A man weighs 750 N on the surface of the Earth. What would be his weight when standing on the Moon? The masses of the earth and the moon are respectively, 5.98×10^{24} kg and 7.36×10^{22} kg. Their radii are respectively 6.37×10^{3} km and 1.74×10^{3} km.

Solution.

We write the Newton`s law of universal gravitation:

$$F = G\frac{m_1 m_2}{r_{1,2}}$$

where G is the is the gravitational constant. Particularly, for a man on the Earth surface,

$$F_E = G\frac{m M_E}{R_E},$$

and on the Moon surface:

$$F_M = G\frac{m M_M}{R_M},$$

where m is the mass of a man, $M_{E,M}$ and $R_{E,M}$ are the masses and radii of the Earth and the Moon respectively. Dividing these equations one to another, we obtain

$$F_M = F_E\frac{M_M R_E^2}{M_E R_M^2}$$

Putting figures into the final equation, we have:

$$F_M = 700\,N\,\frac{7.36\times10^{22}\,kg\left(6.37\times10^{3}\,km\right)^2}{5.98\times10^{24}\,kg\left(1.74\times10^{3}\,km\right)^2} = 123.7\,N.$$

Answer.

$F_M = 123.7\,N.$