Newton's Law of Universal Gravitation pg 263 #1

$$F_g = G \cdot \left(\frac{m_1 \cdot m_2}{r^2} \right)$$

$$\text{Gravitational Force} = \text{constant} \times \frac{\text{mass 1} \times \text{mass 2}}{\left(\text{distance between center of masses}\right)^2}$$

* $G = 6.673 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$

- This formula is used to calculate gravitational forces between any two particles.
- This law is an example of an inverse-square law. The force between two masses decreases as the masses move further apart.

Pg. 264 Sample Problem 7I

Find distance

$m_1 = 0.3\ kg$

$m_2 = 0.4\ kg$

$F_g = 8.92 \times 10^{-11} N$

$G = 6.673 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$

Formula

$$F_g = G \cdot \left(\frac{m_1 \cdot m_2}{r^2} \right)$$

$$8.92 \times 10^{-11} N = 6.673 \times 10^{-11} \frac{N \cdot m^2}{kg^2} \left(\frac{0.3 \times 0.4}{r^2} \right)$$

$$r^2 = \frac{6.673 \times 10^{-11} \frac{N m^2}{kg^2} \left(0.3_{kg} \times 0.4_{kg}\right)}{8.92 \times 10^{-11} N}$$

$r^2 = 0.0897\ m^2$ ← $\sqrt{\ }$ Square root

$[r = 0.299 \approx 0.3\ m]$

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#1. $m_1 = 0.8\,kg$

$m_2 = 0.8\,kg$

Formula

$$F_g = G \cdot \left(\frac{m_1 \times m_2}{r^2}\right)$$

$F_g = 8.92 \times 10^{-11}\,N$

$G = 6.673 \times 10^{-11}\,\frac{N \cdot m^2}{kg^2}$

$R = \underline{?\,m}$

$$8.92 \times 10^{-11}\,N = 6.673 \times 10^{-11}\,\frac{N \cdot m^2}{kg^2}\left(\frac{0.8\,kg \times 0.8\,kg}{r^2}\right)$$

$$r^2 = \frac{6.673 \times 10^{-11}\,\frac{N \cdot m^2}{kg^2}\,(0.8\,kg \times 0.8\,kg)}{8.92 \times 10^{-11}\,N}$$

$r^2 = 0.479\,m^2$

$[r = 0.692\,m]$

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#3

2. $m_1 = 6.4 \times 10^{23}\ kg$

$m_2 = 9.6 \times 10^{15}\ kg$

$F_g = 4.6 \times 10^{15}\ N$

$G = 6.673 \times 10^{-11}\ \frac{N \cdot m^2}{kg^2}$

$r =$ _____ m

Formula

$$F_g = G \cdot \left(\frac{m_1 \times m_2}{r^2}\right)$$

$$4.6 \times 10^{15}\ N = 6.673 \times 10^{-11} \cdot \left(\frac{6.4 \times 10^{23}\ kg \times 9.6 \times 10^{15}\ kg}{r^2}\right)$$

$$r^2 = 6.673 \times 10^{-11}\ \frac{N \cdot m^2}{kg^2} \left(\frac{6.4 \times 10^{23}\ kg \times 9.6 \times 10^{15}\ kg}{4.6 \times 10^{15}\ N}\right)$$

$$r^2 = 8.913 \times 10^{13}\ m^2$$

$$r = 9440766.365\ m \approx 9.4 \times 10^{6}\ m$$