

(1) The ratio of the effect of the Moon on ocean tides to the effect of the Sun is approximately $7/3$. Using that fact and anything you have observed with your eyes, find the ratio of the mean density of the Moon to that of the Sun.

The tidal effect is proportional to the gradient of the gravitational field, that is to M/D^3 , where M is the mass of the body and D its distance from Earth. The mass M is proportional to ρR^3 , where R is the radius of the body and ρ is its mean density. Thus the tidal effect is proportional to $\rho R^3/D^3$. We observe in obvious ways that R/D is nearly the same for the Sun and Moon. Hence the stated ratio of tidal effects, $7/3$, must also be the ratio of the mean densities. (In fact the mean density of the Moon, 3.34 g cm^{-3} , is 2.37 times that of the Sun.)