

Questions

Q1.

All the planets in the Solar System have both a sidereal and synodic period.

Figure 11 gives some data about two moons of Jupiter, Io and Europa.

Moon of Jupiter	Io	Europa
Orbital period / days	1.77	
Mean distance from Jupiter / km	421 600	670 900

Figure 11

(i) Calculate the time for Europa to complete one orbit of Jupiter.

(5)

time

(ii) The small moon Mimas orbits the planet Saturn once every 0.9 days at a mean distance of 0.0012 AU.

Calculate the ratio of the mass of Jupiter to the mass of Saturn.

(3)

answer

(Total for question = 8 marks)

Q2.

Long-period comets, like Comet Hyakutake shown in Figure 9, can take many thousands of years to complete one orbit of the Sun. They are thought to originate in the Oort Cloud.



(Source: © NASA)

Figure 9

Comet Crommelin orbits at an average distance of 9 AU from the Sun. Calculate the time it takes to complete one orbit. Give your answer in years.

Use the relationship: $T^2 = r^3$

(2)

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(Total for question = 2 marks)

Q3.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

(i) If the mass of the Earth is doubled, the gravitational force between the Earth and the Moon would:

(1)

- A** double
- B** stay the same
- C** halve
- D** drop to one quarter

(ii) If instead the distance between the Earth and the Moon is doubled, the gravitational force would:

(1)

- A** double
- B** stay the same
- C** halve
- D** drop to one quarter

(Total for question = 2 marks)

Q4.

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

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

(Total for question = 1 mark)

Q5.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

(i) Which of the following theories was introduced by the astronomer Ptolemy?

(1)

- A** All planets orbiting in the plane of the ecliptic
- B** Elliptical orbits
- C** Epicycles
- D** The Sun being at the centre of the solar system.

(ii) Which of the following theories was introduced by the astronomer Johannes Kepler?

(1)

- A** All planets orbiting in the plane of the ecliptic
- B** Elliptical orbits
- C** Epicycles
- D** The Sun being at the centre of the solar system.

(Total for question = 2 marks)

Q6.

The Polish astronomer, Nicolaus Copernicus was one of the first to propose a theory of the Solar System where the Sun, rather than the Earth, was at the centre.

In what other way did Copernicus' theory improve on earlier theories of the Solar System?

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(Total for question = 1 mark)

Q7.

Long-period comets, like Comet Hyakutake shown in Figure 9, can take many thousands of years to complete one orbit of the Sun. They are thought to originate in the Oort Cloud.



(Source: © NASA)

Figure 9

How many times bigger is the gravitational pull on a comet when it is 5 AU from the Sun than when it is 50 AU from the Sun?

(2)

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(Total for question = 2 marks)

Q8.

Many ancient monuments were aligned with the rising and setting of the Sun and the Moon.

An ancient monument was built so that a star in constellation X aligned with two of the stones during the solstice, as shown in Figure 3.

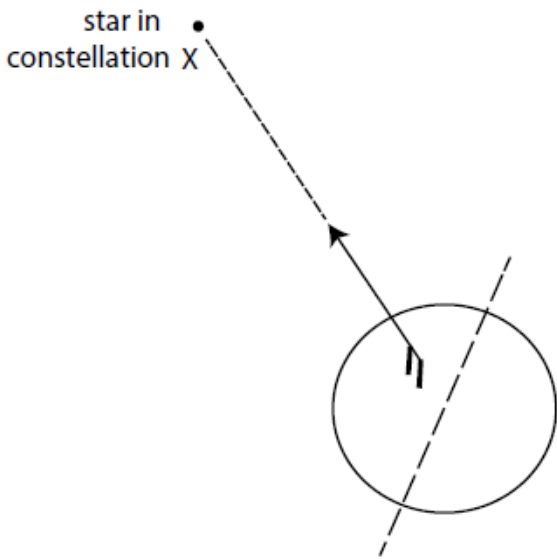


Figure 3

(i) These two stones are currently 35.4° from the star in constellation X.

Explain why precession would cause a star in constellation X to no longer be aligned with the stones during the solstice.

(2)

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(ii) The average rate of precession is 1.38° per century.

Calculate an approximate date for the building of this ancient monument.

(2)

date

(iii) Today, Polaris is the pole star.

In the past, it was Thuban.

In the future, it will be Alderamin.

Explain why precession causes variation in pole stars.

(3)

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(Total for question = 7 marks)