Sample Exam type questions
to be addressed in Discussion Sections

Equations that may or may not be useful:

$F = ma; E = mc^2; T = T_o(1+z); D = v/H_0; F = L/(4\pi D^2)$

$H_0 = \dot{\mathrm{R}}_0/R_0;\ \dot{\mathrm{R}}_0^2/R_0^2 + kc^2/R_0^2 = G8\pi\rho_0/3$

$H_0^2 + kc^2/R_0^2 = G8\pi\rho_0/3$

$\rho_c = 3H_0^2/G8\pi;\ d\tau^2 = (cdt)^2 - R^2dr^2/(1-kr^2)$

1.

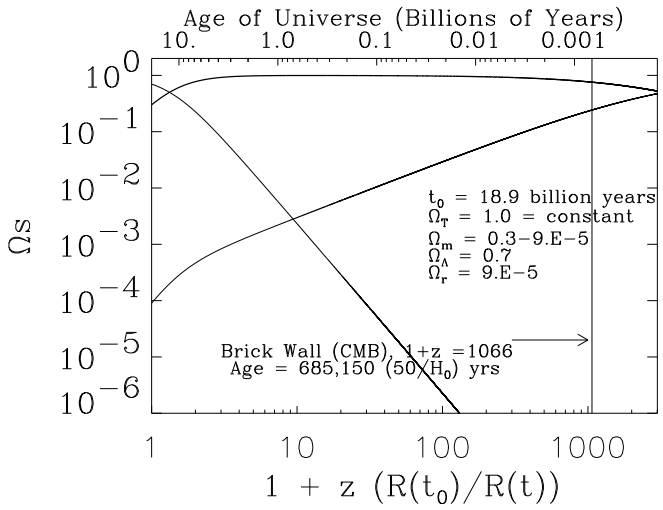

Figure 1: What does this plot tell us about the various values of Ω versus time? And also what does this figure tell us about the age of the observed universe versus 1+z and how we study the early universe?

2. In a bottom up scenario which clusters form first? High or low mass? Therefore, as we observe clusters at higher and higher 1+z which would we expect to disappear first?

3. As the universe continues to expand from today it: (a) cools, (b) heats, (c) keeps constant in temperature, (d) undergoes episodic heating and cooling

4. Assuming there is no relative motion between us and an *exact* replica of our planet (*same* people history etc) that is 94 (2002-1908) light years away, and you watched the replica planet this fall you would see: (a) the Cubs in a World Series, (b) your grand children, (c) your counterparts taking this class, (d) those of you with older parents, your parent as kids 47 years (= 94/2) younger than they are now.

5. The radius of the observable universe is about (a) 10^{28} cm, (b) 10^9 cm, (c) 10^{12} cm, (d) 10^{14} cm

6. If the beginning of the universe corresponds to a 1+z of 5×10^{60} , what is the ratio of the scale factor of the universe today to that at the beginning of the universe?

7. A test of GR was to observe the _____. of the major (or minor) axis of Mercury.

8. The deflection of the star light by the sun during a solar eclipse is evidenced by (a) the star image blinking, (b) the star image fading, (c) a change in the apparent position of the star relative to star images not close to the sun, (d) the star image getting bluer.

9. What value of k goes with $\Omega_0 = 1$?

10. Given: $H_0^2 + kc^2/R_0^2 = G8\pi\rho_0/3$, what do the different variables stand for?

11. What is the formula for the critical density that contains the Hubble constant, and what is the meaning of the critical density in terms of the equation that relates "potential energy" to kinetic energy for the universe?

12. How is the critical density related to Ω_0?

13. If I told you the "rest wavelength" of a hydrogen "line" (distinguishable feature in the graph or plot of intensity versus wavelength) was 400 nm and I observed the line from an object to be 800 nm, I would conclude that the scale factor of the universe when the object emitted the light was how much smaller (or larger) than today's value?_____

14. If I saw an object which emitted same hydrogen line but I saw it shifted to 200 nm, what would be good one word response :)? _____

15. The Robertson-Walker metric refers to which equation and what path does it describe when this value = 0?