

Write your name here

Surname

Other names

Pearson
Edexcel GCSE

Centre Number

--	--	--	--	--	--

Candidate Number

--	--	--	--	--	--

Astronomy

Unit 1: Understanding the Universe

Wednesday 7 June 2017 – Morning
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 ►

P48508A

©2017 Pearson Education Ltd.

1/1/1/1/1/1



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) Which of these planets is the largest? (1)

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

(b) A lunar eclipse can occur at which of these phases? (1)

- A First Quarter
- B Full
- C Last Quarter
- D New

(c) The point in the Earth's orbit where it passes closest to the Sun is called: (1)

- A Aphelion
- B Elongation
- C Equinox
- D Perihelion

(d) Which of these planets **cannot** be seen with the naked eye? (1)

- A Jupiter
- B Neptune
- C Saturn
- D Venus

(Total for Question 1 = 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



- 2 (a) Which of these is a dwarf planet? (1)
- A Callisto
 - B Ceres
 - C Moon
 - D Triton
- (b) The Large Magellanic Cloud is an example of a: (1)
- A Cluster
 - B Galaxy
 - C Nebula
 - D Nova
- (c) The average distance between the Earth and the Moon is: (1)
- A 3500 km
 - B 13 000 km
 - C 380 000 km
 - D 150 000 000 km
- (d) The average diameter of the Earth is: (1)
- A 3500 km
 - B 13 000 km
 - C 380 000 km
 - D 150 000 000 km
- (e) Which of these planets does **not** have a satellite system? (1)
- A Earth
 - B Jupiter
 - C Neptune
 - D Venus



(f) Which part of the Sun has the **highest** temperature?

(1)

- A** Chromosphere
- B** Corona
- C** Photosphere
- D** Sunspot

(g) Which type of telescope is **only** found on satellites orbiting the Earth?

(1)

- A** infra-red
- B** radio
- C** visible light
- D** X-ray

(Total for Question 2 = 7 marks)



3 Figure 1 shows an image of Pluto taken by the New Horizons space probe in 2015.

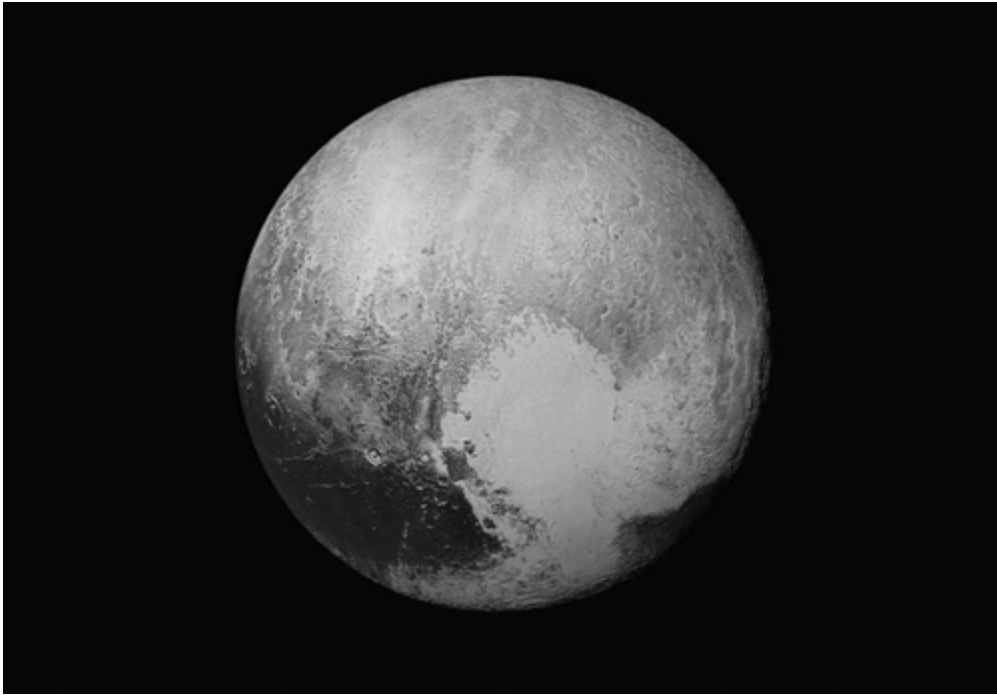


Figure 1

(Source: © NASA)

(a) (i) Which of these planets comes closest to Pluto?

(1)

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

(ii) Pluto was discovered by:

(1)

- A Galileo Galilei
- B William Herschel
- C Isaac Newton
- D Clyde Tombaugh

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Pluto has a much larger orbit and takes longer to orbit the Sun than the Earth.

State **two other** differences between the orbital paths of Pluto and the Earth.

(2)

1

2

(c) In 2006, Pluto was reclassified as a dwarf planet.

State **one** reason for this change.

(1)

.....

.....

(Total for Question 3 = 5 marks)



4 Around 200 BCE, the Greek astronomer Eratosthenes heard that the Sun was directly overhead at midday on June 21st in the southern Egyptian city of Syene.

Observing the Sun on June 21st in Alexandria, in the north of Egypt, he found that it was **not** directly overhead at midday.

He used these observations to prove that the Earth was a sphere.

(a) Explain, using a carefully-labelled diagram, how these observations prove that the Earth cannot be flat.

(3)

.....

.....

.....

.....

.....

(b) Eratosthenes went on to use his observations to make an estimate for the size of the Earth.

What **two** measurements would Eratosthenes need to take to calculate the circumference of the Earth?

(2)

1

2



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) In Eratosthenes' time there were other observations that showed the Earth is a sphere.

State **one** of these observations.

(1)

.....

.....

(Total for Question 4 = 6 marks)



5 Figure 2 shows part of the constellation of Pegasus.

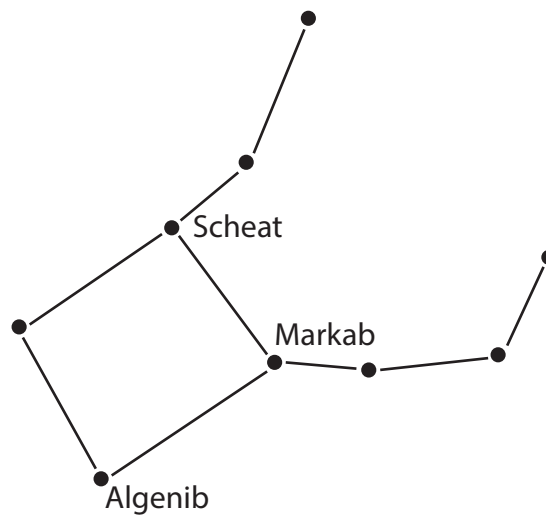


Figure 2

- (a) (i) Draw an arrow on Figure 2 to show how this constellation may be used to find the star Fomalhaut. (1)
- (ii) Show the approximate position of the Andromeda Galaxy (M31) on Figure 2. Use the letter **X**. (1)



- (b) This group of stars has only been referred to as Pegasus since the time of the Ancient Greeks.

Explain why the name 'Pegasus' was not used before that time.

(1)

- (c) The Andromeda Galaxy is listed in the Messier Catalogue as M31.

Why did Charles Messier include the Andromeda Galaxy in his catalogue?

(1)

- (d) The star Markab has an apparent magnitude of 2.5 and an absolute magnitude of -0.7 .

(i) This means that the star's distance from Earth must be:

(1)

- A exactly 10 pc
- B greater than 10 pc
- C less than 10 pc
- D not possible to calculate from these data

(ii) Explain your choice.

(1)

(Total for Question 5 = 6 marks)



- 6 (a) Venus has the highest surface temperature of all the planets in the Solar System because: (1)
- A it is closest to the Sun
 - B it is the largest inferior planet
 - C its clouds reflect a very high proportion of the Sun's light
 - D its atmosphere is almost entirely carbon dioxide
- (b) Which **one** of these statements about the lunar phase cycle is correct? (1)
- A it takes the same time as the Moon's orbital period
 - B it takes one year
 - C it is 2.2 days longer than the Moon's orbital period
 - D it is 2.2 days shorter than the Moon's orbital period
- (c) The most southerly latitude where the Sun is above the horizon for 24 hours on 21st June is called the: (1)
- A Antarctic Circle
 - B Arctic Circle
 - C Tropic of Cancer
 - D Tropic of Capricorn
- (d) Light from a distant galaxy that is moving away from the Earth will appear to have a: (1)
- A greater brightness
 - B higher frequency
 - C higher speed
 - D longer wavelength



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(e) A planet is said to have reached **opposition** for an observer on Earth when:

(1)

- A** it appears to cross the face of the Sun
- B** it is directly opposite the Sun in the sky
- C** it is directly behind the Sun in the sky
- D** it is directly in line with another planet in the sky

(Total for Question 6 = 5 marks)



P 4 8 5 0 8 A 0 1 3 4 4

7 Sarah made the drawing of a gibbous Moon shown in Figure 3.

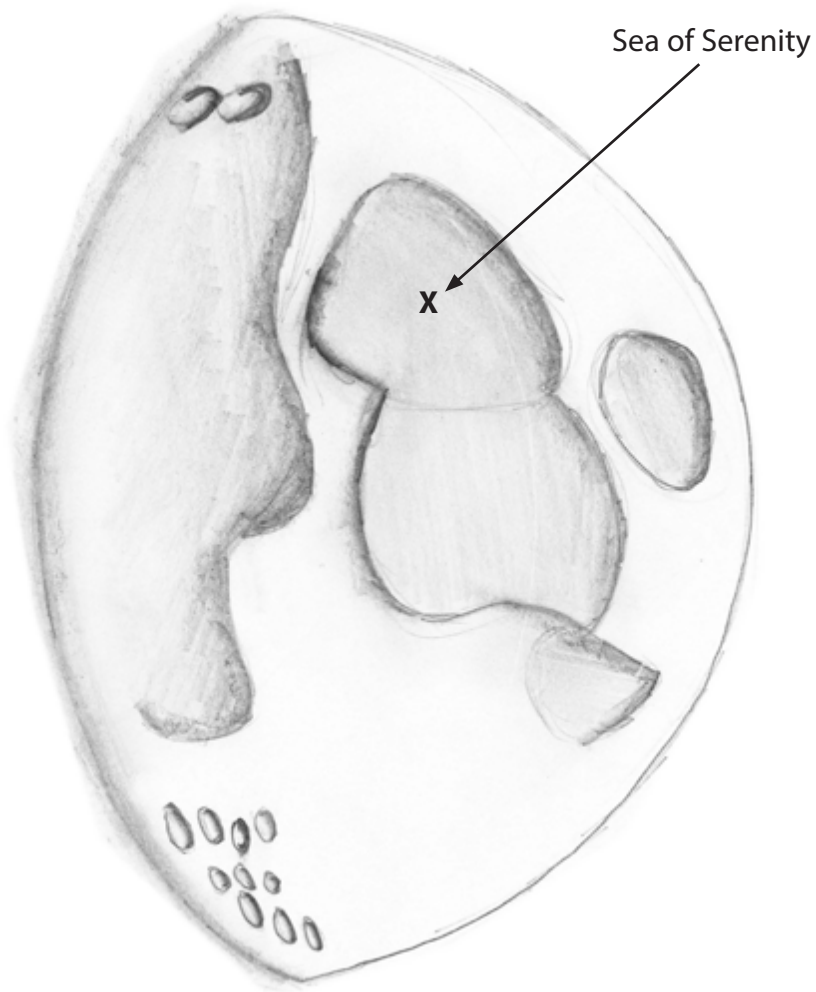


Figure 3

(a) Label on Figure 3 the position of **three** named lunar features.

The position of the Sea of Serenity has been labelled for you.

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) A few weeks later, Sarah made another drawing of the Moon, shown in Figure 4.



Figure 4

When drawing this sketch, Sarah found it much easier to draw details of the craters.

Explain why the craters were easier to draw on this occasion.

(2)

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(c) Even though Sarah waited for over one month, she was only able to draw half of the Moon's surface.

Explain why we can only ever see about half of the Moon's surface from Earth.

You may use a carefully-labelled diagram to support your answer.

(2)

.....

.....

.....

.....

.....

(Total for Question 7 = 7 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



P 4 8 5 0 8 A 0 1 7 4 4

8 Figure 5 shows part of a star map from the area around the constellations Ursa Major and Ursa Minor.

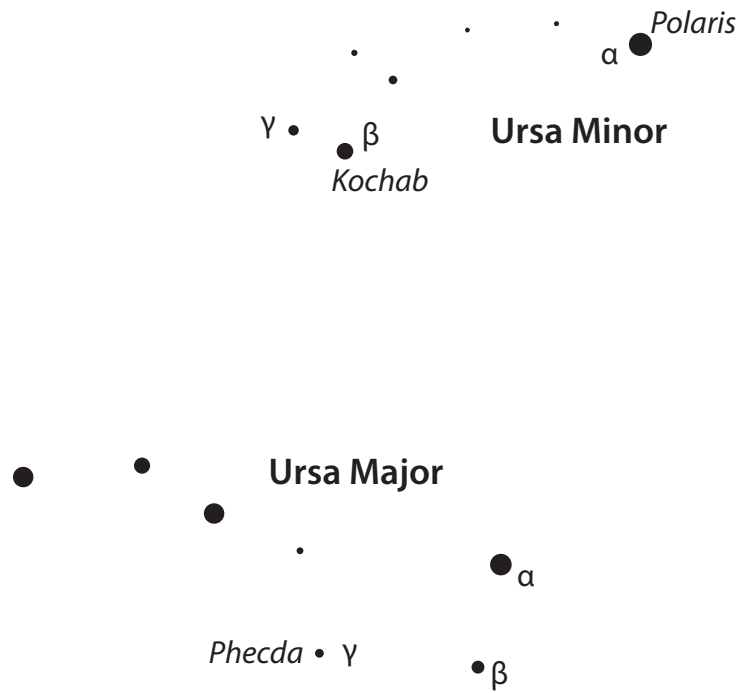


Figure 5

(a) What is the significance of the Greek letters (α , β , γ) next to the stars in Figure 5? (1)

(b) Name a well-known asterism that can be seen in Figure 5. (1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



- (c) Two of the brightest stars in Figure 5 are Phecda (γ in Ursa Major) and Kochab (β in Ursa Minor). Their coordinates are shown in Table 1.

	Right ascension (h : min)	Declination ($^{\circ}$)
Phecda	15h 20min	72 $^{\circ}$
Kochab	14h 50min	74 $^{\circ}$

Table 1

The Ancient Egyptians referred to these two stars as the 'Eternal' or 'Immortal' ones.

Egypt has a latitude of around 30 $^{\circ}$ N.

Explain, using **astronomical** information from Table 1, why they gave them this name.

(3)

.....

.....

.....

.....

.....

.....

.....

(Total for Question 8 = 5 marks)



- *9 Figure 6 shows the meteor that was seen from the Russian city of Chelyabinsk in February 2013.



Figure 6

(Source: © Marat Ahmetvaleev)

This is an eyewitness account of the event.

‘Shortly after sunrise this morning a burning hot meteor from **beyond our Solar System** crashed into the Earth’s atmosphere above the city of Chelyabinsk. **This meteor shone even more brightly than the Sun.** Many people on their way to work saw the blinding light and felt the incredible heat of this **shooting star.** Scientists are now searching the area to **collect meteors that may have landed** near the city, for further study.’

In this account, four phrases have been highlighted in **bold**. These phrases can be improved.

Explain, using astronomical terminology, how these phrases can be improved.

(5)

‘beyond our Solar System’

.....

.....

‘This meteor shone even more brightly than the Sun.’

.....

.....



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

'shooting star'

'collect meteors that may have landed'

(Total for Question 9 = 5 marks)



P 4 8 5 0 8 A 0 2 1 4 4

- 10 Figure 7 shows patches of brightly-coloured lights in the night sky over Iceland (Latitude = 65°N).



Figure 7

(Source: © Vincent Brady)

- (a) State the full astronomical name for this phenomenon. (2)

- (b) Explain how these patches of coloured light are created.

Draw a labelled diagram to support your answer. (3)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) Explain why the images of stars in Figure 7 are slightly curved lines, rather than dots.

(2)

.....

.....

.....

.....

(Total for Question 10 = 7 marks)



P 4 8 5 0 8 A 0 2 3 4 4

11 Figure 8 shows the globular cluster 47 Tucanae.



Figure 8

(Source: © NASA)

(a) (i) Where are globular clusters located in relation to the Milky Way?

Use a sketch of the Milky Way galaxy in your answer.

(2)

(ii) State **one** way in which a star in a globular cluster differs from a star in the Milky Way, apart from its location.

(1)



(b) Table 2 shows some astronomical data about 47 Tucanae.

Apparent magnitude:	4.9
Right ascension:	0h 24min
Declination:	-72°
Angular diameter:	0.5°

Table 2

Owen is observing from Costa Rica (Latitude = 10°N) using a small pair of binoculars. He is planning to make some detailed drawings of 47 Tucanae.

Identify **two** difficulties that Owen will encounter when making these observations and suggest a solution for each one.

(4)

Difficulty:

.....

.....

Solution:

.....

.....

Difficulty:

.....

.....

Solution:

.....

.....

(Total for Question 11 = 7 marks)



12 (a) (i) A star has a heliocentric parallax angle of one tenth of a second of arc ($0.1''$). This means its distance from Earth is: (1)

- A 0.1 parsec
- B 1 parsec
- C 10 parsecs
- D 100 parsecs

(ii) Star X is three magnitudes dimmer than Star Y. This means that the two stars differ in brightness by: (1)

- A 3 times
- B 4 times
- C 9 times
- D 16 times

(iii) The asteroid Vesta orbits the Sun at an average distance of 2.4 AU. According to the equation

$$T^2 = r^3$$

it will orbit the Sun once every: (1)

- A 1.8 years
- B 3.7 years
- C 5.8 years
- D 13.8 years

(b) (i) When observing from a latitude of 50°N on the Earth, the Pole Star will appear to have an altitude of: (1)

- A 0°
- B 40°
- C 50°
- D 90°



(ii) When observing from a latitude of 50°N on the Earth, the Celestial Equator will have a maximum altitude of:

(1)

- A 0°
- B 40°
- C 50°
- D 90°

(Total for Question 12 = 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



P 4 8 5 0 8 A 0 2 7 4 4

13 Figure 9 shows the planet Mars.

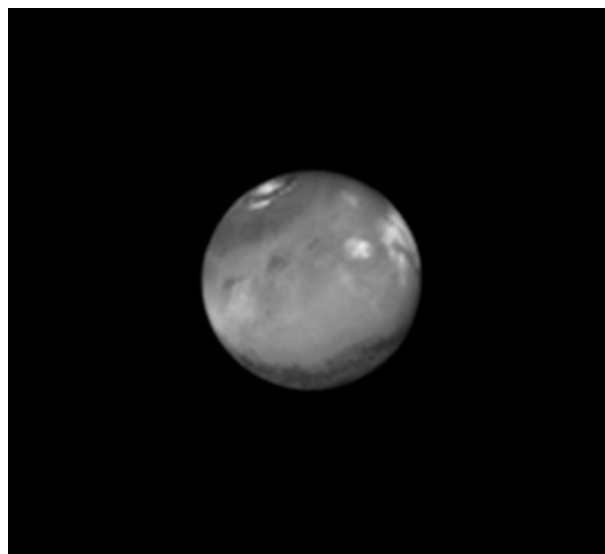


Figure 9

(Source: © NASA)

The planet Mars has two moons orbiting it – Phobos and Deimos. Although Mars can be seen with the naked eye from Earth, Phobos and Deimos were not discovered until 1877, using a large telescope.

(a) Explain why these two moons are so much harder to see than the planet Mars itself. (2)

.....

.....

.....

.....

(b) Describe the most likely origin of these two moons. (2)

.....

.....

.....

.....



(c) Table 3 contains some information about these two moons and their orbits.

	Average distance from Mars (km)	Orbital period (hours)	Diameter of moon (km)
Phobos	9377	7.7	22.2
Deimos	23 460	30.4	12.6

Table 3

The planet Mars rotates on its axis once every 24.7 days.

Describe how the two moons would **appear to move** for an observer standing on the surface of Mars.

Use data from Table 3 to explain your answer.

(4)

(Total for Question 13 = 8 marks)



*14 Table 4 shows some information about the planet Venus.

average distance from the Sun	0.7AU
orbital period	225 days
rotation period	243 days
diameter (Earth = 1)	0.95
gravity at surface (Earth = 1)	0.91
surface temperature (average)	465°C
atmospheric pressure (Earth = 1)	90
atmosphere	96% carbon dioxide 3% nitrogen

Table 4

A group of astronomers wish to take some detailed measurements of surface conditions on Venus and are planning to send a manned mission to the planet.

Discuss some of the difficulties in sending a mission of this kind along with its advantages over sending a robotic probe.

Your answer should include information from Table 4.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 14 = 6 marks)



P 4 8 5 0 8 A 0 3 1 4 4

15 Figure 10 shows an image of the Sun.

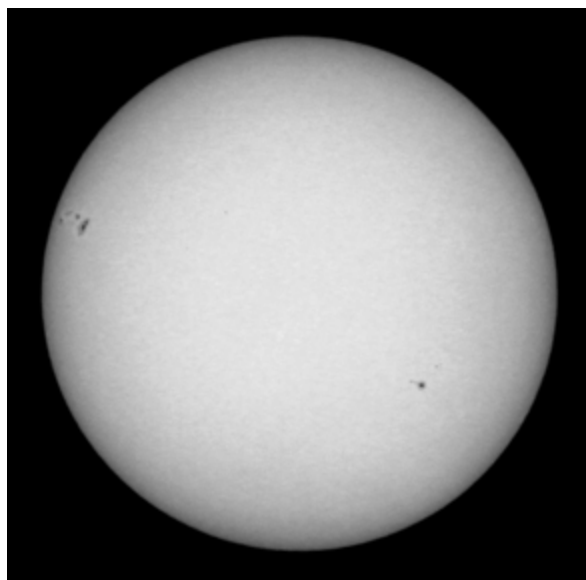


Figure 10

(Source: © NASA)

(a) Explain how large numbers of helium nuclei are produced every second in the Sun. (3)

.....

.....

.....

.....

.....

.....

(b) The Sun is known as a Main Sequence star.
Describe the stages of evolution it will pass through once it stops being a Main Sequence star. (2)

.....

.....

.....

.....

(Total for Question 15 = 5 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



P 4 8 5 0 8 A 0 3 3 4 4

16 Figure 11 shows the Moon.



Figure 11

(Source: © NASA)

*(a) Explain the Giant Impact Hypothesis for the formation of the Moon.
You may use a clearly-labelled diagram as part of your explanation.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) Observation of the Earth and Moon system has produced evidence to suggest that the Giant Impact Hypothesis is correct.

Describe in detail **two** of these pieces of evidence.

(4)

1

.....

.....

.....

2

.....

.....

.....

(Total for Question 16 = 8 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



17 Figure 12 shows a series of radio wave pulses from an object discovered by radio astronomers in the 1960s.

At the time these objects were referred to as 'pulsars'.

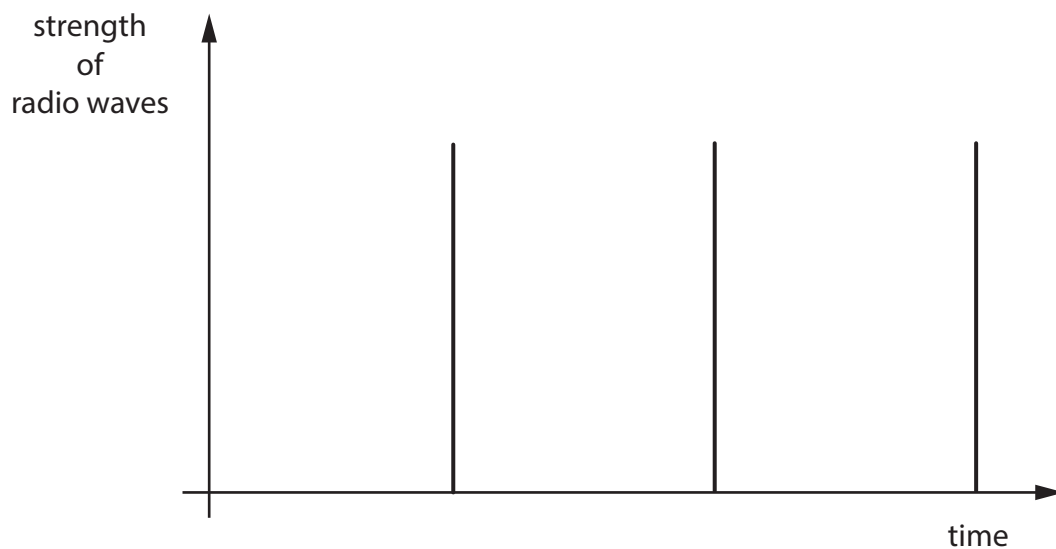


Figure 12

(a) These radio waves are now known to come from a neutron star.

Explain why the radio waves from a neutron star appear as pulses when received on Earth. You may use a clearly-labelled diagram to support your answer.

(3)

.....

.....

.....

.....



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) When these signals were detected, they were first thought to be produced by intelligent life forms.

Explain why astronomers made this suggestion with reference to Figure 12.

(2)

.....

.....

.....

.....

(Total for Question 17 = 5 marks)



P 4 8 5 0 8 A 0 3 7 4 4

- 18 Figure 13 shows how the apparent magnitude of a Cepheid variable star varies with time.

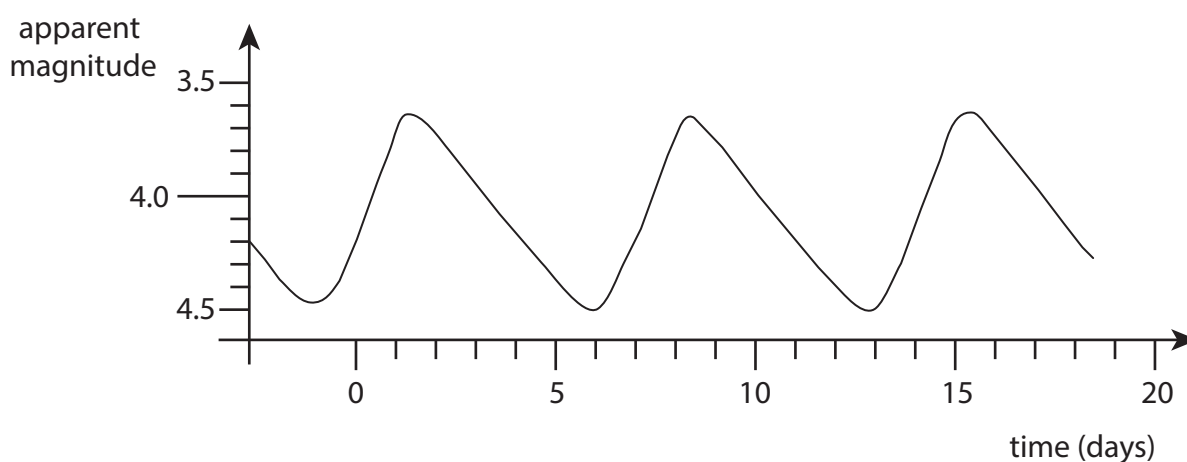


Figure 13

- (a) Use Figure 13 to determine the period of this variable star.

(2)

- (b) Figure 14 shows the connection between the period of a Cepheid variable star and its absolute magnitude.

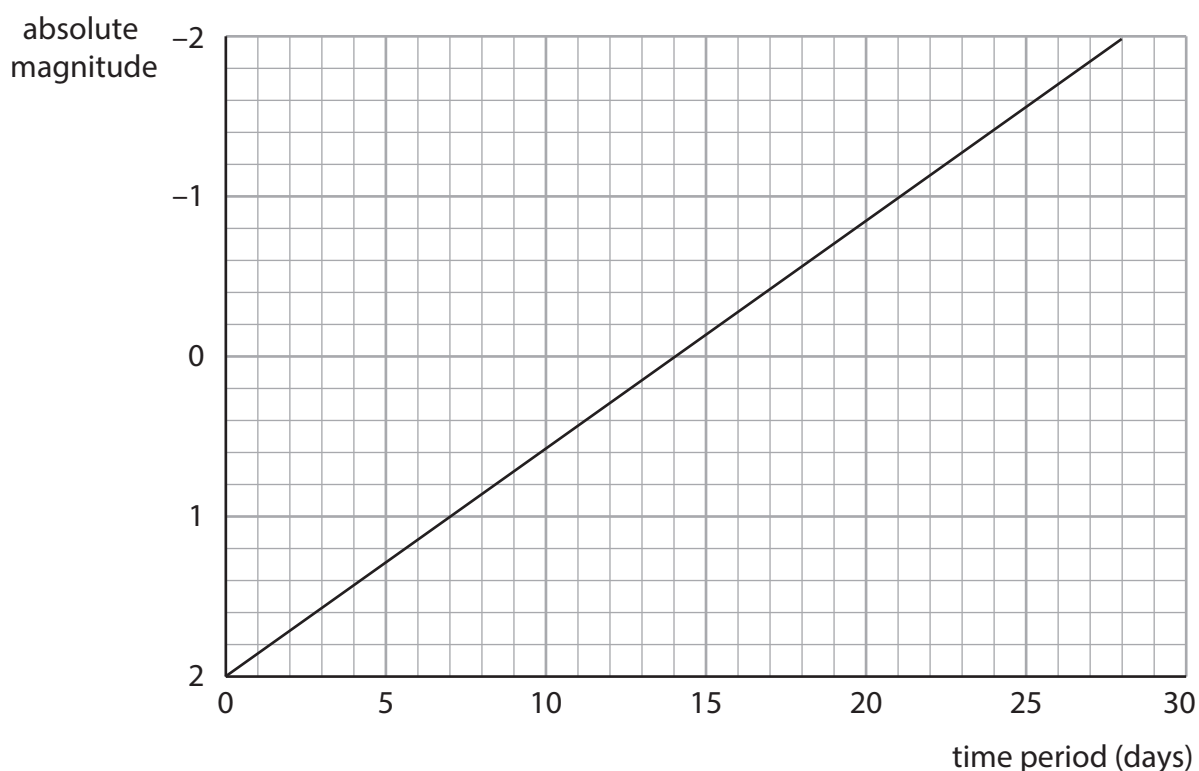


Figure 14

- (i) Use Figure 14 to determine the absolute magnitude of this Cepheid variable star.

(1)



(ii) Make an estimate of the distance to this star, using information from Figure 13 and your answer to part (b) (i).

Explain your working clearly.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 18 = 6 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



19 Figure 15 shows the Planck satellite. Measurements from this satellite have been used in the search for Dark Matter.



Figure 15

(Source: © European Space Agency)

(a) Describe **one** observation that astronomers have made that suggests the existence of Dark Matter. (1)

.....
.....

(b) Describe **two** practical difficulties involved in detecting Dark Matter. (2)

1

2

.....



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

*(c) Describe the current evidence for Dark Energy.

(3)

.....

.....

.....

.....

.....

.....

(d) State the effect that Dark Energy could have on the future of the universe.

(1)

.....

.....

(Total for Question 19 = 7 marks)

TURN OVER FOR QUESTION 20



20 Earth is the only planet in the Solar System with large quantities of liquid water on its surface.

(a) State **two** reasons why liquid water is able to exist on the surface of the Earth. (2)

1

.....

.....

2

.....

.....

*****(b) A number of theories have been proposed to explain how liquid water formed on Earth.

Describe in detail **one** theory that accounts for the existence of liquid water on the Earth's surface. (3)

.....

.....

.....

.....

.....

.....

.....

(c) Describe a piece of evidence that might help astronomers to decide which is the correct theory for the existence of liquid water on Earth. (1)

.....

.....

.....

(Total for Question 20 = 6 marks)

TOTAL FOR PAPER = 120 MARKS



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

Every effort has been made to contact copyright holders to obtain their permission for the use of copyright material. Pearson Education Ltd. will, if notified, be happy to rectify any errors or omissions and include any such rectifications in future editions.

