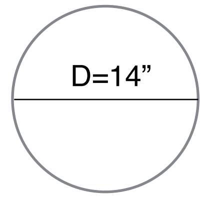
CLASS:____________________ **NAME:______________________________**

Prelab for T3: Astrophotography

Instructions*: This prelab should be done before coming to the observatory! Please read the instructions for the lab carefully first, so you know what you'll be doing at the observatory. Then, answer all the questions on this sheet, and bring the completed sheet to the observatory on your scheduled date.*

1. Light Collecting Power: One of the main advantages of using a telescope instead of just looking at the stars with your eyes is that you can collect a lot more light - if you think of a telescope as a light bucket, the larger the area of your bucket, the more light you will collect. How many more photons will a 14" diameter telescope collect than your two 4mm diameter pupils? **Show your work [1pt]**



2. Advantages of CCDs. Telescopes become even more useful when you attach a camera to them. Besides the obvious advantage of storing the information for later viewing, cameras enable you to detect much fainter objects because you can collect light for a much longer period of time. Your brain has a neurological "shutter speed" of ~0.1 seconds - after 0.1 seconds, the brain hits a refresh button, and you start forming a new image. In contrast, CCD cameras can leave their shutters open for hours. You can also add exposures to get total exposure times of days or even weeks. In this lab we'll mostly be taking modest exposures of ~30 seconds. How many more photons will the camera collect in a 30 sec exposure than if you were just peering through the telescope eyepiece? **Show your work [1pt]**

3. Now multiply the two factors you got in the previous questions to find out how many more photons a telescope+30second exposure on a camera will get you compared to your unaided eye.

   We will collect _______________ times more photons in one exposure **[1pt]**

CLASS:____________________ **NAME:**______________________________

Good to know: *When you increase your exposure time, you increase the number of photons collected, which makes objects appear brighter. It also means that you will be able to see things that were too faint to detect with lower exposure times, and that your images will have more detail. In other words, you will collect more information about the object you want to study. Because you can see fainter things, you'll also be able to see more distant objects!*

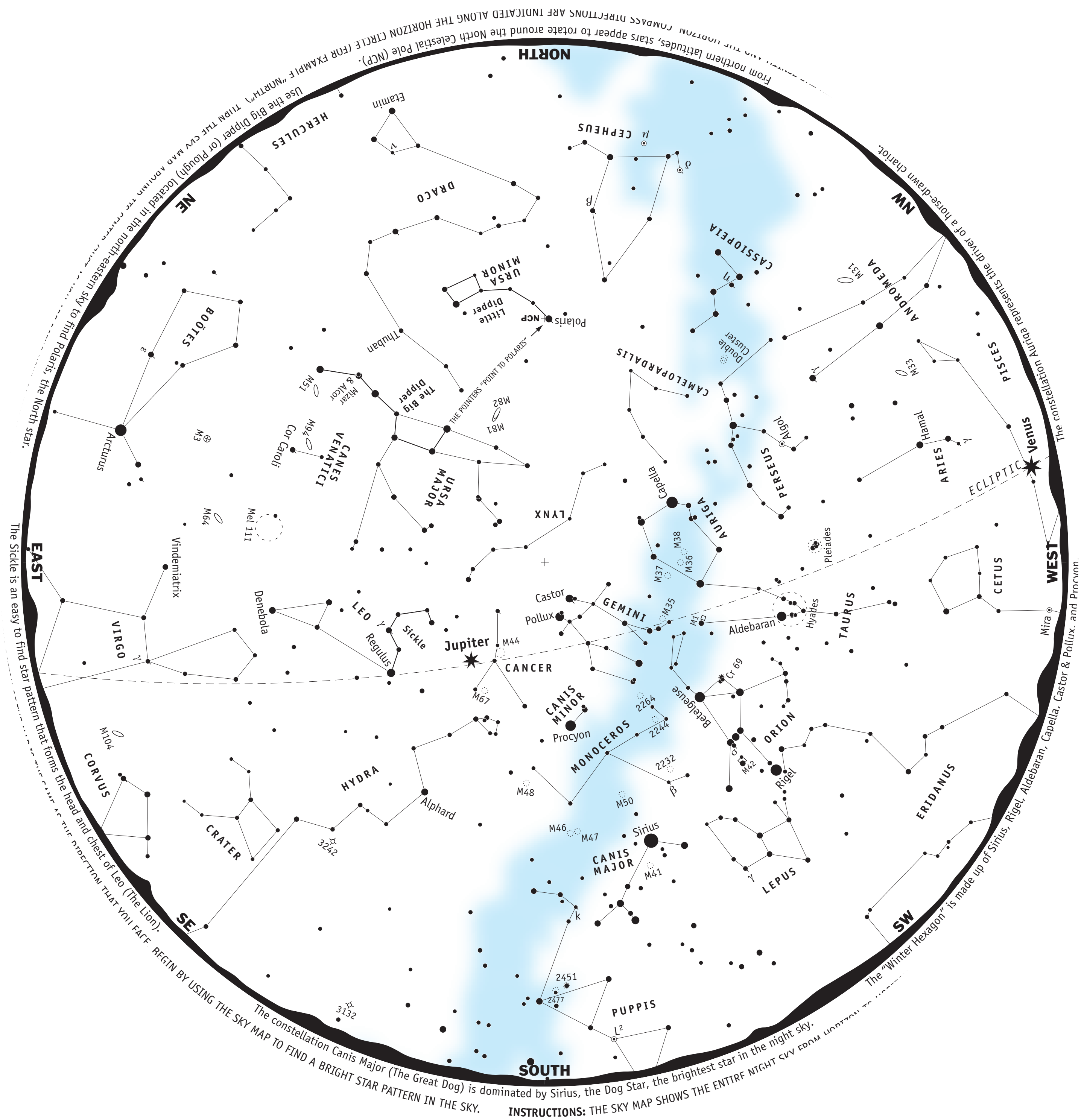
4. Color photography : Go to the following website: http://hubblesite.org/gallery/behind_the_pictures/meaning_of_color/ and learn about the color photography done by the Hubble space telescope (there are 5 pages total). In the final page, called "hubble's color toolbox", there is a color image of Mars. Explain, in your own words, why the polar cap appears white in the color image, whereas the rest of the planet appears reddish (hint: what do the individual R/G/B images look like?) **[1pt]**

Targets : Below is a list of possible targets for your observations. The first column shows the name of the object, the second, the type of object (planetary nebula, supernova remnant, star formation nebula, open star cluster, globular star cluster or galaxy). The third column shows what constellation you'll find the object in, and the fourth column shows the approximate distance from us, in kly (1 kly = 1000 light years).

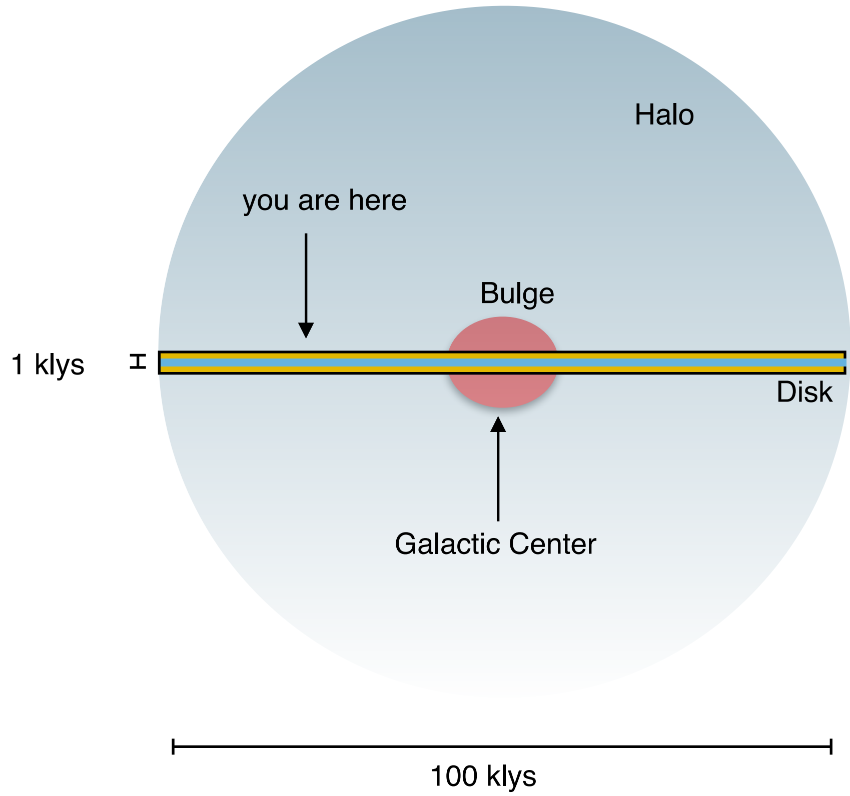
OBJECT	TYPE (PN/SNR/ SF/OC/GC/G)	CONSTELLATION	Distance from Earth (kly)	Disk/Halo/ Extra-galactic
M46	OC	Puppis	5	
M1	SNR	Taurus	7	
NGC 2392	PN	Gemini	4	
M51	G	Canes Venatici	23,000	
M104	G	Virgo	30,000	
M42	SF	Orion	1	
M3	GC	Canes Venatici	33	
NGC 457	OC	Cassiopeia	8	
NGC 2477	OC	Puppis	4	
M82	G	Ursa Major	12,000	

CLASS:____________________ **NAME:**______________________________

5. Find the objects (or the constellations they reside in) on the star chart below, and mark their locations. Color code your objects according to their distance: Use one color for objects that are <10 klyrs away, and one for objects that are > 10 klyrs away. Do you notice a trend? Do these two groups of objects have different distributions on the sky? Why do you think this is? [**2pts**]



CLASS:____________________ **NAME:**______________________________



6. Our galaxy has a very thin flat disk, about ~100,000 lys = 100 kly in diameter, and ~1kly thick. The Sun is a little more than half way out along the disk: the galactic center is ~28kly away in the constellation of Sagittarius. The galatic disk is embedded in a large, diffuse, halo. Based on this information, the figure at the top of this page, and the map from question 5, classify each object in the table as belonging to the disk, to the halo or as extra-galactic (residing outside the galaxy) [**1pt**]
7. Mark a possible location for M3 on the figure above. [1**pt**]
8. If you were to draw another galaxy representing M104 on this figure and you kept the distances to scale, how far away from our galaxy would it have to go ? 10 inches,10 feet, 100 feet, 1 mile away? **Show your work [2pt]**