

Answer **THREE** questions from Section A and **THREE** questions from Section B.

You are advised to spend no more than 10 minutes on each Section A answer, and about 30 minutes on each Section B answer.

The numbers in square brackets indicate the provisional allocation of maximum marks for sub-sections of the question.

SECTION A

1. How was the system of stellar magnitudes originally set up? [4]

What is the difference between the Apparent and Absolute Visual Magnitude of a star? [3]

2. Briefly describe how one may observationally determine the temperature of a star from the shape of its spectrum and the presence of particular absorption lines. [7]

3. What constraints are important in siting a telescope designed to observe in the infrared? [7]

4. List the physical properties of the planet Mercury. Include in your discussion its size, density, surface features, temperature (day and night), atmosphere, and rotation. [7]

5. Draw an ellipse representing the orbit of a planet around the Sun and correctly label the Sun, planet, perihelion and aphelion, and semimajor axis.[3]

State Kepler's three laws of planetary motion [4]

6. Describe the currently accepted theory of the origin of Earth's Moon. [4]

Describe the evidence that favours this theory. [3]

SECTION B

7. Describe the physical properties of the three different types of emission nebulae. [9]

How do the properties of the general Interstellar Medium differ from those of emission nebulae? [5]

What are dark nebulae and why are they important? [6]

8. Give an account of the structure of our Galaxy, utilising a labelled diagram. [8]

Stars of different ages are found within the Galaxy. How might one distinguish between very old and very young stars on the basis of their spectra? [4]

Briefly describe the properties of elliptical and irregular galaxies. [8]

9. Why are observations of binary stars important to astronomers? [4]

Briefly describe the different ways that visual, spectroscopic and eclipsing binaries may be identified. [12]

In a binary system one star has a similar luminosity and temperature to the Sun, while the second has three times the radius and four times the temperature. How much more luminous is this star? [4]

10. Write short essays (including diagrams if appropriate) on any TWO (and only two) of the following three topics:

A. The main types of terrain and features seen on the Moon's surface, stating which terrain or features are probably oldest and which youngest. Explain why maria are seen only on the side of the Moon facing the Earth. [10]

B. The asteroids. [10]

C. Comets, addressing their orbital characteristics, physical structure and appearance as they approach the Sun, and the origin of the short-period and long-period comets. [10]

11. Consider the two outermost giant planets Uranus and Neptune and answer the following questions about them.

What is the approximate main atmospheric composition of both planets (express as percentages)? What constituent of the atmosphere gives them a strong bluish tint when viewed through a large telescope? [4]

What is unusual about the axis of rotation of Uranus? [2]

How were the rings of Uranus discovered? [2]

Compare the average densities of Uranus and Neptune, 1318 and 1638 kg/m³, respectively, with those of Jupiter and Saturn. What do these results imply regarding the bulk properties and compositions of the two planets? [4]

The average distance of Uranus from the Sun is about 19 AU and that of Neptune is 30 AU. They both have nearly the same albedo and both rotate rapidly. Show by calculation that if the average cloudtop temperature of Uranus is 55 K, the corresponding value for Neptune should be about 44 K. [6]

However, the cloudtop temperature of Neptune is observed to be 55 K, the same as Uranus. How do astronomers account for the similar cloudtop temperatures of these two planets? [2]

12. Consider planet Earth and answer the following questions about it.

What are the main constituents of the atmosphere and in what percentages? [3]

What is the Greenhouse Effect? What gases cause it? [3]

Describe, with the aid of a diagram, the interior structure of the Earth. [4]

Explain, with the aid of a diagram, how the study of earthquakes has made it possible to deduce the interior structure of the planet. [5]

Explain what is meant by the phrase “plate tectonics”. Include definitions of mid-ocean rifts and subduction zones. Use diagrams if necessary. Cite an example of each. [5]