

Sample Exam type questions
to be addressed in Discussion Sections

Equations that may or may not be useful:

$$F = ma; E = mc^2; T = T_0(1 + z); D = v/H_0; F = L/(4\pi D^2)$$

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

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

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

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

$$q = \Omega_m/2 - \Omega_\Lambda; p \rightarrow p - c\Lambda/8\pi G$$

$$dU = -pdV$$

1. The Big Bang Model of the Universe was devised to "explain" or to be consistent with 5 things (as discussed in class) Give any 3:
2. What particle left over from the Big bang would let us see back to about 1 second after the Big Bang _____.
3. What is Olber's paradox and why does the Big Bang make this "go away."
4. How do we relate nucleosynthesis in the first 3 minutes of the Universe to a relationship between observed ratios of He/H and D/H.
5. A gas made up of free electrons and protons is called a : (a) plasma ; (b) wimp gas; (c) polymer (d) PAH
6. Why do those who "invented" inflation argue that we need a model in which the universe is flat?
7. How many poles does a typical bar magnet (or the Earth have) _____.
8. If we cut a bar magnet in half how many poles would each half have _____?
9. The one of the particles the neutron decays into is (a) alpha, (b) photon, (c) proton (d) gamma-ray
10. Suppose neutrons decayed in 1 second rather than 10.6 minutes, what elements or element would we expect to find in low abundance compared to what we find today.

11. Inflation was actually modeled well before Alan Guth “invented it.” The name of that model is called the: (a) Lemaître model, (b) deSitter Model, (c) Einstein-deSitter Model (d) Eddington Model.
12. GUTs stands for _____.
13. The Harrison Zel’dovich spectrum is (a) the name of Lemaître’s mother (b) “ the “same-power-on all-scales perturbation distribution”, (c) the redshifted spectrum from distant galaxy (d) the gravitational spectrum form the surface of neutron star.
14. Baryogenesis is evoked to explain what imbalance we see today in the Universe between: (a) neutrinos and baryons (b) wimps and baryons (c) photons and baryon (d) between protons and baryons
15. Discuss how Inflation, the CMB and the Harrison-Zel’dovich spectrum are all tied together. And why or why not do we *require* inflation to produce the Harrison-Zel’dovich spectrum?
16. Discuss what basic concept underlies the desire of physicists to invent baryogenesis to explain the observable universe today. And, discuss why or why not you think this is valid in 100 words or fewer.
17. Discuss: what do C, P and T stand for in the CPT theorem? And how do they “operate” on particle reactions, and how this all relates to baryogenesis.
18. How does Big Bang nucleosynthesis models couple with obervation that tell us Ω_{m0} is about 0.3 to imply something about the value of $\Omega_{m,b}$ (where b stands for baryonic, m for matter) and the very existence of non-baryonic matter and its value of Ω ($\Omega_{m,nb}$; where nb stands for non-baryonic). And can we tell anything else about this matter form these two ideas redgin teh ‘temperature of the non-baryonic matter (if there is any), e.g. hot, cold, or warm?