

- 1 Ganymede is a moon of mass 1.50×10^{23} kg and radius 2.64×10^6 m orbiting the planet Jupiter of mass 1.90×10^{27} kg as shown in Fig. 1.1. The orbital period of Ganymede is 171.6 hours.

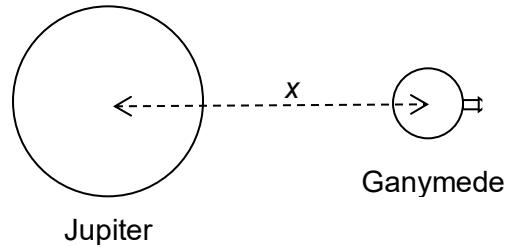


Fig. 1.1

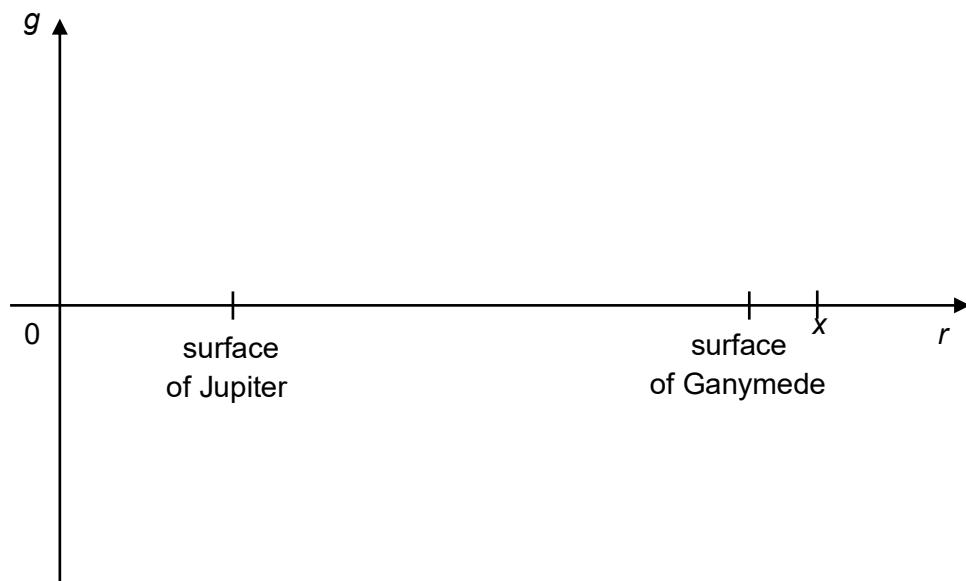
- (a) (i) Show that the distance x between the centres of Jupiter and Ganymede is 1.07×10^9 m. Explain your working.

[2]

- (ii) S is a point between Jupiter and Ganymede where the resultant gravitational field strength is zero. Determine the distance from the centre of Jupiter to point S.

distance = m [2]

- (iii) On the axes below, sketch a graph from the surface of Jupiter to the surface of Ganymede to show the variation of gravitational field strength g with distance r from the centre of Jupiter. [2]



- (b) A rock is positioned on the surface of Ganymede at the point furthest from Jupiter, as shown in Fig. 1.2. The rock is launched with an escape velocity v for it to reach infinity, far away from Jupiter and Ganymede.

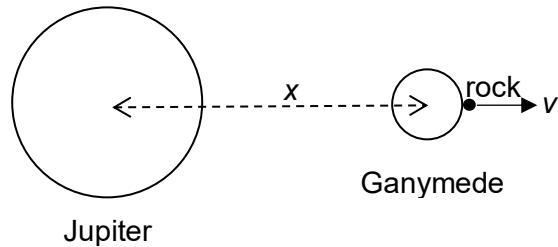


Fig. 1.2

- (i) Show that the gravitational potential at the position of the rock in Fig. 1.2 is $-1.22 \times 10^8 \text{ J kg}^{-1}$.

[2]

(ii) Calculate the escape velocity v .

$$v = \dots \text{ m s}^{-1} [2]$$

[Total: 10]