

Hints for Lab No. 9 – Impact Craters

Under “Your Report,” there are 6 questions. Here are some hints:

3) (Extra Credit) For this question, first look at the equation for the volume of a sphere:

$$V = \left(\frac{4}{3} \times \pi\right) \times R^3$$

where V is the volume, R is the radius, and pi is just a constant. The radius is one-half of the diameter.

Note: A “constant” is a number in an equation that *never* changes. So, in this case, $(4/3 \times \pi)$ is a constant and its value will never change no matter what V and R are.

Now, if the material is homogeneous, then the density of the material is *constant* throughout the sphere.

The equation for density is:

$$\rho = \frac{M}{V}$$

where M is mass and V is volume.

So, we can multiply both sides by V, and we get:

$$M = V \times \rho$$

Now, we can substitute the equation for volume into this equation, and the result is:

$$M = \left(\frac{4}{3} \times \pi \times \rho\right) \times R^3$$

or

$$M = C \times R^3$$

where C is a *constant*.

So, this shows that the mass varies with the cube of the radius, which also means it varies with the cube of the diameter of the impactor.

Now, you just need a couple more steps, and you can answer the question...

6) For this question, you need to use ratios:

First, look at the picture on page 9.2 of the lab manual, and measure the size of the two craters, using a ruler.

Now, you can set up an equation with one ratio on each side:

$$\frac{D_E}{D_C} = \frac{P_E}{P_C}$$

So, D_E and D_C represent the real diameters of Eratosthenes and Copernicus, and P_E and P_C represent the diameters of Eratosthenes and Copernicus in the picture.

Now, you multiply both sides by D_C , and you get:

$$D_E = \frac{P_E}{P_C} \times D_C$$

In the question, you are told that D_C is 96 km, and you measure P_E and P_C with a ruler. You plug these numbers into the formula, and you get D_E in kilometers.

Now, the second part of the question assumes that you obtained a straight line when you plotted your data points for the *first* part of the lab. Since this means that there is a *linear* relationship between diameter of impactor and diameter of crater, you can use the same method that I just used above to find the size of the impactor that created Eratosthenes. (Hint: the size of the impactor that created Eratosthenes is *smaller* than the impactor that created Copernicus).