

SECTION B*Answer all questions.*

The questions refer to the case study.

Direct quotes from the original passage will not be awarded marks.

7. (a) Explain briefly how parallax is used to measure the distances of stars from the Earth. (See paragraph 1.) [2]

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- (b) The parallax angle for a certain star is measured as 0.25 arcseconds. Calculate the distance of the star in light years. (See paragraph 4.) [2]

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- (c) Consider two stars of equal absolute magnitude the first at a distance of 1 parsec and the second at a distance of 10 parsec. Use the equation $M = m + 5(1 + \log_{10} p)$ to confirm that 'a difference of 5 magnitudes is defined as being equivalent to a factor of 100 in brightness'. (See paragraphs 7 and 8.) [3]

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- (d) What percentage of the Universe is not hydrogen or helium? (See paragraph 10.) [1]

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- (e) In your own words, explain why absorption corresponding to the Paschen series does not occur in relatively cold stars. (See paragraphs 11 and 12.) [3]

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- (f) Calculate a value for the constant, b , in the equation $L = br^2T^4$ and give its unit. (See paragraph 15.) [3]

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- (g) (i) Show that the equation $(M + m)T^2 = a^3$ is valid for the orbit of the Earth around the Sun. (See paragraph 16.) [1]

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- (ii) A small planet orbits a star that has a mass $0.32 M_{\text{Sun}}$ and its period of orbit is found to be 0.46 year. Estimate the planet's distance from its star stating any approximation that you make. [2]

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- (h) Explain the intensity variation with respect to time shown in the diagram for the eclipsing binary star. (See paragraph 21.) [3]

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