**Answer on Question #61299-Physics-Mechanics-Relativity**

A satellite of mass 2.00X10^4 kg is placed in orbit 6.00X10^5 m above the surface of Jupiter.

a) Determine the force of gravitational attraction between the satellite and Jupiter.

b) What must be the orbital speed of the satellite?

c) What must be the value of the gravitational field constant, g, at the location of the satellite?

d) One of the moons of Jupiter is Europa. Its period of motion is 3.07X10^5 s. What must be the radius of its orbit?

e)If a satellite was placed in orbit around Europa at a height of 100.0 km above the surface of Europa, and the period of motion was 7.58X10^3s, what must be the mass of Europa? The radius of the moon Europa is 1.57X10^6 m.

**Solution**

a)

$$F = 6.67 \cdot 10^{-11} \frac{(2.00 \cdot 10^4)(1.90 \cdot 10^{27})}{(6.00 \cdot 10^5)^2} = 7.04 \cdot 10^9 N$$

b)

$$F = \frac{mv^2}{r}$$

$$v^2 = \frac{Fr}{m}$$

$$v = \sqrt{\frac{Fr}{m}} = \sqrt{6.67 \cdot 10^{-11} \frac{(1.90 \cdot 10^{27})}{6.00 \cdot 10^5}} = 7.60 \cdot 10^5 \frac{m}{s}.$$

c)

$$g = \frac{F}{m} = 6.67 \cdot 10^{-11} \frac{(1.90 \cdot 10^{27})}{(6.00 \cdot 10^5)^2} = 3.52 \cdot 10^6 \frac{m}{s^2}$$

d)

$$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$$

$$r = \sqrt[3]{\frac{GM}{4\pi^2} T^2} = \sqrt[3]{\frac{(6.67 \cdot 10^{-11})(1.90 \cdot 10^{27})}{4\pi^2} (3.07 \cdot 10^5)^2} = 6.71 \cdot 10^8 m.$$

e)

$$M = \left(\frac{4\pi^2}{G}\right) \frac{r^3}{T^2} = \left(\frac{4\pi^2}{(6.67 \cdot 10^{-11})}\right) \frac{(1.57 \cdot 10^6 + 1.00 \cdot 10^5)^3}{(7.58 \cdot 10^3)^2} = 4.80 \cdot 10^{22} kg.$$