5 A binary star consists of two stars A and B that orbit about a common centre P, a distance *d* from the centre of star A, as illustrated in Fig. 5.1.

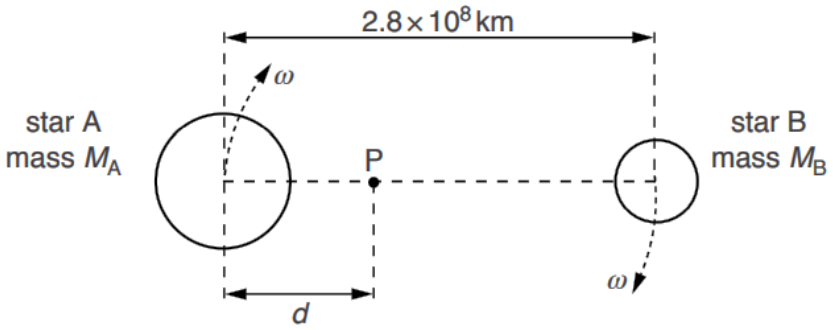

Fig. 5.1

(a) **(i)** Explain why the centripetal force acting on both stars has the same magnitude.

……...

……...

……...

…… [2]

(ii) The period of the orbit of the stars about point P is 4.0 years.

Calculate the angular speed ω of the stars.

ω = …… rad s^{-1} [2]

(b) The separation of the centres of the stars is 2.8×10^8 km.

The mass of star A is M_A. The mass of star B is M_B.

The ratio of $\frac{M_A}{M_B}$ is 3.0.

(i) Determine the distance d.

d = ... km [3]

(ii) Use your answers in **(a)(ii)** and **(b)(i)** to determine the mass M_B of star B. Explain your working.

M_B = …… kg [3]

[Total: 10]