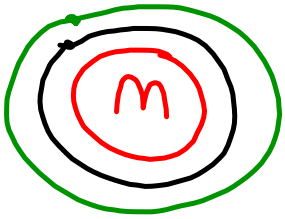
1. The satellites of Mars, Phobos and Deimos, have mean orbital radii of 9.38×10^6 m and 2.35×10^7 m, respectively. The orbital period of Deimos is 30.30 hr. Use Kepler's third law of planetary motion to predict the period of Phobos.



$r_A = 9.38 \times 10^6 m$ (Phobos)

$r_B = 2.35 \times 10^7 m$ (Deimos)

$T_A = ?$

$T_B = 30.30h$

$$\left(\frac{T_A}{T_B}\right)^2 = \left(\frac{r_A}{r_B}\right)^3$$

$$\left(\frac{T_A}{30.30h}\right)^2 = \left(\frac{9.38 \times 10^6 m}{2.35 \times 10^7 m}\right)^3$$

$$\frac{T_A^2}{918.09h^2} = \frac{8.25 \times 10^{20} m^3}{1.30 \times 10^{22} m^3}$$

$$1.30 \times 10^{22} T_A^2 = 7.57 \times 10^{23}$$

$$T_A^2 = 58.26$$

$$T_A = 7.63h$$

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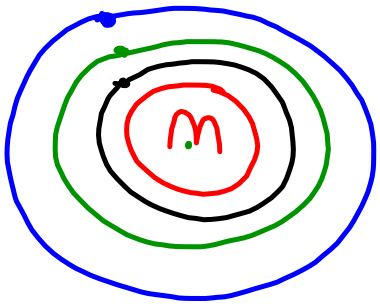
2. Use Kepler's third law to predict the altitude of a Martian satellite that would have a period of 24.0 h.



$r_A =$ [ ]

$r_B = 2.35 \times 10^7 m$ (Deimos)

$T_A = 24 h$

$T_B = 30.30 h$

$$\left(\frac{T_A}{T_B}\right)^2 = \left(\frac{r_A}{r_B}\right)^3$$

$$\left(\frac{24}{30.30}\right)^2 = \left(\frac{r_A}{2.35 \times 10^7 m}\right)^3$$

$576 = r_A^3$

$918.09 = 1.30 \times 10^{22}$

$r_A = 2.01 \times 10^7 m$

$918.09 r_A^3 = 7.488 \times 10^{24}$

$r_A^3 = 8.16 \times 10^{21}$

r_A^3

5. What is the gravitational attraction between two protons ($m_{proton} = 1.67 \times 10^{-27}$ kg) at a distance of 5.0×10^{-15} m, about the diameter of the nucleus of an atom?

$$F = \frac{G m_1 m_2}{r^2} = \frac{(6.67 \times 10^{-11})(1.67 \times 10^{-27}\ kg)^2}{(5.0 \times 10^{-15}\ m)^2}$$

$$F = 7.44 \times 10^{-36}\ N$$

6. Two bowling balls, each with a mass of 6.80 kg, are 1.00 m apart. Compare the weight of the first ball with the gravitational force exerted on it by the second ball.

$$F = \frac{G m_1 m_2}{r^2} = \frac{(6.67 \times 10^{-11})(6.80\,kg)^2}{(1\,m)^2}$$

$$F = 3.08 \times 10^{-9}\,N$$