1 **(a)** State Newton's law of gravitation.

.....

.....

..... [2]

(b) A binary star consists of star A, of mass 4.0×10^{30} kg, and star B, of mass 2.0×10^{30} kg, separated by a distance of 3.3×10^{12} m. The stars are both in circular orbit around their common centre of gravity X, as shown in Fig. 1.1.

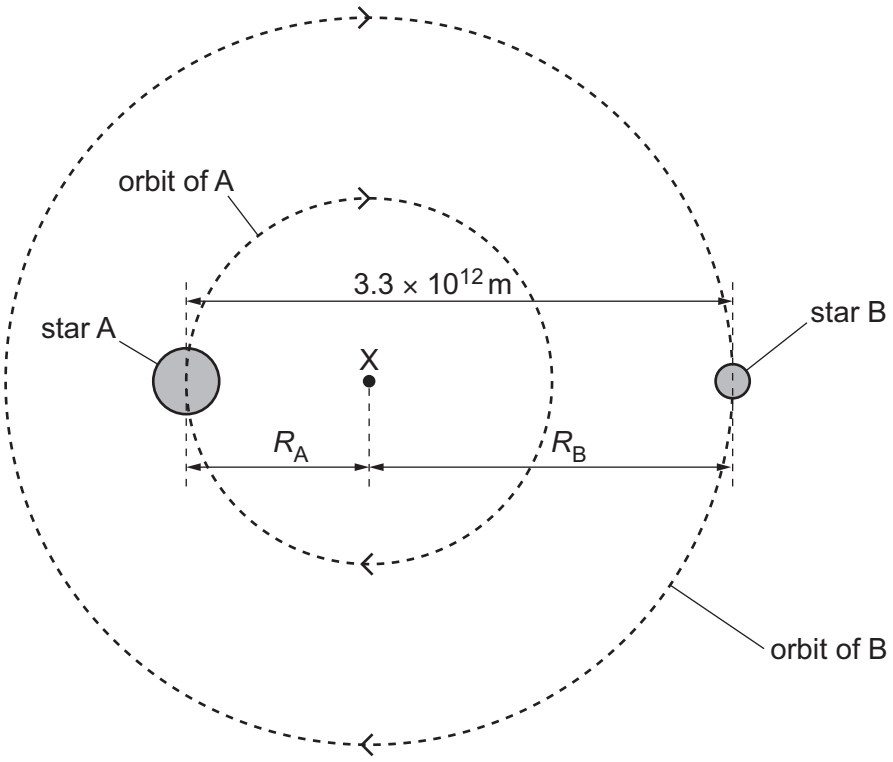

Fig. 1.1

The radius R_B of the orbit of star B is double the radius R_A of the orbit of star A.

(i) Use Newton's law of gravitation to calculate the magnitude of the gravitational force exerted by each star on the other.

force = ... N [2]

(ii) Calculate the centripetal acceleration of star A.

acceleration = ... $m\,s^{-2}$ [1]

(iii) Use your answer in **(b)(ii)** to determine the period of the orbit of star A.

period = ... s [3]

(iv) By placing a tick (✓) in each row, complete Table 1.1 to show how the quantities indicated for star B compare with the same quantities for star A.

Table 1.1

	B less than A	B equal to A	B greater than A
centripetal acceleration			
linear speed			
period			

[3]

[Total: 11]