A certain hypothetical planet has a radius of 500 km and a surface gravity of 3.0 meters/sec². (a) What is the gravitational acceleration 100 km above the surface of the planet? (b) What is the mass of the planet?

(a) \[ g_s = -\frac{GM}{r_s^2} \text{ and } g_r = -\frac{GM}{r^2}, \text{ where } r_s = \text{radius of the planet} \]

\[ g_r = \left(\frac{r_s}{r}\right)^2 g_s = \left(\frac{500 \text{ km}}{600 \text{ km}}\right)^2 (3 \text{ m/s}^2) \]

\[ g_r = 2.08 \text{ m/s}^2 \]

(b) \[ M = \frac{g_s r_s^2}{G} = \frac{(3 \text{ m/s}^2)(500 \times 10^3 \text{ m})^2}{(6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2)} \]

\[ M = 1.12 \times 10^{22} \text{ kg} \]