5 Two stars A and B are separated by a distance of 1.2×10^{10} m as shown in Fig. 5.1. x is the distance from the centre of star A, in the direction toward the centre of star B.

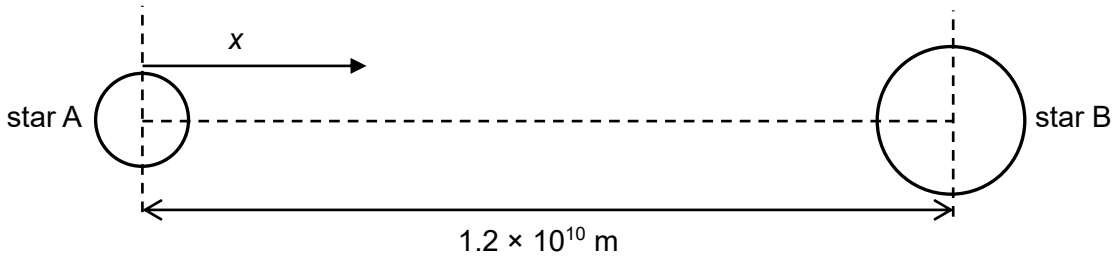

Fig. 5.1

The variation with x of the gravitational potential ϕ due to the two stars along the line joining their centres is shown in Fig. 5.2.

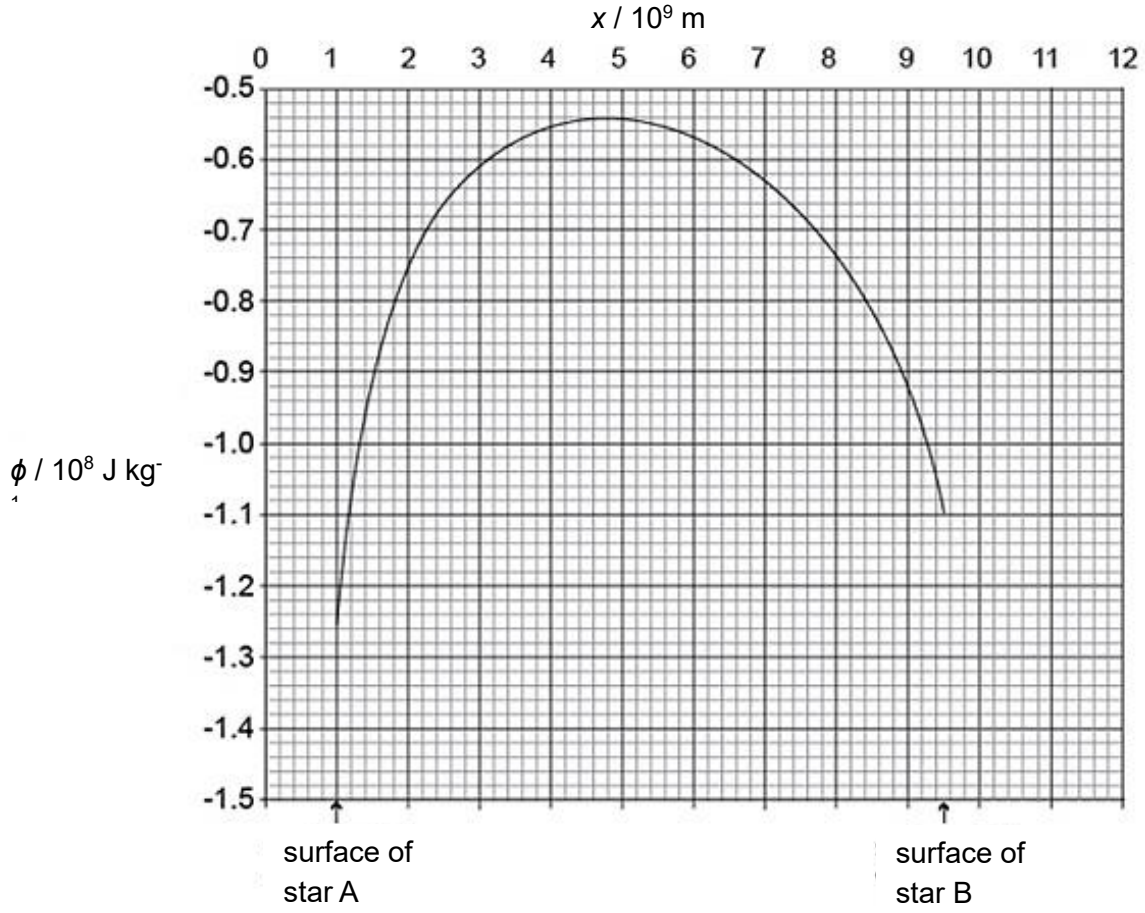

Fig. 5.2

A body is launched with kinetic energy E_K from the surface of star B.

The body then arrives at the surface of the star A.

(a) Define *gravitational potential* at a point.

.....
.....
.....
.....

.....
.....
.....[1]

(b) Use Fig. 5.2 to explain whether the kinetic energy of the body when it arrives at the surface of star A is less than, equal to, or larger than E_k.

.....
.....
.....
.....

.....
.....
.....
.....

.....
.....
.....[2]

(c) State and explain the distance x at which the resultant gravitational field strength due to the two stars is zero.

.....
.....
.....
.....

.....
.....
.....
.....

.....
.....
.....[2]

(d) Determine the ratio $\frac{\text{average density of star A}}{\text{average density of star B}}$.

ratio = ... [3]

[Total: 8]