

Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Q1.

- (a) (i) State what is meant by the *Doppler effect*.

- (ii) Explain how observing the spectrum of a star and applying the Doppler equation to the experimental observations enables the speed of recession of the star to be obtained.

- (iii) Give an example from astronomy of a situation where the double Doppler effect would have to be applied, explaining why it is necessary to apply the double effect.

(6)

- (b) One of the brightest galaxies in the Virgo cluster of galaxies is named M87 and is approximately 4.9×10^7 light years away.

- (i) Use the value of the Hubble constant given in the Data booklet to show that the speed of M87 relative to Earth is about $8 \times 10^5 \text{ m s}^{-1}$.

- (ii) The wavelength of one particular line in the hydrogen spectrum measured in the laboratory is $6.5647 \times 10^{-7} \text{ m}$. Use the result obtained in part (b)(i) to calculate the wavelength of the equivalent line observed in the spectrum of M87.

Q2.

The table gives information on two stars.

star	apparent magnitude	spectral class	distance/pc
Proxima Centauri	11	M	1.30
Antares	1.0	M	160

- (a) (i) Explain what is meant by

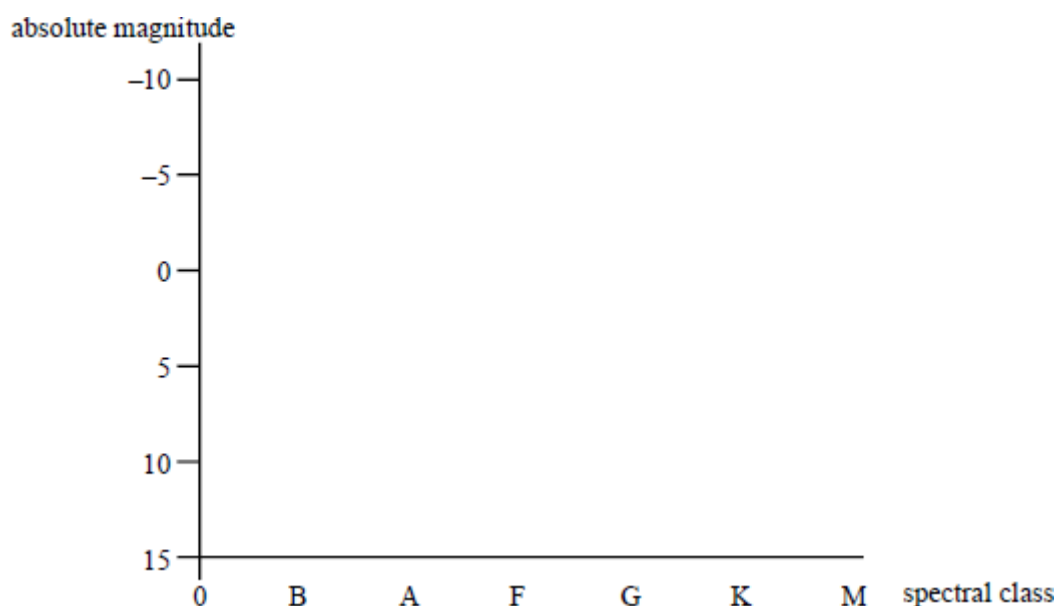
apparent magnitude _____

absolute magnitude _____

- (ii) The two stars named in the table are viewed through a telescope. State and explain **one** difference in the appearance of the two stars.

(4)

- (b) (i) Draw a Hertzsprung-Russell diagram for main sequence stars, Giant Stars and White Dwarfs.



- (ii) With reference to the table, calculate the absolute magnitude of Proxima Centauri.

- (iii) Given that the absolute magnitude of Antares is -5 , mark and label with an X its approximate position on the Hertzsprung-Russell diagram.

(6)

- (c) (i) Giving your reason, what can you say about the surface temperature of the two stars?

- (ii) Hence, deduce which star has the larger diameter. Explain how you arrive at your answer.

(4)
(Total 14 marks)