

Cosmology.

1. The centre of the universe
 - a) does not exist anywhere in space.
 - b) is changing as the universe expands
 - c) is where the Big Bang happened.
 - d) is the Milky Way.
 - e) is the Sun.

2. The redshift of the galaxies is correctly interpreted as
 - a) a Doppler shift due to the random motions of galaxies in space.
 - b) an aging of light as gravity weakens with time.
 - c) placing our Galaxy near the center of the Local Group.
 - d) the differences in temperatures and star formation in old and young galaxies.
 - e) space itself is expanding with time, so the photons are stretched while they travel through space.

3. In pair production in the Big Bang, which statement is FALSE?
 - a) The heaviest particles and their antiparticles formed first, from collisions of the highest energy gamma rays.
 - b) Even neutrons have their antineutrons, although both lack any charge.
 - c) Every electron should have a proton formed at the same time with it.
 - d) In addition to familiar neutrons and protons, many other exotic particle and antiparticle pairs formed, but decayed back to radiation.
 - e) Matter is frozen energy, according to Einstein's $E = mc^2$.

4. Because of their mass, the threshold temperature for electrons is
 - a) lower than that of protons.
 - b) lower than that of hydrogen.
 - c) higher than that of neutrons.
 - d) higher than that of hydrogen.
 - e) higher than that of protons.

5. Which of the following observations about the nature of the universe could you make with a pair of binoculars?
 - a) The universe is expanding
 - b) Most of the matter in the universe does not emit light
 - c) Luminous matter in the universe occurs in clumps rather than being evenly distributed
 - d) There is background radiation in all directions from the Big Bang

6. The cosmic microwave background is strong evidence that
 - a) Star formation has been taking place for billions of years
 - b) The universe evolved from a hot dense state
 - c) Colliding galaxies release lots of synchrotron radiation
 - d) At 3K, the early universe was very cool

7. If the universe only contains matter and its density is greater than the critical density
 - a) The universe is open and will expand forever
 - b) The universe is closed and will expand forever
 - c) The universe is closed and will eventually collapse again
 - d) The Big Bang can not be correct

8. Astronomers know the universe is expanding because
 - a) there is a cosmic microwave background.
 - b) most galaxies are moving away from us.
 - c) all stars are moving away from us.
 - d) everything is moving away from us.
 - e) some galaxies are moving towards us