Sample Questions for Final Exam

1. The geometry of our Universe is “flat.” This condition is highly unlikely because
   A. space is really three-dimensional.
   B. space must be curved by mass.
   C. it requires the overall density of our Universe to be less than the critical density.
   D. it requires that the Big Bang had exactly critical density 13.7 billion years ago.
   E. all of the above

2. Which of the following statements is, or are, TRUE? (Circle all possibilities.)
   A. The Big Bang is not a “creation event.” It concerns the aftermath of creation.
   B. Our Universe may have a net energy of zero.
   C. Scientists do not understand the makeup of dark matter and dark energy.
   D. The four forces in Nature today may all have been unified in the beginning.
   E. The early Universe had a slight excess of matter over antimatter.

3. The age of our Universe is about 13.8 billion years. Evidence for this age includes
   A. the low "metal" abundances in the spectra of old stars.
   B. Hubble’s Law.
   C. the “temperature” of the CMB.
   D. temperatures of old white dwarf stars.
   E. all of the above

4. Our nighttime sky is relatively dark because the Universe
   A. is filled with dust.
   B. is mostly empty and is expanding.
   C. is very large.
   D. has a finite age and is expanding.
   E. is infinite.

5. The CMB has a thermal spectrum and is extremely "isotropic." These characteristics
   A. mean the CMB could have been produced by a supernova.
   B. prove that the light could have been emitted by a local source such as the Earth.
   C. mean that the brightness of the CMB is nearly identical in every direction at every wavelength.
   D. cannot be explained by a Big Bang origin of our Universe.
   E. all of the above

6. Elliptical galaxies are much different from spiral galaxies. Ellipticals …
   A. have more interstellar gas and dust.
   B. very little interstellar gas and dust and are more oval shaped like the bugles in spiral galaxies.
   C. are forming young hot stars.
   D. come in groups but spirals don't.
   E. B & C

7. Even though galaxies are so far apart, they can merge
   A. but their stars are unlikely to collide.
   B. and their gas clouds can collide causing new stars to form.
   C. and grow larger. The Milky Way is still cannibalizing other small galaxies.
   D. but some stars can be ejected by gravitational forces.
   E. all of the above

8. DAILY SKILLS: Do the following statements demonstrate correct use of exponents?
   Examples: 4.3 x 10^-6 = 4.3000000
   2.7 x 10^6 = 2.7000000
9. **DAILY SKILLS:** The volume \( V \) of a sphere is \( V = \frac{4\pi r^3}{3} \). Pretend one bubble has three times the radius of another’s. How many times larger is the volume?

10. **DAILY SKILLS:** “Justify” - “Explain” - “Describe” - “React” - Convince us! We want your insightful descriptions but not (a) superficial phrases, (b) stating the obvious, and (c) the Internet.

   Improve the following sentence: “Science to me is the attempt to explain the unknown.”

11. **DAILY SKILLS:** Using as many Daily Skills as possible, write a one-sentence definition of “cosmology.”
ANSWERS
1. D
2. all
3. E
4. D
5. C
6. B
7. E
8. Exponents do not indicate the precision of a number, i.e., not the number of figures following the decimal point. Instead they indicate the overall size ("magnitude") of the entire number.
   4.3 \times 10^{-6} = 4.3 \div 1,000,000 = 0.0000043
   2.7 \times 10^6 = 2.7 \times 1,000,000 = 2,700,000.
   2.7 \times 10^{11} = 2.7 \times 100,000,000,000 = 270,000,000,000.
9. If \( r \) triples, then \( r^3 \) becomes \( 3 \times 3 \times 3 = 27 \) times larger.
10. “Science is an area of study that uses systematic processes and objective processes to ascertain the facts. Science is ever seeking and searching and improving our knowledge of the universe inside and outside our reality.”
11. submit for feedback