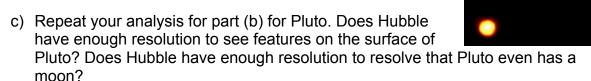**Your name: _____**   **TA name: _____**

Written HW 7: Optics
(due FRIDAY (!) Dec 3, 2010 at 5 PM)

Turn in this written homework in the appropriate slot in the brown Homework Cabinet at the entrance of the HelpRoom, Duane G2B90. Please STAPLE pages together, and **put your name and TA name at the top of every page!**

The primary optical element of the Hubble Space Telescope (HST) is 2.4 m in diameter and has a focal length of 57.6 m. (Treat it as a simple, single lens for this homework) The telescope is aimed at Jupiter and the collected light is focused onto a sensitive Charge Coupled Device (CCD) detector, similar to what is in a digital camera. Each pixel in the detector is a 21 μm × 21 μm square, and the full CCD is 1024×1024 pixels. Thus the CCD is about one square inch in size. The HST is in orbit very close to the Earth (compared to other distances in the Solar system).

a) Is the image real or virtual? Magnified or reduced? Upright or inverted?

b) Look up the size of Jupiter and the distance to Jupiter when it is closest to Earth. Use the lens formula to determine the magnification of the image. How many pixels in diameter is Jupiter's image on the CCD? Given this CCD, what is the smallest feature on Jupiter you would expect to be able to resolve? (Another way of thinking about that question is: How large a square on the surface of Jupiter does one pixel in the image represent?)

c) Repeat your analysis for part (b) for Pluto. Does Hubble have enough resolution to see features on the surface of Pluto? Does Hubble have enough resolution to resolve that Pluto even has a moon?
(For part c you will again need to look up relevant astronomical information about Pluto and its moon, called Charon)