Complete these studio problems, and demonstrate your answers to one of the instructors by the end of class today.

1. Determine the volume, in both cubic meters (m$^3$) and liters (L), of 1 mole of an ideal gas at standard temperature and pressure. State your answer to three significant figures.

   Write the ideal gas law.
   Use the value of R from your book, and Wikipedia values for P and T.
   Do the calculation.

2. A marathon foot race has a defined length of exactly 26 miles and 385 yards. Convert this length into kilometers, using the correct number of significant figures.

   Convert 26 miles to yards.
   Express the total length in yards.
   Convert the length to inches.
   Convert inches to cm to km.

3. An average hurricane (typhoon) drops approximately 6.4 cubic miles of liquid water per day when it makes landfall. As the water condenses as rain, it gives off a great deal of heat, 1060 BTU per lb of water. The density of water is 62.4 lb per cubic foot.

   Calculate the total heat energy released by the hurricane in joules (J) during three days of rain. Compare this value to the yearly electricity consumption of China (2014 estimate: $5.46 \times 10^9$ MW-h). How many years of electricity consumption are equivalent to the energy of one hurricane?

4. An object of mass $m$ has potential energy given by $PE = mgh$, where $g$ is the gravitational acceleration and $h$ is the height of the object above the ground. When dropped in a vacuum, the potential energy is converted to kinetic energy, given by $KE = \frac{1}{2}mv^2$, where $v$ is the velocity when the object hits the ground.

   Show that $v = k\sqrt{h}$. Determine the value and units of the constant $k$ (to 3 significant digits) when:

   $h$ is given in m, $v$ is expressed in m/s
   $h$ is given in in (inches), $v$ is expressed in ft/s
   $h$ is given in mm, $v$ is expressed in mi/h (miles per hour)

   Use the conversion factors in Appendix A, Part 1, and the standard value for $g$ given in Appendix A, Part 3 of the text. **Verify your results!**