Answer on Question 69734, Physics, Other

Question:

A bottle lying on the windowsill falls off and takes $4.95\ s$ to reach the ground. The distance from the windowsill to the ground is $120.0\ m$. Find the time the bottle would take to land if it were to fall the same distance on the Moon instead of the Earth. (Note: Acceleration due to gravity on the Moon is $1/6$ that on the Earth.)

Solution:

We can find the time the bottle would take to land if it were to fall the same distance on the Moon instead of the Earth from the kinematic equation:

$$d = v_0 t + \frac{1}{2} g_{Moon} t^2,$$

here, d is the distance that the bottle falls from the windowsill to the ground, $v_0 = 0$ is the initial velocity of the bottle, $g_{Moon} = (1/6) \cdot g_{Earth}$ is the acceleration due to gravity on the Moon, $g_{Earth} = 9.8\ m/s^2$ is the acceleration due to gravity on the Earth and t is the time the bootle needs to land on the Moon.

Then, from this equation we can find t:

$$t = \sqrt{\frac{2d}{g_{Moon}}} = \sqrt{\frac{12d}{g_{Earth}}} = \sqrt{\frac{12 \cdot 120\ m}{9.8\ \frac{m}{s^2}}} = 12.12\ s.$$

Answer:

$t = 12.12\ s.$