14. We follow the method shown in Sample Problem 14-3. Thus,

$$a_g = \frac{GM_E}{r^2} \quad \Longrightarrow \quad da_g = -2\frac{GM_E}{r^3}dr$$

which implies that the change in weight is

$$W_{\text{top}} - W_{\text{bottom}} \approx m\,(da_g) \ .$$

But since $W_{\text{bottom}} = GmM_E/R^2$ (where R is Earth's mean radius), we have

$$mda_g = -2\frac{GmM_E}{R^3}dr = -2W_{\text{bottom}}\frac{dr}{R} = -2(530\,\text{N})\frac{410\,\text{m}}{6.37\times 10^6\,\text{m}}$$

which yields -0.068 N for the weight change (the minus sign indicating that it is a decrease in W). We are not including any effects due to the Earth's rotation (as treated in Eq. 14-12).