

GRAVITATIONAL FIELDS QUIZ – Version 2

1. A satellite, with a mass of 1000.0 kg, orbits a faraway planet, with a radius of 4.5×10^6 m. The satellite experiences a force of gravity equal to 525 N. If the planet has a mass of 7.56×10^{30} kg, determine the height of the satellite above the surface of the planet.

$$m = 1000.0 \text{ kg}$$

$$r_p = 4.5 \times 10^6 \text{ m}$$

$$F_g = 525 \text{ N}$$

$$M = 7.56 \times 10^{30} \text{ kg}$$

$$h = ?$$

$$F_g = \frac{GMm}{r^2} \quad (1)$$

$$F_g = \frac{GMm}{(r_p + h)^2} \quad (1)$$

$$\cancel{F_g} \implies (r_p + h)^2 = \frac{GMm}{F_g}$$

$$\sqrt{(r_p + h)^2} = \sqrt{\frac{GMm}{F_g}}$$

$$r_p + h = \sqrt{\frac{GMm}{F_g}} \quad (1)$$

$$h \cancel{=} \cancel{=} = \sqrt{\frac{GMm}{F_g}} - \cancel{\frac{1}{2}} r_p$$

$$h \cancel{=} = \sqrt{\frac{(6.67 \times 10^{-11} \text{ N m}^2 / \text{kg}^2)(7.56 \times 10^{30} \text{ kg})(1000.0 \text{ kg})}{525 \text{ N}}} - r_p$$

$$h = 3.1 \times 10^{10} \text{ m} \quad (1)$$