Astrophotography

Description: Using a 35mm camera and a shutter cable or a digital SLR camera, you will take photographs of a number of objects including: several constellations, star trails, at least two deep-sky objects, a planet, and the moon.

Materials needed: 35mm camera with shutter cable and film OR digital SLR camera capable of taking at least a 30 minute exposure (may require an external remote), tripod

Resources:
Sky and Telescope magazine has a number of articles and how-tos on astrophotography (film and digital).
http://www.skyandtelescope.com/howto/astrophotography
Jerry Lodriguss' website also has a number of how tos and sample images. The "Quick Start Guide" (under "Astrophotography Techniques") in particular might be useful.
http://www.astropix.com

Instructions:
Daytime Component:

(1) Go outside during the daytime and take a series of shots of the same object with your camera at different aperture, and shutter speed settings. Keep a record of the settings for each shot with the chart provided by your instructor. When studying the effect of aperture, be sure to keep the shutter speed constant and when studying shutter speed, keep the aperture constant (this is a basic laboratory technique - change only one variable at a time).

(2) Find a stationary object (a light post, car, rock or tree) which has a distant, unobstructed and easily identifiable background behind it (anything uniform like water will not work well). Stand at least ten feet away from the object and directly behind it. Mark the spot where you are standing and take a picture facing the object. Turn and walk ten feet to your right, then take a picture of the object against the background. Do the same thing from ten feet to the left of your marked spot.

Nighttime Component:
Remember that this lab may not be done at just any time - pick a clear night with a relatively dim moon (crescent or new phase). Go somewhere dark (bring someone with you) and set up your camera and tripod. Bring a flashlight, but cover the front with red film or cloth (ask your instructor if you don't have any). This will allow you to see what you are doing, while maintaining your night vision.

(1) Before embarking on your astrophotography adventure, take one picture in a well-lit room if you are using a film camera. This will help the developer to know where to cut the film.
(2) You need to have at least one **successful** shot for each of the categories listed below to succeed in this lab, which means you may wish to take more than one shot with a film camera and examine your results closely before moving on with a digital camera. For each shot you take, record: the name and location of the object, the length of the exposure, and the f-stop setting on your data log, which you can get on the course website (Astrophotography_Data_Log.pdf).

i. Point the camera at the North Pole and expose for at least 30 minutes
ii. Point the camera towards the celestial equator (90 degrees from the north pole) and expose for at least 30 minutes
iii. Take a picture of the moon at several different shutter speeds and aperture settings
iv. Take a picture of the constellation Orion and at least one other recognizable constellation at 30sec, 1min, 2min and 4min intervals (same aperture setting)
v. Take a picture of a planet. Make sure to note its location relative to nearby fixed stars in your notes so that you can identify it later.
vi. Take a picture of two other deep sky objects. Some good options include: The Andromeda Galaxy, The Orion Nebula, The Pleiades Star Cluster and The Globular Cluster in Pegasus (M15) (all of which are visible with the naked eye, but will be revealed in much more detail in your pictures)

Caution: People who do not do well on this project typically fall into two categories: (1) They wait too long to begin the project and end up with very few useable photographs (typical for those using 35mm cameras where you can't tell if an image turned out until the film is developed) or (2) They get very creative with the pictures they're taking but fail to follow directions or to do any science with or analysis of their photographs. This lab is not ***just*** *about taking pretty pictures!!!!*

Data:

(1) Your photos
(2) Your data log showing exposure time, aperture setting, etc. for each shot taken.

Questions to Address in Your Poster's Data Analysis Section:

(1) Describe the basic effects of changing aperture and exposure time on your camera. Use your daytime shots to show these effects.
(2) What about the motion of the Earth is revealed in your star trail shots? How and why are the polar and celestial equator shots different?

(3) Discuss the difference in sensitivity brightness, wavelength and color sensitivity between your camera and your eye and how the ability to take longer time exposures benefits each
(4) For each picture that you've taken, describe what is revealed from a scientific point of view. What celestial phenomenon created this object? Would it appear different if you were to observe it again in an hour? Tomorrow? Next week? Next year? In 10, 100, 1000, etc. years? How?
(5) What do your daytime observations of a distant scene relative to a foreground object reveal? Describe the phenomenon and its causes,