Answer on Question #51973 – Physics – Other

Question.

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,5.98×1024kg and 7.36×1022kg. Their radii are respectively6.37×103km and 1.74×103km.

Given:

$W_E = 750\ N$

$M_E = 5.98 \cdot 10^{24}\ kg$

$M_M = 7.36 \cdot 10^{22}\ kg$

$R_E = 6.37 \cdot 10^3 km$

$R_M = 1.74 \cdot 10^3\ km$

Find:

$W_M = ?$

Solution.

Weight of the mass $m$is defined as:

$$W_k = mg_k,$$

whereW_k is the weight on the gravitational object$k$; g_k is the gravitational acceleration due to object k.

By definition the gravitational acceleration is:

$$g_k = G\frac{M_k}{R_k^2}$$

Therefore,

$$m = \frac{W_E}{g_E} = \frac{W_M}{g_M} \rightarrow W_M = W_E\frac{g_M}{g_E} = W_E\frac{M_M R_E^2}{R_M^2 M_E}$$

Finally,

$$W_M = W_E\frac{M_M}{M_E}\left(\frac{R_E}{R_M}\right)^2$$

Calculate:

$$W_M = W_E\frac{M_M}{M_E}\left(\frac{R_E}{R_M}\right)^2 = 750 \cdot \frac{7.36}{598} \cdot \left(\frac{6.37}{1.74}\right)^2 = 750 \cdot 0.0123 \cdot 13.4 = 750 \cdot 0.165 = 124\ N$$

Answer.

$$W_M = W_E\frac{M_M}{M_E}\left(\frac{R_E}{R_M}\right)^2 = 124\ N$$