

Friday, February 7, 2025

Example 1: Force of Earth on an object of mass m at the surface.

According Newton: $F_{E \rightarrow m} = G \frac{M_E m}{r^2} = \frac{G M_E m}{R_E^2}$ (1)

$r = \text{Earth-object} = R_E = \text{radius of the Earth distance}$

According to Newton's 2nd Law: $F_{E \rightarrow m} = m a_m$ (2)

combine (1) & (2): $m a_m = F_{E \rightarrow m} = \frac{G M_E m}{R_E^2}$

m cancels on both sides !!!

$\Rightarrow a_m = \frac{G M_E}{R_E^2}$

$M_E = 5.972 \times 10^{24} \text{ kg}$

$R_E = 6371 \times 10^3 \text{ m}$

a_m is independent of the mass m

$$\Rightarrow a_m = \frac{(6.6743 \times 10^{-11}) (5.972 \times 10^{24})}{(6371 \times 10^3)^2}$$

$$\Rightarrow a_m = 9.82 \text{ m/s}^2 = g$$

acceleration due to gravity on Earth