

Paper Reference(s) 1AS0/01

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Astronomy

Paper 1: Naked-eye Astronomy

Total Marks

Wednesday 3 June 2020 – Afternoon

Time: 1 hour 45 minutes plus your additional time allowance

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Formulae and Data Booklet, Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided – there may be more space than you need.

Calculators may be used.

Any diagrams may NOT be accurately drawn, unless otherwise indicated.

You must show all your working out with your answer clearly identified at the end of your solution.

INFORMATION

The total mark for this paper is 100.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

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.

Answer ALL questions. Write your answers in the spaces provided.

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) Look at Figure 1 for Question 1(a) in the Diagram Booklet. It shows a photograph of the Moon with four features labelled.**

Which of these features is named?

(i) Copernicus (1 mark)

☐ **A**

☐ **B**

☐ **C**

☐ **D**

(continued on the next page)

1 continued.

(ii) the Sea of Crises (1 mark)

☐ A

☐ B

☐ C

☐ D

(iii) the Sea of Tranquility (1 mark)

☐ A

☐ B

☐ C

☐ D

(continued on the next page)

1 continued.

(b) Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows a sketch of part of the constellation of Pegasus.

(i) In Area A there is a faint patch of light. This is the: (1 mark)

☐ **A Andromeda galaxy**

☐ **B Milky Way galaxy**

☐ **C Orion nebula**

☐ **D Triangulum galaxy**

(ii) Arrow B points to the bright star called: (1 mark)

☐ **A Aldebaran**

☐ **B Fomalhaut**

☐ **C Polaris**

☐ **D Sirius**

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Turn over

1 continued.

(c) Which of the following CANNOT show the observer's horizon? (1 mark)

☐ **A computer program**

☐ **B phone app**

☐ **C planisphere**

☐ **D star map**

(TOTAL FOR QUESTION 1 = 6 MARKS)

- 2 Look at Figure 3 for Question 2 in the Diagram Booklet. It shows a star chart containing the constellation of Virgo.**

The ecliptic has been drawn on the chart.

- (a) Which of the following is the name of the region that lies a few degrees either side of the ecliptic?
(1 mark)**

- ☐ **A Celestial Equator**
- ☐ **B observer's meridian**
- ☐ **C observer's zenith**
- ☐ **D Zodiacal Band**

- (b) Draw on Figure 3 the position of the Sun at the Autumnal Equinox.**

Use the label P. (1 mark)

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2 continued.

(c) State the Right Ascension and Declination of the star labelled α in Figure 3. (1 mark)

Right Ascension (h : min)

Declination ($^{\circ}$)

(continued on the next page)

2 continued.

(d) (i) In which season is the constellation of Virgo easiest to observe? (1 mark)

☐ **A autumn**

☐ **B spring**

☐ **C summer**

☐ **D winter**

(ii) State a reason for your answer. (1 mark)

(continued on the next page)

2 continued.

- (e) Look at Figure 4 for Question 2(e) in the Diagram Booklet. It shows part of a grid from a star chart.**

Analyse Figure 4 to determine whether the grid shows part of the Northern or Southern hemisphere of the Celestial Sphere and explain your answer. (2 marks)

(TOTAL FOR QUESTION 2 = 7 MARKS)

3 (a) People have divided the Earth's surface using several lines that have astronomical significance.

**(i) Which line separates the Earth into its Northern and Southern hemispheres?
(1 mark)**

- ☐ **A Equator**
- ☐ **B Prime Meridian**
- ☐ **C Tropic of Cancer**
- ☐ **D Tropic of Capricorn**

(ii) Which line joins all locations with a latitude of $23\frac{1}{2}^{\circ}\text{S}$? (1 mark)

- ☐ **A Equator**
- ☐ **B Prime Meridian**
- ☐ **C Tropic of Cancer**
- ☐ **D Tropic of Capricorn**

(continued on the next page)

3 continued.

(iii) Which line joins all locations with a longitude of 0° ? (1 mark)

- ☐ **A Equator**
- ☐ **B Prime Meridian**
- ☐ **C Tropic of Cancer**
- ☐ **D Tropic of Capricorn**

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3 continued.

- (b) An observer on the Earth makes some measurements of four bright stars.**

Look at Figure 5 for Question 3(b) in the Diagram Booklet. His results are shown.

- (i) Which star is located nearest to the North Celestial Pole? (1 mark)**

☐ **A Star α**

☐ **B Star β**

☐ **C Star γ**

☐ **D Star δ**

- (ii) Which star culminated 3 hours before these observations were made? (1 mark)**

☐ **A Star α**

☐ **B Star β**

☐ **C Star γ**

☐ **D Star δ**

3 continued.

**(iii) Which star is nearest to the Celestial Equator?
(1 mark)**

☐ **A Star α**

☐ **B Star β**

☐ **C Star γ**

☐ **D Star δ**

**(iv) Which star is crossing the observer's meridian
at this time? (1 mark)**

☐ **A Star α**

☐ **B Star β**

☐ **C Star γ**

☐ **D Star δ**

(TOTAL FOR QUESTION 3 = 7 MARKS)

- 4 A student performs a shadow stick experiment to determine her longitude.

Figure 6 shows her results.

Figure 6

Time GMT (h : min)	Length of shadow (cm)
11:45	102.2
11:50	100.1
11:55	98.4
12:00	97.7
12:05	97.8
12:10	98.8
12:15	101.0

- (a) (i) Look at the grid for Question 4(a)(i) in the Diagram Booklet. Plot a graph of the student's results and draw a line of best fit. (3 marks)
- (ii) State the time of local noon at the student's location. (1 mark)

(continued on the next page)

4 continued.

(iii) Calculate the student's longitude.

The Equation of Time on this date was
0 minutes. (2 marks)

Longitude = _____

(continued on the next page)

4 continued.

- (b) (i) The 'lunar distance' method can be used to measure longitude.**

Which of the following measurements must be taken in this method? (1 mark)

- ☐ **A The angular distance across the Moon's disc**
- ☐ **B The angular distance between the Moon and certain bright stars**
- ☐ **C The angular distance between the Moon and the horizon**
- ☐ **D The angular distance between the Moon and a comet**

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4 continued.

- (ii) Sailors on a ship can use observations of the Sun and the time on an accurate clock to find their longitude.**

Describe in detail this method for finding longitude.

You may include a clearly labelled diagram in your answer. (3 marks)

(continued on the next page)

Turn over

4 continued.

(TOTAL FOR QUESTION 4 = 10 MARKS)

- 5 (a) State ONE reason why it is easier to observe a meteor shower with the naked-eye than with a telescope. (1 mark)

- (b) State the reason why meteor showers appear to originate from one area in the sky. (1 mark)

- (c) Major meteor showers include the Perseids, the Leonids and the Geminids.

State how meteor showers get their names.
(1 mark)

(continued on the next page)

Turn over

5 continued.

(d) Design a naked-eye experiment to determine the position of a meteor shower's radiant.

Describe what you would record to find the position of the radiant.

Describe how you would analyse your observations to find its position. (6 marks)

5 continued.

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5 continued.

(TOTAL FOR QUESTION 5 = 9 MARKS)

6 (a) Look at Figure 7 for Question 6(a) in the Diagram Booklet. It shows graphs of the rising and setting times of the Sun, during the year.

(i) State whether the graphs in Figure 7 relate to a location in the Northern or Southern hemisphere. (1 mark)

(ii) State the reason for your answer to (i) above. (1 mark)

(continued on the next page)

6 continued.

- (iii) During two months of the year, local clocks were adjusted to allow for daylight-saving time.**

**Figure 7 shows that these two months were:
(1 mark)**

- ☐ **A January and December**
- ☐ **B March and October**
- ☐ **C June and July**
- ☐ **D October and December**

- (iv) State the feature of the graphs in Figure 7 that shows the effect of daylight-saving time.
(1 mark)**
-
-

(continued on the next page)

6 continued.

- (b) Sarah wishes to measure her local time using observations of the Sun.**

Look at Figure 8 for Question 6(b) in the Diagram Booklet. She looks up some values of the Equation of Time, as shown.

- (i) On 13th September she observes the Sun with a sundial. It shows a time of 15:01.**

Estimate her Mean Solar Time (MST) at this time. (3 marks)

Mean Solar Time = _____ : _____

6 continued.

- (ii) Sarah then takes a further sundial reading 30 days later, on the 13th October.**

She suggests that the Equation of Time for the 13th October would be +19 minutes.

Analyse the data in Figure 8 and comment on Sarah's estimate for the Equation of Time on the 13th October. (2 marks)

(continued on the next page)

6 continued.

- (c) To measure Apparent Solar Time accurately, a sundial must be correctly aligned.**

State TWO ways of ensuring this. (2 marks)

1 _____

2 _____

(TOTAL FOR QUESTION 6 = 11 MARKS)

- 7 (a) Describe TWO differences in the appearance of an aircraft and an artificial satellite to a naked-eye observer at night. (2 marks)

1 _____

2 _____

(continued on the next page)

7 continued.

(b) State TWO differences between seeing conditions and weather. (2 marks)

1 _____

2 _____

(continued on the next page)

7 continued.

(c) Naked-eye techniques can make use of dark adaptation and averted vision.

Describe each of these techniques.

(i) dark adaptation (1 mark)

(ii) averted vision (1 mark)

(continued on the next page)

7 continued.

- (d) An astronomy student wishes to measure the level of light pollution in his back garden. An extract from his observational plan said:**

‘Under ideal seeing conditions, I should be able to see stars as faint as magnitude 5. However due to light pollution I am not able to see this limiting magnitude. I plan to measure the limiting magnitude (faintest stars) that I can see by counting the number of observable planets in the night sky.’

Evaluate his proposed method and give reasons why it is not suitable.

Include a detailed alternative plan to determine the effect of light pollution. (6 marks)

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7 continued.

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7 continued.

(TOTAL FOR QUESTION 7 = 12 MARKS)

- 8 (a) We can only ever see one side of the Moon from the Earth.

This is because: (1 mark)

- ☐ A the Earth's rotational period is equal to the Earth's orbital period
- ☐ B the Earth's rotational period is equal to the Moon's orbital period
- ☐ C the Moon's rotational period is equal to the Earth's orbital period
- ☐ D the Moon's rotational period is equal to the Moon's orbital period

- (b) State the effect that lunar libration has on the amount of the Moon's surface that is visible from Earth over a period of one month. (1 mark)
-
-

(continued on the next page)

8 continued.

- (c) Look at Figure 9 for Question 8(c) in the Diagram Booklet. It shows a drawing of the lunar disc, indicating the position of the crater Tycho. An astronomer noticed that this crater appeared to change its position on the lunar disc. This is caused by lunar libration.**

Lunar libration is caused by the Moon's elliptical orbit and by the inclination of its orbit to the ecliptic.

- (i) Draw on Figure 9 a possible new position where Tycho could be observed as a result of libration caused by the Moon's elliptical orbit.**

Use the label A. (1 mark)

- (ii) Draw on Figure 9 a possible new position where Tycho could be observed as a result of libration caused by the Moon's orbital inclination to the ecliptic.**

Use the label B. (1 mark)

(continued on the next page)

8 continued.

- (d) Some astronomers have suggested that when the Moon formed it was only 34 000 km from the Earth.**

Calculate the ratio of the Moon's current distance from the Earth to its distance when it formed.

**Use information from the Formulae and Data Sheet.
(1 mark)**

Ratio = _____

(continued on the next page)

8 continued.

(e) Explain what would happen to each of the following if the Moon orbited much closer to the Earth:

(i) the tides on the Earth (2 marks)

(ii) the lunar phase cycle (2 marks)

(continued on the next page)

Turn over

8 continued.

**(iii) the appearance of a total solar eclipse
(2 marks)**

(TOTAL FOR QUESTION 8 = 11 MARKS)

- 9** Look at Figure 10 for Question 9(a) in the Diagram Booklet. It shows sketches of two stages in the construction of an ancient stone circle.

The first sketch shows the circle in 7000 BCE. The axis of the circle is at an angle of 49° from due North.

The second sketch shows the circle in 5000 BCE. The axis of the circle is at an angle of 78° from due North.

- (a) (i) It is thought that this stone circle was designed to have an alignment with the star Sirius.

Suggest ONE reason why ancient civilisations may have aligned their stone circles with bright stars such as Sirius. (1 mark)

(continued on the next page)

9 continued.

- (ii) It is thought that this stone circle was rebuilt between 7000 BCE and 5000 BCE, changing its alignment, as shown in Figure 10.**

It has been suggested that this was done as a result of precession of the Earth's axis.

Calculate the time taken for the Earth to precess once on its axis.

Use the data in Figure 10. (3 marks)

Time = _____ years

(continued on the next page)

Turn over

9 continued.

- (b) Some ancient civilisations aligned their stone circles in an East-West direction.**

It is thought that they did this using the rising or setting Sun.

State TWO days of the year when the rising or setting Sun can be used to find the exact direction of East or West. (2 marks)

1 _____

2 _____

- (c) (i) Look at Figure 11 for Question 9(c) in the Diagram Booklet. It shows a sketch of the horizon and night sky. The position of Polaris is shown.**

The Plough is a bright asterism in the night sky. Draw a possible position for the Plough on Figure 11 and show how it can be used to locate Polaris. (2 marks)

(continued on the next page)

9 continued.

- (ii) Polaris is currently located close to the North Celestial Pole.**

Describe how astronomers can use Polaris to help find their position on the Earth.

You may include a carefully labelled diagram in your answer. (3 marks)

9 continued.

- (iii) Describe how the precession of the Earth's axis will affect the use of Polaris for finding positions on the Earth.**

You may use a clearly labelled diagram in your answer. (2 marks)

(continued on the next page)

Turn over

9 continued.

(TOTAL FOR QUESTION 9 = 13 MARKS)

10 (a) Look at Figure 12 for Question 10(a) in the Diagram Booklet. It shows a ray diagram of the Earth, Moon and Sun during a solar eclipse.

(i) Label on Figure 12 a location on the Earth's surface where the eclipse would be seen as total.

Use the label T. (1 mark)

(ii) Label on Figure 12 a location on the Earth's surface where the eclipse would be seen as partial.

Use the label P. (1 mark)

**(b) Give TWO reasons why a total solar eclipse can only be observed for a short period of time by an observer standing on the Earth's surface.
(2 marks)**

1 _____

2 _____

(continued on the next page)

Turn over

10 continued.

(c) Which of the following gives the position of the Moon when an annular eclipse is MOST likely to be visible from Earth? (1 mark)

- ☐ **A aphelion**
- ☐ **B apogee**
- ☐ **C perihelion**
- ☐ **D perigree**

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10 continued.

- (d) The Greek astronomer Aristarchus noticed that the Sun and full Moon appear to be the same size in the sky, when viewed from Earth.**

Look at Figure 13 for Question 10(d) in the Diagram Booklet. It gives some data about the Earth, Sun and Moon system.

Calculate a value for the mean distance between the Earth and the Sun.

Use the data from Figure 13 and the fact that both the Sun and the Moon have the same apparent diameter. (3 marks)

**Mean distance between
the Earth and the Sun = _____ km**

10 continued.

(e) A lunar eclipse occurs when the Moon passes into the Earth's shadow. Look at Figure 14 for Question 10(e) in the Diagram Booklet. It shows a sketch of the Earth's shadow with the umbra and penumbra labelled.

(i) Which label from Figure 14 marks the position of the first umbral contact? (1 mark)

☐ **A 1**

☐ **B 2**

☐ **C 4**

☐ **D 5**

(ii) Which label from Figure 14 marks the position of the third umbral contact? (1 mark)

☐ **A 1**

☐ **B 2**

☐ **C 4**

☐ **D 5**

(continued on the next page)

Turn over

10 continued.

- (f) Describe how the astronomer Eratosthenes used observations of a lunar eclipse to estimate the diameter of the Moon.**

You may include a carefully labelled diagram in your answer. (3 marks)

(continued on the next page)

Turn over

10 continued.

- (g) State ONE feature of the Moon's orbit which means that lunar and solar eclipses do NOT occur every month. (1 mark)**

(TOTAL FOR QUESTION 10 = 14 MARKS)

**TOTAL FOR PAPER = 100 MARKS
END**