

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCSE

Astronomy

Unit 1: Understanding the Universe

Thursday 9 June 2011 – Morning

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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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 of these objects in the Solar System has the smallest diameter? (1)

- A Earth
- B Jupiter
- C The Moon
- D The Sun

(b) Which of these objects in the Solar System is closest to the Sun? (1)

- A Earth
- B Mars
- C Mercury
- D The Moon

(c) Which of these objects in the Solar System takes the longest time to orbit the Sun? (1)

- A Earth
- B Neptune
- C Pluto
- D Venus

(d) What is the name of the dwarf planet that orbits **closest** to the Sun? (1)

(Total for Question 1 = 4 marks)



2 (a) What is the value of 1 astronomical unit?

(1)

- A 15 million km
- B 150 million km
- C 15 million miles
- D 150 million miles

(b) What is the name of the shape of the Earth's orbit around the Sun?

(1)

- A eccentric
- B eclipse
- C ecliptic
- D ellipse

(c) What is the name of the plane of the Earth's orbit around the Sun?

(1)

- A ecliptic
- B eclipse
- C zenith
- D zodiac

(d) How many hours and minutes does it take the Earth to rotate on its axis once?

(1)

..... hours, minutes.

(e) How long does it take the Moon to spin on its axis once?

(1)

- A 27.3 days
- B 28.0 days
- C 29.5 days
- D 31.0 days

(Total for Question 2 = 5 marks)



3 Figure 1 shows a rough sketch of the Moon.



Figure 1

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

(1)

(b) How many days into the lunar cycle is this?

(1)

- A 6 days
- B 10 days
- C 17 days
- D 28 days

(c) What is the phase of the Moon during a **lunar** eclipse?

(1)

(d) In the space below, sketch and label the relative positions of the Sun, Earth and Moon during a **lunar** eclipse.

(2)

(Total for Question 3 = 5 marks)



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Turn over for Question 4



4 Figure 2 shows the near side of the Moon.

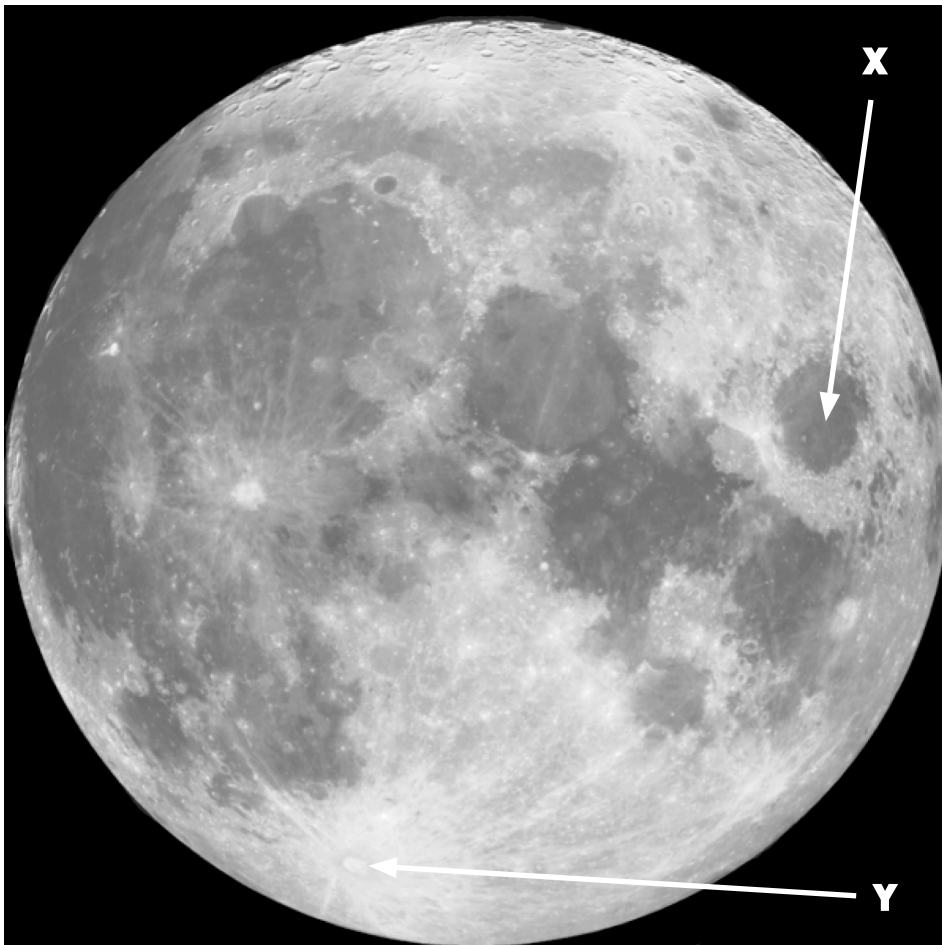


Figure 2

(a) What is the name of feature **X**?

(1)

- A** Bay of Rainbows
- B** Ocean of Storms
- C** Sea of Crises
- D** Sea of Tranquility

(b) What is the name of crater **Y**?

(1)

- A** Copernicus
- B** Galileo
- C** Kepler
- D** Tycho



(c) On Figure 2, indicate the location of the Apennine mountain range.

Use the letter **A**.

(1)

(d) The Moon's far side is not visible from the Earth.

How do astronomers know what the far side looks like?

(1)

.....

*(e) State **two** ways in which the appearance of the Moon's far side differs from the near side.

(3)

.....

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.....

(Total for Question 4 = 7 marks)



5 (a) The planet Saturn is well-known for its prominent ring system.

Name **two** other planets that have ring systems.

(2)

1

2

(b) Which planet has two small satellites that astronomers believe are captured asteroids?

(1)

.....

(c) The atmosphere of Venus can be used to demonstrate the danger of extreme global warming on Earth.

State **two** properties of the atmosphere of Venus responsible for this.

(2)

1

2

(Total for Question 5 = 5 marks)

.....



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Turn over for Question 6



6 (a) A student observed the star Polaris in the night sky.

(i) In which direction was the student looking?

(1)

A North

B South

C East

D West

(ii) State the declination of Polaris.

(1)

(iii) The latitude of the student was 55° N.

What was the angle of elevation of Polaris above the student's horizon?

(1)

(b) The student observed the constellation Cassiopeia.

From the student's latitude, the stars in this constellation are circumpolar.

(i) In the space below, sketch Cassiopeia.

(1)



(ii) What are circumpolar stars?

(1)

.....

.....

(iii) State whether a star of declination $+60^\circ$ would be circumpolar from the student's latitude.

Give a reason for your answer.

(2)

.....

.....

.....

.....

(Total for Question 6 = 7 marks)



7 (a) An astronomer observes sunspots using a telescope fitted with a H-alpha filter.

(i) Describe the appearance of the sunspots.

(1)

(ii) Name **one** other feature that the astronomer might observe.

(1)

(iii) Why does the H-alpha filter improve the astronomer's observations of the sunspots?

(1)

(b) With the aid of a diagram(s), explain how astronomers use sunspots to determine the Sun's rotation period.

(2)



(c) Sunspots are thought to be a possible origin of the solar wind, which can cause aurorae.

(i) Describe the appearance of aurorae.

(1)

.....

.....

.....

(ii) Explain the connection between aurorae and the solar wind.

(2)

.....

.....

.....

(Total for Question 7 = 8 marks)



8 A group of students were observing the Perseid meteor shower that occurs annually in August. This shower is caused by a short-period comet.

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

(1)

- A Asteroid Belt
- B Kuiper Belt
- C Orion's Belt
- D Van Allen Belt

(b) Figure 3 shows the Earth's orbit around the Sun.

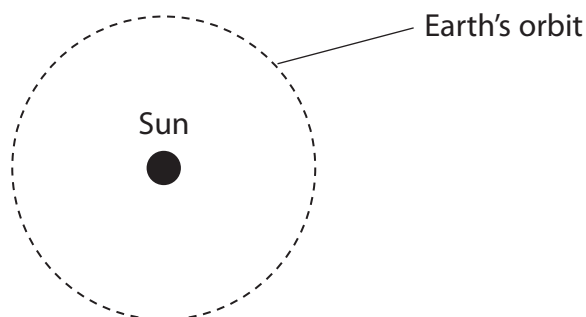


Figure 3

- (i) On Figure 3, draw the orbit of a typical short-period comet.
- (ii) On Figure 3, indicate a point at which this meteor shower could occur. Use the letter **P**.

(3)



(c) (i) What is the name of the point from which meteors appear to diverge? (1)

(ii) In which constellation does the point for this meteor shower occur? (1)

(d) During their observations, the students also saw a fireball.
What is the difference between a fireball and a meteor? (1)

(Total for Question 8 = 7 marks)



9 (a) What is the approximate diameter of our Galaxy?

(1)

- A 30 AU
- B 30 pc
- C 30 kpc
- D 30 Mpc

(b) Figure 4 shows a sketch of our Galaxy.

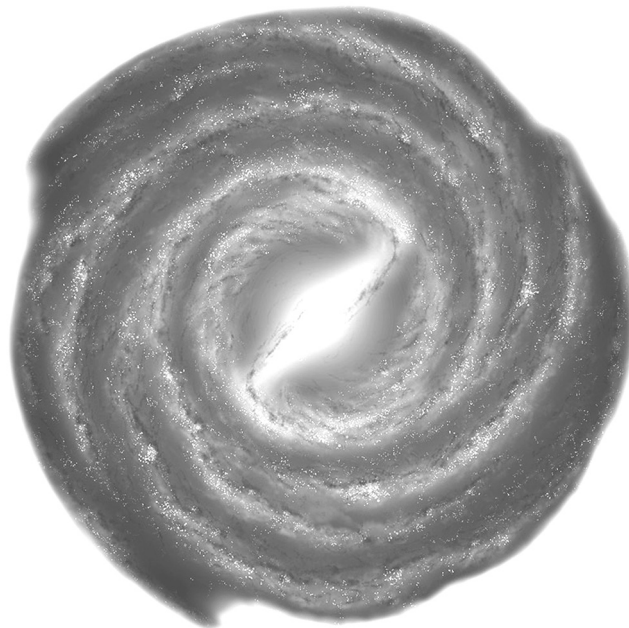


Figure 4

On Figure 4, indicate the position of:

(3)

- (i) the Sun (use the letter **S**)
- (ii) a typical site of star formation (use the letter **F**)
- (iii) a typical globular cluster (use the letter **G**).

(Total for Question 9 = 4 marks)



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Turn over for Question 10



10 A group of students were using a star chart to plan a naked-eye observing session of the region of the sky close to the constellation Pegasus.

Figure 5 shows the Great Square of Pegasus, some other stars and a faint, fuzzy patch of light **X**. Some stars are labelled with Greek letters.

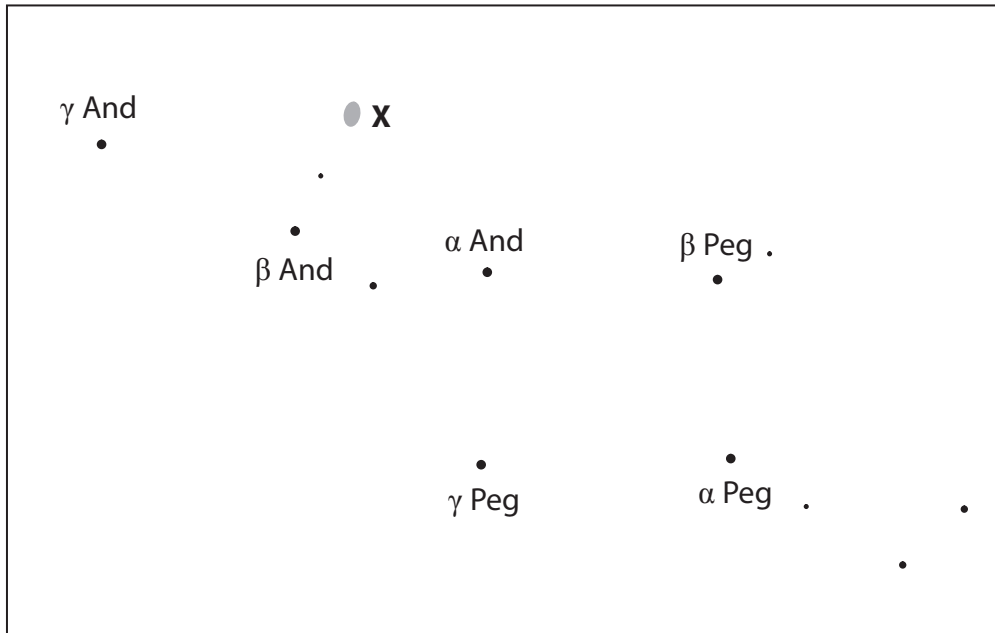


Figure 5

(a) In addition to the star chart, state **two** other **sources** of information that the students might need in order to plan the observing session.

(2)

1

2

(b) On Figure 5, indicate with an arrow how stars in the Great Square of Pegasus can be used to locate the star Fomalhaut.

(1)



(c) What is the name of faint object **X**?

(1)

- A** Andromeda Galaxy
- B** Orion Nebular
- C** Oort Cloud
- D** The Pleiades

(d) The group of students observed object **X** with **averted vision**.

What is averted vision?

(1)

(e) Name **one** other naked-eye observing technique to help observe object **X**.

(1)

(f) The students planned to observe object **X** on a future date using a robotic telescope.

State **two** reasons why the use of such a telescope might improve their observations.

(2)

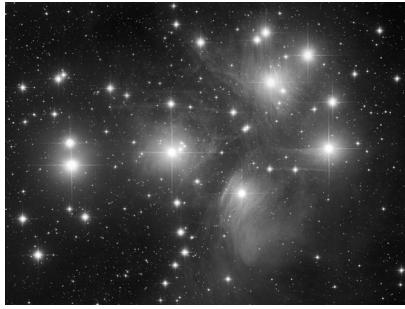
1

2

(Total for Question 10 = 8 marks)



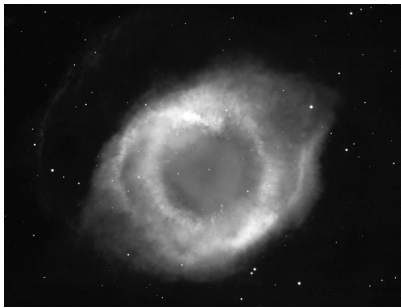
11 The four images labelled **A** to **D** in Figure 6 show different stages in the evolution of a solar-mass star.



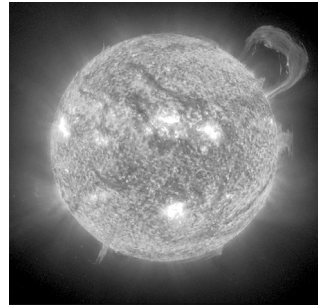
A The Pleiades, an open cluster



B NGC 281, an emission nebula



C The Helix Nebula, a planetary nebula



D The Sun, a main sequence star

Figure 6

(a) Arrange the letters of the images in Figure 6 in order of evolution, starting with the youngest.

(3)

(b) What type of object lies at the centre of a planetary nebula?

(1)



(c) Figure 7 shows one stage in the death of a star that has a much greater mass than the Sun.

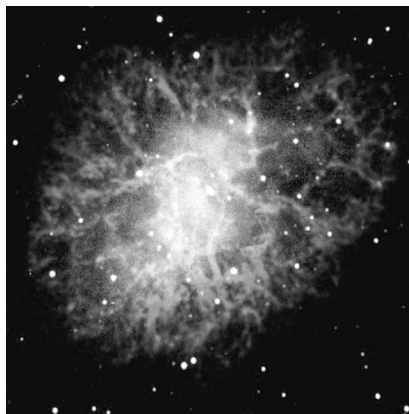


Figure 7

(i) What is the name of this stage? (1)

(ii) Name **one** possible type of object that lies at the centre of Figure 7. (1)

(Total for Question 11 = 6 marks)



12 (a) Recently, astronomers have discovered that many stars possess systems of planets (exoplanets).

(i) Describe **two** methods that astronomers use to detect the presence of exoplanets.

(2)

1

.....

2

.....

(ii) Explain why astronomers find it difficult to detect **individual** planets.

(2)

.....

.....

.....

.....

(b) The Drake Equation can be used to estimate the likelihood of intelligent life existing elsewhere in our Galaxy.

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

(2)

1

.....

2

.....

(Total for Question 12 = 6 marks)



13 The table below lists the co-ordinates of some of the stars in the constellation Orion.

star	RA	dec / °
α Ori	5 h 55 min	+7
β Ori	5 h 15 min	-8
γ Ori	5 h 25 min	+6
δ Ori	5 h 32 min	0

(a) An astronomer observed Orion from the UK in December.

Which star appeared:

(i) the highest, (1)

(ii) the furthest east? (1)

(b) Explain why the astronomer would not be able to observe Orion from the UK in June. (2)

.....

.....

.....

(c) The astronomer observed β Ori when it crossed her meridian at 16:40 GMT.

(i) What is meant by the term **meridian**?
.....

(ii) Deduce the time at which α Ori would cross the astronomer's meridian.
.....
..... (3)

(Total for Question 13 = 7 marks)



14 (a) Our knowledge about the Solar System is greatly increased through the use of space probes.

Describe briefly **one** major space mission, naming the mission, its 'target' and **one** key piece of information that was obtained.

(3)

Mission name

'Target'

One piece of information.....

.....

.....

.....

.....

(b) Manned exploration of the Solar System has so far been restricted to our immediate neighbourhood.

State **two** problems that astronauts are likely to face during a manned expedition to a planet such as Mars.

(2)

1

.....

2

.....

(Total for Question 14 = 5 marks)



15 Martha measured the length of the shadow cast by a straight vertical stick at certain times of the day.
Some of her results are shown in the table below.

Time (GMT)	Shadow length / mm
11:30	527
11:40	512
11:50	505
12:00	494
12:10	480
12:20	495
12:30	502

(a) Use the table to determine the time at which the Sun appeared to be at its highest in the sky.

(1)

(b) On the date that Martha carried out her shadow stick experiment, the Equation of Time was equal to -6 min.

Calculate the Apparent Solar Time at which the Sun was highest in the sky.

Use the formula : Equation of Time = Apparent Solar Time – Mean Solar Time

(2)

(c) Deduce the longitude from where Martha carried out her experiment.

(1)

(d) Martha’s friend Jojo carried out a similar experiment from a longitude of 3° W.

At what time (GMT) did the Sun appear highest in the sky to Jojo?

(1)

(Total for Question 15 = 5 marks)



16 (a) State the difference between a binary star and an optical double star.

(2)

.....

.....

.....

(b) The table below gives data for four stars in a constellation.

Star	Apparent magnitude
α	-0.6
β	1.4
δ	4.4
ϵ	6.8

(i) Which is the faintest star that could be seen with the naked eye?

(1)

.....

(ii) How many times does star α appear brighter than star β ?

(1)

.....

(iii) The distance of star δ is 100pc. Calculate the absolute magnitude of δ .

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

(2)

.....

.....

.....

(Total for Question 16 = 6 marks)



17 (a) (i) State **one** major source of light pollution.

(1)

(ii) Why does light pollution cause problems for amateur astronomers?

(1)

*(b) The Greek mathematician Eratosthenes was the first person to determine the circumference of the Earth.

Describe the observations and the method used by Eratosthenes to determine the Earth's circumference.

You may draw a diagram.

(5)

Observations

Method

(Total for Question 17 = 7 marks)



18 (a) Why do astronomers use 21 cm radio waves rather than visible light to determine the rotation of our Galaxy?

(1)

.....

(b) Give **three** key facts about Cosmic Microwave Background radiation.

(3)

1

2

3

(c) Describe how astronomers use the value of the Hubble Constant to determine the age of the Universe.

(2)

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.....

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.....

(Total for Question 18 = 6 marks)

.....



19 (a) Figures 8 and 9 show two galaxies, the Andromeda Galaxy and Large Magellanic Cloud respectively.



Figure 8

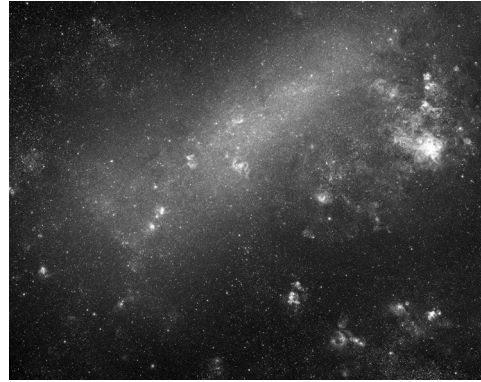


Figure 9

State the type of galaxy shown in:

(2)

(i) Figure 8

(ii) Figure 9

(b) The two galaxies shown in Figures 8 and 9 are members of our Local Group.

Give the names of **two** other galaxies in our Local Group.

(2)

1

2

(c) Some galaxies are described as 'active'.

Give **two** key facts about active galaxies.

(2)

1

2

(Total for Question 19 = 6 marks)



20 Quasars are distant galaxies with high redshifts.

(a) Describe briefly how quasars were discovered.

(2)

.....

.....

.....

.....

(b) An astronomer obtained the following data for an absorption line in the spectrum of a quasar:

measured wavelength = 610 nm
true wavelength = 460 nm

At what fraction of the speed of light is the quasar receding?

Use the formula: $\frac{v}{c} = \frac{\lambda - \lambda_0}{\lambda_0}$

(3)

.....

.....

.....

(c) When the astronomer observed another galaxy, she found that its spectrum was blueshifted. What could the astronomer deduce from this?

(1)

- A** The galaxy is in the southern hemisphere
- B** The galaxy is moving towards us
- C** The Universe is contracting
- D** The Universe is expanding

(Total for Question 20 = 6 marks)

TOTAL FOR PAPER = 120 MARKS



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