**INST 2403 Solutions to STUDY GUIDE for Final Exam Fall 2017**

**Sample Questions**

1. If a galaxy is a distance of 10 million light years from Earth, which of the following is true?
	1. We see the galaxy the way it will be in 10 million years.
	2. We see the galaxy the way it was 10 million years ago.(CORRECT)
	3. We see the galaxy the way it was when the universe was 10 million years old.
	4. We see what our galaxy will be like in 10 million years.
	5. We cannot see so far into the universe, since it has a finite age.
2. What does the Hubble Law imply about the history of the universe?
	1. The universe started expanding at some time in the past; the universe has an age. (CORRECT)
	2. The universe has been expanding forever; it is infinitely old.
	3. The Milky Way galaxy is at the exact location where the universe started to expand.
	4. Before the universe started to expand, it had collapsed and expanded many times before.
	5. There will be a big crunch at the end of the universe’s life.
3. Cosmologists have predicted three possible futures for the universe. The average density of matter in the universe will determine which one actually happens. Why is this?
	1. The density of matter determines the strength of gravity, which decelerates the expansion over time. .(CORRECT)
	2. The density of matter determines the rate of formation of black holes which will eventually collapse the universe.
	3. The density of matter tells astronomers whether new matter is constantly forming, thereby producing a steady-state.
	4. All of the above.
4. An acceleration in the rate of expansion of the universe could be explained by
	1. the cosmological principle.
	2. a cosmological constant a.k.a. dark energy. .(CORRECT)
	3. a cosmological density parameter greater than one.
	4. supermassive black holes.

2. 

1. 

1. The above photographs show
	1. 1−a spiral galaxy; 2-−an elliptical galaxy.(CORRECT)
	2. 1−a spiral galaxy; 2−an irregular galaxy
	3. both pictures show spiral galaxies but viewed from different angles
	4. 1−an irregular galaxy; 2−a spiral galaxy
	5. 1- a spiral galaxy; 2- a quasar
2. A typical Cepheid variable is 100 times brighter than a typical RR Lyrae star. On average, how much farther away than RR Lyrae stars can Cepheids be used as distance-measuring tools?
	1. Same distance, since they both have variable brightnesses
	2. 1/10 times as far
	3. 10 times as far.(CORRECT)
	4. 100 times as far
	5. It is not possible to use Cepheids, since we do not know their absolute brightness
3. The current best value for the Hubble constant suggests that the universe is
	1. 600 million years old.
	2. 1 to 5 billion years old.
	3. About 14 billion years old. .(CORRECT)
	4. more than 50 billion years old.
	5. infinitely old; the universe has always existed.

 8. Two stars have the same chemical composition, spectral type, and luminosity class, but one is 3 light years from the Earth and the other is 300 light years from the Earth. The farther star appears to be …

a) 100 times fainter.

b) 10,000 times fainter.

 (CORRECT)

c) 100,000,000 times fainter.

d) the same brightness since the stars are identical.

e) None of the above

 9. Two stars have the same chemical composition, spectral type, and luminosity class, but one is 5 light years from the Earth and the other is 50 light years from the Earth. The farther star appears to be …

a) 100 times fainter.

 .(CORRECT)

b) 10,000 times fainter.

c) 100,000,000 times fainter.

d) the same brightness since the stars are identical.

e) None of the above

 10. Two stars have the same chemical composition, spectral type, and luminosity class, but one is 75 light years from the Earth and the other is 75000 light years from the Earth. The farther star appears to be …

a) 100 times fainter.

b) 10,000 times fainter.

c) 100,000,000 times fainter.

d) the same brightness since the stars are identical.

e) None of the above.(CORRECT)

1. Two stars have the same radius, but one has two times the temperature of the other star. How much brighter is the hotter star?
	1. 4 times
	2. 16 times .(CORRECT)
	3. 64 times
	4. 1/64 as bright
	5. None of the above
2. Two stars have a temperature that differs by a factor of two, and a radius that differs by a factor of four. How much brighter is the larger, hotter star?
	1. 4 times
	2. 16 times
	3. 64 times
	4. 1/64 as bright
	5. None of the above .(CORRECT)

**Short Answer Questions [3 points each]**

***(Please use the back side of the computer sheet to record your answers)***

1. Explain what the Hubble law is and what it implies for cosmology.

The Hubble law is the statement that the recessional velocities of distant galaxies are directly proportional to the distance of the galaxies from us. That is, a plot of recessional velocity versus distance is a straight, ascending line. The slope of this line is called the Hubble constant H. The Hubble constant tells us the age of the universe T = 1/H, since it implies that the universe was much smaller in the past, and at some point the universe was a mere point – when it “started” at the big bang.

1. Characterize the three possible shapes of a universe that does not contain Dark Energy.

Three shapes are possible: sphere or ball if the universe contains a lot of mass, flat and open when it contains the critical amount of mass, and saddle-like or negatively curved when the universe contains very little mass.

15. Why and how is galaxy formation and development different from the stellar formation and development?

Galaxies are very large, and their distances are such that they can collide. A collision will deform a galaxy and trigger star births. Hence, collisions will dramatically change the development of a galaxy. On the other hand, stars are very far from each other compared to their size, so it is virtually impossible for them to collide.