Answer on Question #55222-Physics-Mechanics-Kinematics-Dynamics

At what altitude above the earth's surface would the acceleration due to gravity be 4.9ms−2? Assume the mean radius of the earth is 6.4×106 meters and the acceleration due to gravity 9.8ms−2 on the surface of the earth.

Solution

The velocity of a freely falling body increased at a steady rate i.e., the body had acceleration.

This acceleration is called acceleration due to gravity g.

Let a body of mass m be placed on the surface of the Earth:

$$g = \frac{GM}{R^2}.$$

where M is the mass of the Earth, R is the radius of the Earth and G is the gravitational constant.

Let the body be now placed at a height h above the Earth's surface. Let the acceleration due to gravity at that position be g'.

Then,

$$g' = \frac{GM}{(R+h)^2}$$

For comparison, the ratio between g' and g is taken

$$\frac{g'}{g} = \left(\frac{R}{R+h}\right)^2$$

Thus,

$$h = R\left(\sqrt{\frac{g}{g'}} - 1\right) = 6.4 \cdot 10^6 \cdot \left(\sqrt{\frac{9.8}{4.9}} - 1\right) = 2.65 \cdot 10^6\ m$$

Answer: $2.65 \cdot 10^6\ m$