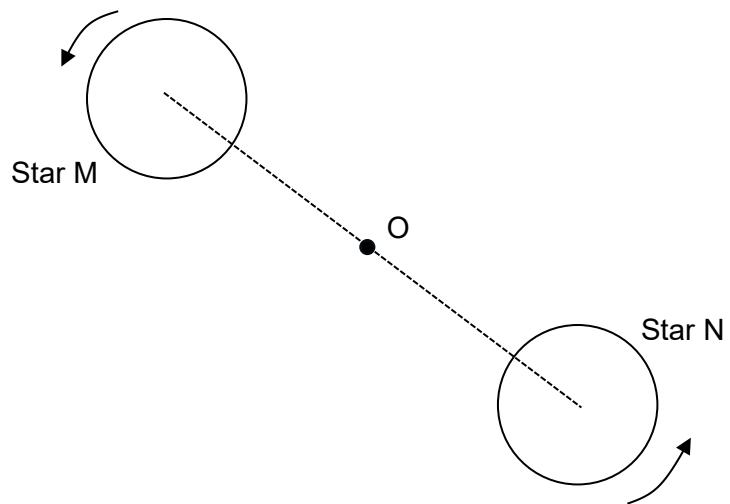


- 2 In a binary star system, two stars of equal mass  $3.5 \times 10^{30}$  kg orbit about their common centre of mass O, as shown in Fig. 2.1. O is equidistant from the centres of the two stars. The separation between the centres of the two stars is  $2.0 \times 10^{11}$  m.



**Fig. 2.1**

- (a) (i) Define gravitational potential at a point.
- .....

[1]

- (ii) Calculate the gravitational potential at O.

gravitational potential = ..... J kg<sup>-1</sup> [2]

- (iii) An asteroid passes through point O.

Determine the minimum speed of the asteroid at point O if it is to escape from the gravitational pull of the binary star system.

minimum speed = ..... m s<sup>-1</sup> [3]

- (iv) On Fig. 2.2, sketch a graph showing the variation of gravitational potential from the surface of Star M to the surface of Star N, along the line joining the centres of the two stars.

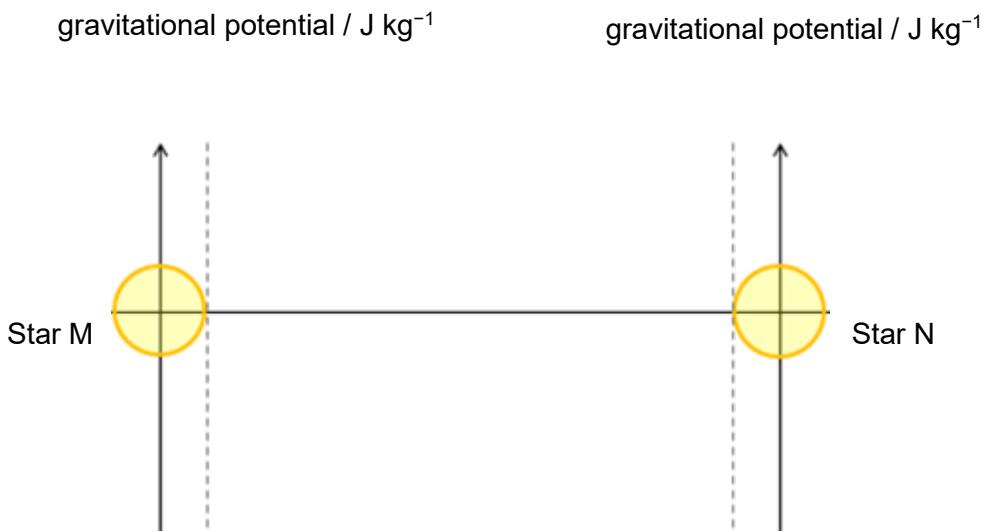


Fig. 2.2

[2]

- (b) (i) Explain why the gravitational force acting on the stars do not cause them to move closer to each other.

.....

.....

.....

[1]

- (ii) Calculate the period of the stars.

period = ..... years [3]

[Total: 12]

