Do the following problems and be prepared to discuss them in class.

1. Suppose that the mean density of a cometary nucleus is 2 g/cm^3.
a) How much mass does a typical nucleus have if it were modeled as a sphere of radius 1 km?
b) How much mass is contained in comets in total if there are a billion such objects?
c) Compare your answer in Problem 1b with the mass of the Earth.
$M_{\rm comets}/M_\oplus =$

2. As in the crater lab, let's simplify things by assuming that a meteoroid's kinetic energy is completely converted into excavating the hemispherical crater. Show that the diameter of the resulting crater scales as the incoming kinetic energy to the $\frac{1}{4}$ power.

3. Imagine a comet strikes the Earth with speed equal to the orbital speed of the Earth around the Sun. Assume the comet's mass is 10% that found in Problem 1a. Assume one megaton of TNT will blast a crater of diameter 1 km.
a) Determine the kinetic energy of the comet in Joules.
b) Express your answer in megatons of TNT.
c) Use the result from Problem 2 to compute the anticipated diameter of the crater formed.