Practice Exam — to prepare for **Second Midterm Exam**

Name: _____

Please select the answer that BEST fits the question. Note: this practice exam is **about half the length** of the actual midterm #2 exam. Reminders for the **actual exam**: (1) Write and bubble in your name and student ID on the Scantron sheet; (2) Write your name on the exam script; and (3) It is VERY important that you turn in BOTH your Scantron and your exam script to one of the exam proctors at the end of the exam.

1. If the matter density of the Universe was greater than the critical density, and there was no anti-gravity from "dark energy", then
A. The Universe would expand forever
B. The expansion of the Universe would stop within about 1.4 billion years
C. The Universe's expansion would slow down and ultimately contract and lead to a "Big Crunch"
D. None of the above
E. Only B and C above

2. As the Universe expands over a certain period of time, the density of matter in the Universe decreases by a factor of 8. Over that same period of time, the energy density of the radiation in the Universe:
A. Increases by a factor of 16
B. Increases by a factor of 4
C. Stays the same
D. Decreases by a factor of 8
E. Decreases by a factor of 16

[All I want students to know for question #2 above is that the radiation density falls more steeply than the matter density as the Universe expands. Only one of the choices, E, satisfies this criterion.]

3. What observational evidence suggests that the light-emitting regions in quasars are small, only a few light hours across?
A. The fact that some quasars emit long-wavelength radio waves
B. Detailed photographs of quasars
C. Some quasars emit radiation over a very wide range of wavelengths
D. The intensity of the radiation of quasars is observed to fluctuate over periods of a few hours
E. All of the above

4. The age of the Universe can be deduced most directly from
A. Hubble's law
B. Kepler's laws
C. The Doppler shift formula
D. Inverse square law of gravitational forces
E. The constancy of the speed of light

5. Olbers' paradox questions why the night sky is dark when a simple calculation suggests that it should be as bright as the surface of a star. Which of the following provides a solution to the paradox?
A. Olbers did not know about quasars
B. The dust and gas between stars absorbs starlight
C. The Universe has a finite age
D. All of the above
E. None of the above

6. What powers the nucleus of a typical active galaxy?
A. The Sun
B. The Big Bang
C. Hawking radiation
D. A massive black hole
E. Globular clusters

7. According to current estimates, the Universe is about _____ years old.
A. 14×10^3
B. 14×10^5
C. 14×10^7
D. 14×10^9
E. 14×10^{11}

8. The Perfect Cosmological Principle
A. Is generally believed to apply to our Universe
B. Proposes that the average properties of the Universe are the same everywhere in space and at all times
C. Is the basis of the Steady State Cosmological model of the Universe
D. None of the above
E. Only B and C above

9. A(n) ___ type galaxy is ___ with a bar-shaped configuration of stars in its central region.
A. Sa; a spiral galaxy
B. E0; an elliptical galaxy
C. E7; a spiral galaxy
D. SBa; a spiral galaxy

10. The stars in the disk of a spiral galaxy are _____ on average than the stars in its _____.
A. Older; bulge
B. Younger; bulge
C. Younger; spiral arms
D. Smaller; outskirts

11. Who was the first astronomer to estimate the distance of the Sun from the center of our Milky Way galaxy by mapping the locations of globular clusters?
A. Isaac Newton
B. Edwin Hubble
C. Harlow Shapley
D. Albert Einstein
E. Fred Hoyle

12. Quarks combined to form protons and neutrons at the epoch of confinement. Which of the following took place **before** the epoch of confinement?
A. Planck time
B. Inflation
C. Formation of neutral hydrogen atoms
D. All of the above
E. Only A and B above

13. Black holes emit Hawking radiation and this is a direct result of:
A. Pair production
B. Energy/matter interconversion near the Schwarzschild radius
C. The accretion disk of swirling material outside the Schwarzschild radius
D. All of the above
E. Only A and B above

14. The theory of Inflation:
A. Proposes that, for a brief period, the Universe expanded faster than the speed of light
B. Explains what happened before the Big Bang and why the Universe is expanding today
C. Is the basis of the Steady State cosmological model
D. Was the first to predict that the afterglow from the Big Bang should be visible today
E. Was first developed by Albert Einstein

15. Which of the following statements is/are **true**?
A. Matter was dominant over radiation during the first 300,000 years after the Big Bang
B. The Universe has been radiation-dominated since the epoch of recombination
C. Radiation was dominant over matter during the first 300,000 years after the Big Bang
D. None of the above
E. Only A and B above

16. The solar system is located about ___ from the center of the Milky Way.
A. 8.5 light years
B. 17 parsecs
C. 17 Megaparsecs
D. 8.5 kiloparsecs
E. 8.5 AU

17. Which of the following lists the forms of matter in the order they came to existence in the early Universe?
A. Hydrogen atoms, water molecules, protons
B. Hydrogen atoms, protons, water molecules
C. Protons, hydrogen atoms, water molecules
D. Protons, water molecules, hydrogen atoms

18. The elliptical galaxies with shapes closest to circular are those in class:
A. E7
B. Sb
C. Ea
D. E0

19. Of the different types of forces observed to operate in the Universe today:
A. Gravity was the last to develop a unique identity
B. The electroweak force is the force that binds together the quarks that make up protons and neutrons
C. The strong nuclear force developed a unique identity at the epoch of recombination
D. None of the above
E. Only A and B above

20. An SBc galaxy has _____ and a _____ than an Sbc galaxy
A. More tightly wound spiral arms; smaller bulge-to-disk ratio
B. More loosely wound spiral arms; smaller bulge-to-disk ratio
C. More tightly wound spiral arms; larger bulge-to-disk ratio
D. More loosely wound spiral arms; larger bulge-to-disk ratio
E. None of the above

21. Which of the following are directly related to the differential rotation of a spiral galaxy?
A. Stars in the outskirts take longer to complete an orbit around the galaxy's center than inner stars
B. Coupled with the Density Wave Theory, this can explain the presence of spiral arms
C. Detailed measurements of this motion can tell us the mass of the galaxy
D. None of the above
E. All of the above

22. Which of the following are consequences of Hubble's discovery of the expansion of the Universe?
A. Absolutely everything in the Universe is expanding at the same rate
B. Light from very distant galaxies tends to be more redshifted than light from less distant ones
C. Light from very distant galaxies tends to be more blueshifted than light from less distant ones
D. The speed of light from more distant galaxies is greater than the speed of light from nearby ones
E. None of the above