

Answer on Question #67607, Physics / Mechanics | Relativity

At what depth from Earth surface when gravitational acceleration becomes three fourth as earth value.

Answer:

The gravitational acceleration of a body is given by:

$$g = G \frac{M}{r^2}$$

Where G is the gravitational constant, M is the mass of the body, r is the distance

$$g = \frac{3}{4}g_0$$

$$\frac{3}{4}g_0 = G \frac{M}{r^2}$$

We are looking for the distance (or height)

$$r = \sqrt{\frac{4GM}{3g_0}}$$

$$r = \sqrt{\frac{4 \times 6.67 \cdot 10^{-11} \times 5.97 \cdot 10^{24}}{3 \times 9.8}}$$

$$r = 7360485$$

The surface of the Earth is about 6371000 meters from the inner core. We subtract the two numbers, the result will be 993384. That will be 993.384 kilometers above the surface.

Since, the value of acceleration due to gravity at a height is same as the value of acceleration due to gravity at a depth.

$$d = 2h$$

$$d = 2 \times 993.384 \text{ km} = 1986.768 \text{ km}$$

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