

Extension Worksheet – Option E, Worksheet 1

- 1 A student states that the asteroid belt is found between Mars and Jupiter. Explain why this statement is wrong and correct the student's statement. [2]
- 2 A star has apparent magnitude $m = 5.6$ and absolute magnitude $M = 4.2$. State and explain, without any calculations, whether the distance to this star is greater or less than 10 pc. [2]
- 3 The table shows information on two stars, X and Y.

| | X | Y |
|--------------------|--------------------------------|--------------------------------|
| Apparent magnitude | 3.1 | 6.8 |
| Luminosity | $6.5 \times 10^{26} \text{ W}$ | $2.2 \times 10^{29} \text{ W}$ |

State and explain which star

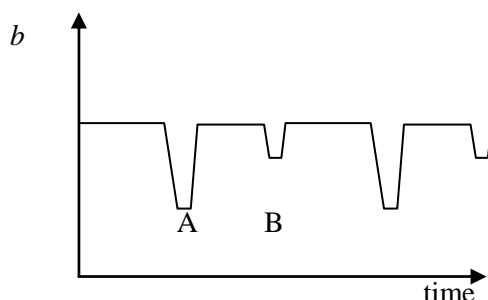
- a appears brighter from the Earth. [2]
 - b is closer to the Earth. [2]
- 4 The table shows information on two stars, P and Q.

| | P | Q |
|---------------------|---------------------------------------|---------------------------------------|
| Apparent brightness | $4.1 \times 10^{-9} \text{ W m}^{-2}$ | $2.2 \times 10^{-8} \text{ W m}^{-2}$ |
| Absolute magnitude | 4.0 | 5.2 |

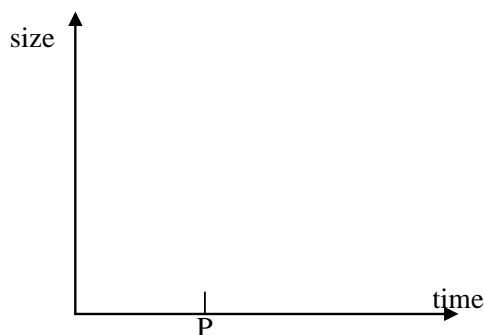
State and explain which star

- a appears brighter from the Earth. [2]
 - b is closer to the Earth. [2]
- 5 The apparent brightness of the Sun is 1400 W m^{-2} and that of star X is $8.1 \times 10^{-8} \text{ W m}^{-2}$. The ratio of luminosities is $\frac{L_X}{L_\odot} = 12$. Calculate the distance to star X in pc. [3]
- 6 The luminosity of a star is accurately known but measurement of its apparent brightness is made difficult by the presence of dust in the interstellar medium. Suggest the effect this has on the measured distance to the star. [3]
- 7 Outline what may be deduced about a star by a study of its spectrum. [3]

- 8 The diagram shows the variation with time of the combined apparent brightness b of two stars of almost equal radius in a binary star system.



- State and explain whether the brighter star is eclipsed at A or at B. [2]
 - On the diagram above draw a line to show the period of revolution of the stars. [1]
 - State what orbital quantities need to be measured in order to deduce the total mass of the two stars. [2]
- 9 The average apparent magnitude of a Cepheid star is $\bar{m} = 5.8$ and the period of variation of its luminosity is 12 days. Using the relation $\bar{M} = -2.83 \log_{10} T - 1.81$ between period T (in days) and average absolute magnitude \bar{M} calculate the distance to this star. [3]
- 10 The apparent magnitude of a Cepheid star varies from $m = 5.2$ to $m = 6.2$. Assuming that the temperature of the star stays constant, calculate the ratio of the star's radii at the extremes of its pulsation. [3]
- 11 Describe the method of spectroscopic parallax for measuring distances to stars. [3]
- 12 Explain how the observed redshift of light from distant galaxies is evidence for an expanding universe. [2]
- 13 Explain **quantitatively** how the Olbers paradox arises in the Newtonian model of the universe. [4]
- 14 On the axes below draw sketch graphs to show the three possible evolutionary paths of the universe according to the standard big bang model. The present time has been indicated by P.



- 15 Use the sketch of question 14 to explain why the three models imply a different age of the universe. [2]