Physics Problems
Solve the following problems. As before, provide a list of your variables and their meaning. Be careful with dimensions when writing equations.

1. How much does a 180-pound man weigh on the moon? It may be helpful to know that $g_{\text{earth}} = 9.8 \text{ m/s}^2$ and $g_{\text{moon}} = 1.6 \text{ m/s}^2$.

2. Hooke’s Law states that the force needed to stretch a spring a distance $s$ is given by $F = ks$, where $k$ is the spring constant. If it takes 5 Newtons to stretch a spring 10 cm beyond its natural length, what is $k$ for this spring?

3. Work is computed by $W = F \cdot d$, where $F$ is the force acting on the object over a distance $d$. How much work is done raising a 4-kilogram mass to a height of 16 meters above the ground?

4. Write a formula that will use the density, $\rho$, of an object and its volume, $V$, to calculate the weight of an object.

5. How much does the water in a circular-right cone of height 20 feet and radius 15 feet weigh? The density of water is $\rho_{\text{water}} = 62.4 \text{ lb/ft}^3$.

6. The density of the earth’s crust is about $\rho_{\text{crust}} = 3000 \text{ kg/m}^3$, and the radius of the earth is about 6,378 kilometers. If the crust is about 20 kilometers thick, on average, then how much does the earth’s crust weigh?

7. Write a formula that relates pressure, $P$, force, $F$, and area, $A$. Make sure you know the various units for pressure.

8. The pressure at the bottom of the earth’s mantle is about 140 GPa (giga-Pascals, 140,000,000,000 Pa). If this pressure were applied over the surface of South Dakota, about 75885 square miles, what force would be applied on the state? Be careful with units.

9. Average barometric pressure in Rapid City is 26.5 inHg (inches of mercury). How much of a force does this exert on the top of your head? Assume your head is half of a sphere with diameter 8 inches. You will need the surface area of a sphere, which is in the formula sheets located in the front of your textbook. Be careful with units.

10. Consider an Olympic-size pool with dimensions 50 meters by 25 meters by 2 meters. If the pool were filled with mercury ($\rho_{\text{mercury}} = 13546 \text{ kg/m}^3$), how much more would the mercury weigh than if the pool were filled with water? (I wanted to do this with Jello, but no one seems to know its density.)