Your Exoplanet Name: _____
Did you collaborate with anyone on this homework? YES NO
If yes, what is their exoplanet name and on what questions did you collaborate?

Prelab 4: Cratering

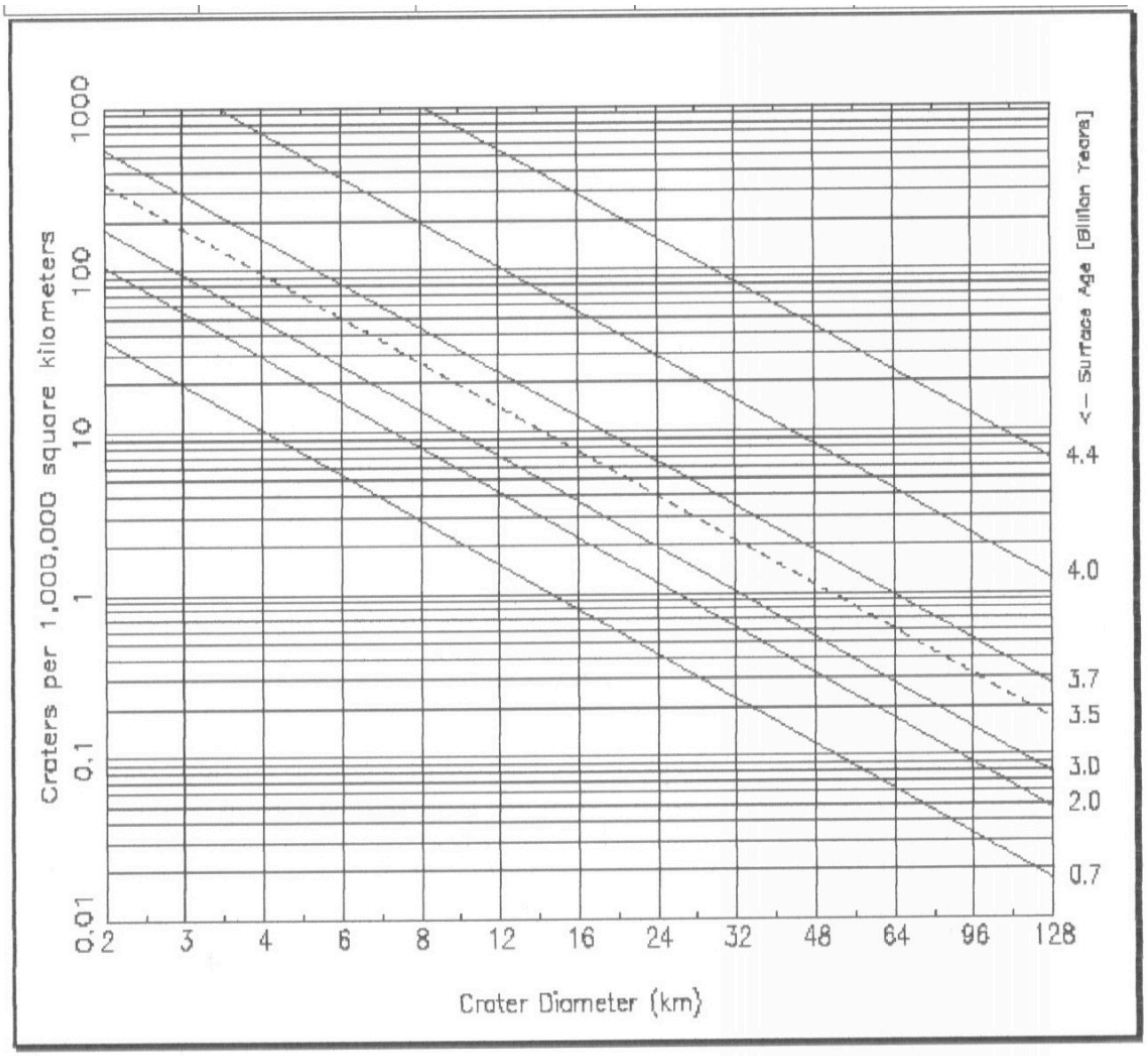
Due Friday, October 4 at the start of class

Please write legibly or type your answers. Illegibile assignments will not be graded

1. The following problem looks at the rate at which the Earth gains and loses mass each year.
    a. The Earth gains about 50,000 metric tons from meteorite impacts every year. How much is this in Earth masses (the mass of Earth is 6×10^{24}kg)?
    b. The Earth loses 3 kg of gas from its atmosphere per second due to the solar wind's stripping of the upper atmosphere. How much is this in Earth masses?
    c. Using your answers to questions 2 and 3, explain whether the Earth is gaining or losing mass with time.
    d. How many years will it take before the earth loses or gains 1% of its mass? Put this number into context relative to something else (e.g. the age of the earth, age of universe, etc.)

2. In this prelab, we will use the moon as a reference object to date the two Martian surfaces whose images are at the end of this Prelab. Answer the following questions to explore what this means.
    a. How are craters created? How are they erased?
    b. Why do we know the absolute age of areas of the lunar surface but not the Martian surface?
    c. Mars has a much more significant atmosphere than the Moon, as well as some evidence of liquid water on its surface/subsurface. Given this, and assuming that Mars and the Moon are cratered at an equal rate, do you expect the number of craters in a given area on Mars' surface will be greater than or less than the number on a Lunar surface of the same age? Why?

3. Below is a plot that you will be using in the in-class lab. You will place your data from Mars on this plot, but let's take a step back and try to understand it first.
    d. The graph has two y axes, which implies a direct relationship between the quantities they represent. In your own words, describe why the two are related.
    e. There are seven lines on the plot, each representing a measurement for a different region on the moon. What do these lines imply about the number of craters of varying sizes in a given region?

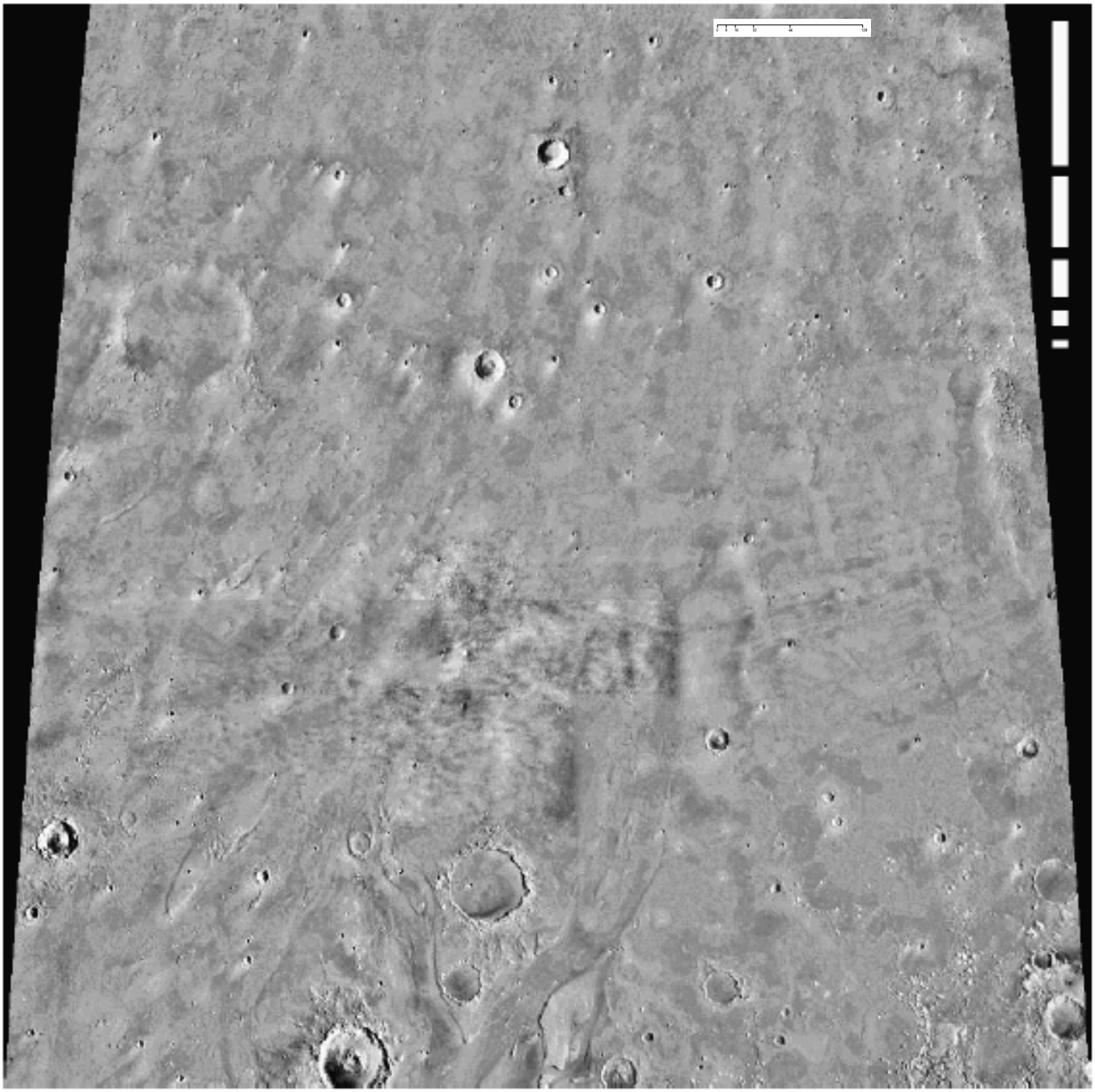


4. Fill in the table below using the two images at the end of this section. Note that printed at the lower left of each image are 5 white bars. The lengths of these bars represent 128, 64, 32, 16 and 8 km. There is also a scale bar at the top of each picture. You have a few options for making your measurements. You can cut out the scale bar or the white bars and line them up with craters in the image to measure their size. Alternatively, you can measure their size with a ruler and use that to judge how many craters of each size are present.

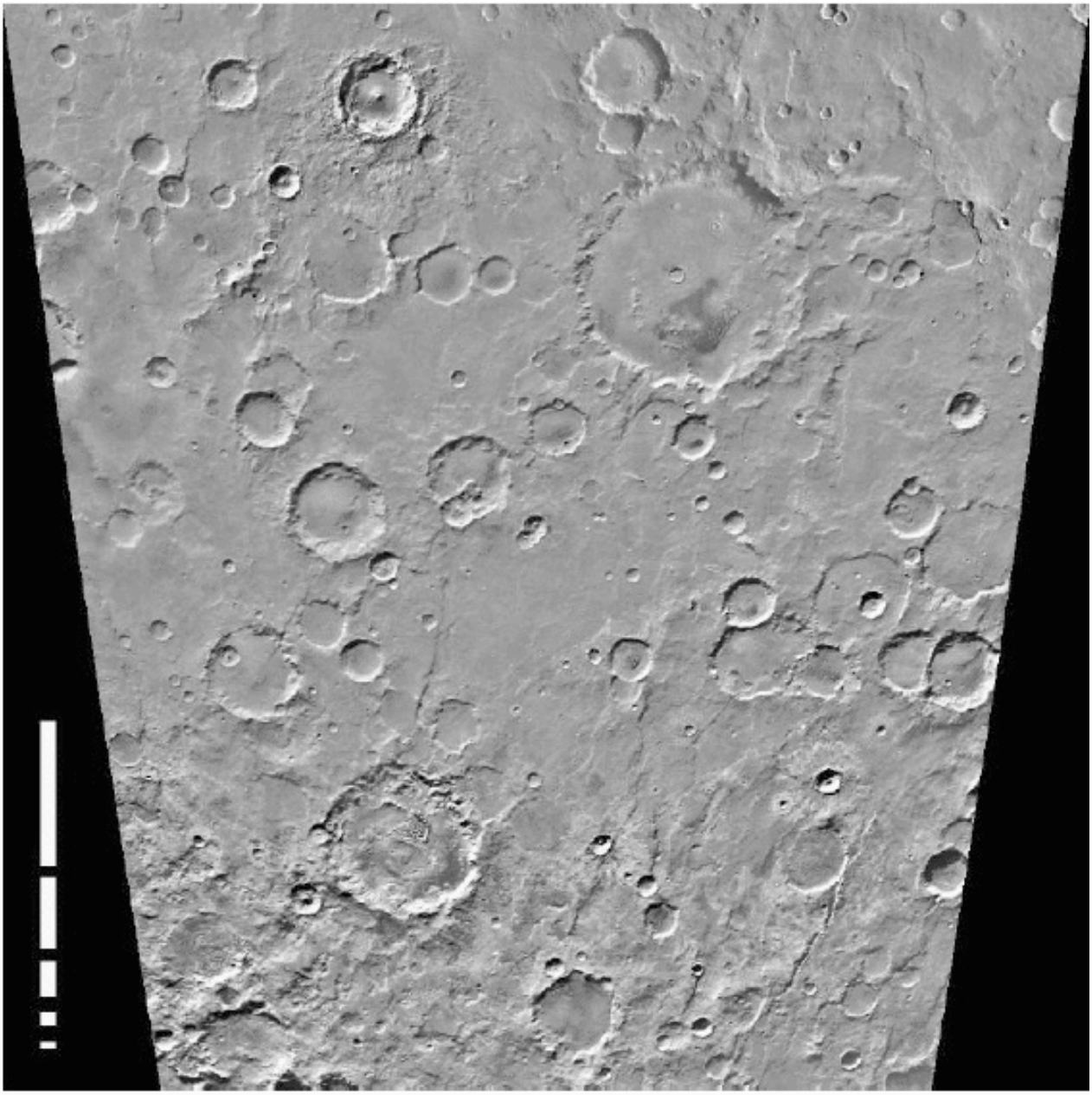
Tip 1: For the best data, you will want to mark the craters that you have already measured in each size range so that you don't double count or miss them. I recommend numbering the craters in different colors for each size range.

Tip 2: There may be no craters in some of the larger ranges for a given image. There will also be a limit to the smallest craters you can positively identify, so use common sense in your counting of the smaller ones. Try to fill in as many of the size ranges as you can with as many craters as you can positively identify. Record the numbers in the Crater Density Table.

Martian Crater Density Data Table		
	Northern Hemisphere	**Southern Hemisphere**
Crater Size Range (km)	**Number of craters in image**	**Number of craters in image**
<8		
8-16		
16-32		
32-64		
64-128		



Martian Northern Hemisphere - Image Size = 812,250 km^2



Martian Southern Hemisphere - Image Size = 774,250 km^2