

Sample Exam type questions
to be addressed in Discussion Sections

Equations that may or may not be useful:

$$F = ma; E = mc^2; T = T_o(1 + z)$$

1. Fill in the blank: if the “brick wall” that makes up the microwave background became transparent at redshift $(1+z) = 2000$, what would we *observe* the temperature of the CMB? Hint: the “local” (actual) temperature of the brick wall is fixed by physics = 3000k” so this is just a “redshift problem.”
2. Discuss the interplay between the need for non-baryonic matter and the observations of the *just* the smoothness of the CMB.
3. The location of the “first” and largest peak in the fluctuation of the CMB versus angular scale tells us (assuming “Adiabatic” fluctuations), multiple choice: (a) The CMB has a temperature of 3 K; (b)The CMB is at 3000k; (c) the Universe is “flat;” (d)the universe is “closed;” (e) the universe is “open.”
4. Hot dark matter (HDM) goes with what scenario for galaxy and cluster of galaxy formation?
5. Cold dark matter (CDM) goes with what scenario for galaxy and cluster formation
6. Multiple choice: total matter (pus Dark energy) density of the universe affects the curvature of the universe because Einstein said: (a) the amount of mass concentration affects space time curvature both locally and for the universe as a whole; (b) $E = mc^2$;(c) $E = h\nu$;(d) The universe is expanding; (e)The maximum velocity anything can travel relative to anything else is the speed of light.
7. Discuss how non-baryonic matter and dark energy are needed to fit with observations of the CMB smoothness the existence of galaxies and currently accepted view that the geometry of the universe is flat.
8. What key obervations that will be reported in January 2003 that could turn “things on their head” and why?