.....

(Total for Question 20 = 6 marks)

TOTAL FOR PAPER = 120 MARKS

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