Astronomy 123
Test 2
November 18, 2011

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. There are 20 multiple choice questions each worth 1 point

1) Homogeneity and isotropy, taken as assumptions regarding the structure and evolution of the universe, are known as: 1) _____
   A) the Grand Unified Theory.
   B) Wien's Law.
   C) the Cosmological Principle.
   D) Hubble's Law.
   E) Obler's Paradox.

2) The darkness of the night sky in a seemingly infinite universe is addressed in: 2) _____
   A) Stefan's Law.
   B) the Cosmological Principle.
   C) parallax shift.
   D) the Doppler shift.
   E) Olbers' Paradox.

3) The Hubble time may be expressed as 3) _____
   A) H × D.
   B) H × T.
   C) 1/H.
   D) the critical density/H.
   E) D/v.

4) The universe has three possible futures. Which one is correct depends only on the average density of matter in the universe. Why is this? 4) _____
   A) The density of matter determines the rate of formation of black holes which will eventually collapse the universe.
   B) The density of visible matter must exactly equal the dark force energy.
   C) The density of matter determines the strength of gravity, which decelerates the expansion over time.
   D) The density of matter tells astronomers whether new matter is constantly forming, thereby producing a steady-state.
   E) If the density is sufficiently high, the geometry of space may be curved.

5) Which relation matches the rotation of a spiral galaxy to its luminosity? 5) _____
   A) Hertzsprung-Russell diagram
   B) Hubble's Law
   C) Hubble's Tuning Fork Diagram
   D) the Chandrasekhar Limit
   E) the Tully-Fisher Relation

6) In a lobe radio galaxy, the ultimate energy source for the entire galaxy is thought to reside: 6) _____
A) in the galaxy's active nucleus.
B) in the spiral arms.
C) in the extended magnetic halo.
D) in the dual lobes.
E) in the relativistic jets.

7) Why does the Cepheid "standard candle" have limited usefulness beyond 65 million light years (20 mllion parsecs) or so? 7) _____
A) Cepheids are too faint to be seen beyond that distance, even with the Hubble Space Telescope (HST)
B) Older distant Cepheids are of population II, where the period–luminosity relation no longer works.
C) Distant galaxies are seen in the past, when Cepheid variables behaved differently than they do today.
D) The light variability of Cepheids diminishes with distance so they do not appear to vary there.
E) Distant galaxies are so young they do not contain Cepheids.

8) Why are supermassive galaxies often found at the cores of rich galaxy clusters? 8) _____
A) They are the result of many galactic mergers; one galaxy growing at the expense of others.
B) Many globular clusters swarmed together to form it.
C) Large galaxies, passing a cluster, get captured into the center.
D) Such a large galaxy attracted smaller galaxies around it to form a cluster.
E) Most of the matter forming the cluster fell into the center to form one large galaxy.

9) What is the Great Wall? 9) _____
A) It is the distance beyond which astronomers cannot view any more galaxies or even quasars.
B) It is a large sheet of galaxies measuring around 700 million light years across.
C) It is a ridge on the Moon near the crater Birt.
D) It is the time before the universe started expanding, about which we can never know anything.
E) It is an enormous intergalactic cloud of dust and gas that hides more distant galaxies.

10) For a flat universe, Ω_o is: 10) _____
A) 1.0.
B) between 1.4 and 2.
C) 0.3.
D) zero.
E) infinite.

11) The critical evidence suggesting an increasing cosmic expansion rate came from teams of astronomers observing: 11) _____
A) hypernovae.
B) type II supernovae.
C) type I supernovae.
D) gamma ray bursts.
E) ages of globular clusters.

12) Currently, most of the mass of the matter of the Universe is believed to consist of: 12) _____
A) tachyonic matter, travelling only faster than the speed of light.
B) tiny but very numerous black holes.
C) dark energy.
D) dark matter not made of protons and neutrons.
E) baryonic matter, made up of protons and neutrons.

13) Pair production can occur if: 13) _____
A) the energy of two photons is greater than the combined mass–energy of a particle–anti–particle pair.
B) photons are at the event horizon of a black hole.
C) the particle and antiparticle have opposite spins.
D) only virtual particles are produced.
E) one particle is struck by a sufficiently high energy photon that a pair of electrons are formed.

14) Gravity becomes separate from the other forces at the: 14) _____
A) beginning of particle production, about .0001 seconds into the universe.
B) decoupling Event, about a million years after the Big Bang.
C) end of electron production, about a minute after creation.
D) end of the Planck Era, about 10^{-43} seconds after the Big Bang.
E) end of the Inflationary Epoch, about 10^{-32} seconds into creation.

15) What would help scientists probe the period from zero time to 10^{-43} second? 15) _____
A) a better understanding of the nature of dark energy
B) more detailed observations of the cosmic microwave background
C) more sophisticated gravity wave detectors
D) discovery of a white hole, with matter and energy flowing out
E) a theory incorporating the force of gravity into existing GUTs

16) The period from about one second to several minutes after the Big Bang: 16) _____
A) is called the pair–production era.
B) is when nucleosynthesis occured.
C) is the quark epoch.
D) is the epoch of recombination
E) is when baryogenesis occured

17) Why didn't large amounts of elements heavier than helium form in the early universe? 17) _____
A) The expansion caused the temperature and density to drop too low for helium could fuse to form carbon.
B) The matter/antimatter asymmetry prohibits the formation of elements heavier than helium, except in the confined environments of stellar interiors.
C) The deuterium bottleneck prevented anything heavier from forming.
D) The creation of dark energy stopped all nucleosynthesis.
E) Heavier elements did form, but they didn't survive the making of the first stars and galaxies.

18) The "flatness" problem arises because Ω_o seems remarkably close to: 18) _____

A) zero curvature, favoring a spherical cosmos.
B) infinity, suggesting an open universe is the only possible cosmology.
C) .5, suggesting we are split between open and closed universes.
D) 2.73 K, in spite of the eddies and turbulence that led to galaxy formation.
E) exactly one.

19) To what use do astronomers put type–I supernova? 19) _____

A) standard candles for finding distances to globular clusters
B) determining distances to galaxies with large redshifts
C) calculating the density of interstellar matter
D) age–dating massive stars
E) determining the half–lives of rare radioactive elements

20) Which of the following is **not** a reason to believe that the early Universe underwent a period of rapid expansion called inflation? 20) _____

A) Inflation makes it possible to combine the four fundamental forces of nature into a single "superforce."
B) Inflation provides a bridge for the separation of the strong force from the others.
C) Inflation provides a solution to the flatness problem.
D) Inflation is a prediction of the Grand Unified Theories, which are themselves becoming more established.
E) Inflation provides a solution to the horizon problem.

SHORT ANSWER. Write your answer in the space provided or on a separate sheet of paper. Each question carries equal work. Each question is worth 6 points.

21) Baryogeneis.

a. What is the matter/antimatter problem?

b. What is a possible solutions for the matter/antimater problem?

22) Olbers's Paradox is the puzzle of the darkness of the night sky.

a. What are the assmptions made when formulating Olbers' paradox?

b. How does the Big Bang rTheory resolve Olbers' Paradox?

23) Models for the Universe.

a. What are the three possible Friedman models for the Universe; what does each say about the ultimate fate for the universe?

i.

ii.

iii.

b. Describe one test which could allow us to determine the model which best describes our Unvierse.

24) The Inflation Theory .

a. Describe how the inflation theory solves the Horizon Problem.

b. Describe how the inflation theory solves the Flatness Problem.

25) Epoch of Recombination.

a. What is the epoch of recombination?

b. When was the epoch of recombination and what is the significance of the epoch of recombination as it relates to the Cosmic Microwave Background Radiation (CMBR)?

Answer Key
Testname: ASTR_123_X2_FALL2011

1) C
2) E
3) C
4) C
5) E
6) A
7) A
8) A
9) B
10) A
11) C
12) D
13) A
14) D
15) E
16) B
17) A
18) E
19) B
20) A