Astronomy 1 fall 2009
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# Solutions to Assignment 6

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**1** Answer to this question may vary, but in general, we like to observe at night. The crescent moon is in the sky at night only just before sunset or just after sunrise. Most students would prefer to observe just after sunset as opposed to just before sunrise. A waxing crescent moon will set just after sunrise, so it will be visible towards the western horizon. The full moon was Nov 2, therefore the new moon will be Nov 14. A few days after the new moon is when we can see a crescent moon just after sunset. We'll schedule our observing night accordingly.

**2** Answer will vary significantly based on your resources. Do you think the world's efforts are enough?

**3** Again answers will vary.

**4** Nasa's Jet Propulsion Laboratory (located in Pasadena, CA) has some great material on Jupiter's moons, as well as most other astronomical objects. See their website at www.nasa.jpl.nasa.gov and search for Io and Europa. Europa is thought to have an ocean of liquid water below a giant sheet of ice. It is one of the few places in the solar system where liquid water could be found (most planets/moons are either too hot or cold. It is the tidal interaction that heats up the ice to form the ocean.

**5** This problem is a very good example of how astronomers take observational data and compute information about other stars. For this problem we're trying to find the radius of Rigel. From the given parallax, we can find the distance to Rigel:

$$d = \frac{1}{p} = \frac{1}{0.0042 arcsec} = 238 pc$$

With this distance and the measured brightness, we can use the inverse square law to compute the luminosity of Rigel:

$$L = 4\pi d^2 b = 4\pi (7.3 \times 10^{18} m)^2 (8 \times 10^{-9} W/m^2) = 5.4 \times 10^{30} W = 1.3 \times 10^4 L_\odot$$

Now use the inverse square law again, but at the surface of the star, where the flux will be given by the Stephan-Bolzmann law. Solve for the Radius as follows

$$F = \frac{L}{4\pi R^2} \Rightarrow R = \sqrt{\frac{L}{4\pi F}} = \sqrt{\frac{L}{4\pi\sigma T^4}}$$

and plug in our values to find

$$R = \sqrt{\frac{5.4 \times 10^{30} W}{4\pi(5.67 \times 10^{-8} W/m^2/K^4)(15000K)^4}} = 1.2 \times 10^{10} m = 17 R_\odot$$