

16. (a) The gravitational acceleration at the surface of the Moon is  $g_{\text{moon}} = 1.67 \text{ m/s}^2$  (see Appendix C). The ratio of weights (for a given mass) is the ratio of  $g$ -values, so  $W_{\text{moon}} = (100 \text{ N})(1.67/9.8) = 17 \text{ N}$ .
- (b) For the force on that object caused by Earth's gravity to equal 17 N, then the free-fall acceleration at its location must be  $a_g = 1.67 \text{ m/s}^2$ . Thus,

$$a_g = \frac{GM_E}{r^2} \implies r = \sqrt{\frac{GM_E}{a_g}} = 1.5 \times 10^7 \text{ m}$$

so the object would need to be a distance of  $r/R_E = 2.4$  “radii” from Earth's center.