Chp 15-Review Questions. Observing the Evolution of the Universe

1. What is Olbers's paradox? How can it be resolved?
2. What does it mean when astronomers say that we live in an expanding universe? What is actually expanding?
3. Describe how the expansion of the universe explains Hubble's law.
4. If a galaxy was discovered to be the most distant ever observed, what would astronomers notice about its spectra and speed?
5. What does it mean to say that the universe is homogeneous? That it is isotropic?
6. How is the expanding universe similar to a baking chocolate chip cake?
7. Where is the center of the universe?
8. Imagine an astronomer living in a galaxy more than a billion light-years away from our own. Is the observable universe for that astronomer the same as for an astronomer on Earth? Why or why not?
9. What is the cosmic microwave background?
10. What was the era of recombination? What significant events occurred in the universe during this era? Was the universe matter- dominated or radiation-dominated during this era?
11. What is dark energy? Describe two ways that we can infer its presence.

Chp 15-Discussion Questions. Observing the Evolution of the Universe

1. How can astronomers be certain that the cosmic microwave background fills the entire cosmos, not just the vicinity of Earth?
2. How does the evidence for the Big Bang confirm or conflict with religious or spiritual views of the beginning of time?
3. Some GUTs predict that the proton is unstable, although with a half-life far longer than the present age of the universe. What would it be like to live at a time when protons were decaying in large numbers?

Chp 15-Collaborative Group Exercises. Observing the Evolution of the Universe

2. Imagine your firm, *Creative Cosmologists Coalition*, has been hired to create a three-panel, folded brochure describing the principal observations that astronomers use to infer the existence of a Big Bang. Create this brochure on an 8½ × 11 piece of paper. Be sure each member of your group supervises the development of a different portion of the brochure and that the small print acknowledges who in your group was primarily responsible for which portion.
3. The three potential geometries of the universe are shown in Figure 15-17. To demonstrate this, ask one member of your group to hold a piece of paper in one of the positions while another member draws two parallel lines that never change in one geometry, eventually cross in another geometry, and eventually diverge in another.
4. The four fundamental forces of nature are the strong force, the weak force, the gravitational force, and the electromagnetic force. List four things at your school that rely on one of these fundamental forces, and explain how each thing is dependent on one of the fundamental forces.
5. Consider the following hypothetical scenario adapted from a daytime cable television talk show. Chris states that Pat borrowed Chris's telescope without permission. Tyler purchased balloons and a new telescope eyepiece without telling Chris. Sawyer borrowed star maps from the library, with the library's permission, but without telling Pat. Eventually, when the four met on Sunday evening, Chris was crying and speechless. Can you create a "grand unified theory" that explains this entire situation?