The *Tycho* crater is a recent impact crater with a diameter of 85 km in the southern lunar highlands. It is believed that the *Tycho* crater's age was determined by Apollo 17, since is thought that the *Tycho* impact led directly to the landslide that was sampled by Apollo 17.

The *Tycho* crater is about 2200 km (2200 km = 2,200,000 meters) from Apollo 17 site. In this exercise we are going to assume that all the material was ejected from the *Tycho* crater at a 45 degree angle (it is not too bad an assumption and it makes the math simpler).

The distance (d) that material was thrown from the crater and the maximum height (h) the material is launched can be found by the formulas:

$$d = \frac{v^2}{g} \qquad\qquad h = \frac{v^2}{4g}$$

**Problem #1**: What is the velocity (v) you have to ejecta material from *Tycho* to make it to the Apollo 17 site? Express your answer in m/s and mph (1 m/s = 2.2 mph). For the Moon, g = 1.62 m/s². Please show **ALL** of your work (including units).

**Problem #2**: How does this velocity compare to the escape velocity of the Moon? (Moon escape velocity = 2,380 m/s)

**Problem #3**: What is the maximum height reached by the material launched to the Apollo 17 site? Please show **ALL** of your work (including units).

**Problem #4**: How does this compare to the height of Apollo 17 command module's orbit of 130 km (130,000 m) from the lunar surface.

The time (t) it takes this material to travel to the site is given by:

$$t = \frac{\sqrt{2} \cdot v}{g}$$

**Problem #5**: Calculate how long is takes material to fly from *Tycho* to the Apollo 17 site. Express your answer in seconds and minutes. Please show **ALL** of your work (including units).

**Due: Wed May 26 in class (Thursday is fine too, if you want to drop it off at my office)**