

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. There are 20 multiple choice questions. Each question is worth 2 points for 40 total points.

- 1) _____ is the concept that all large samples of the universe are alike in appearance anywhere in the universe. 1) _____
A) Conformity
B) Cosmology
C) Homogeneity
D) Isotropy
E) Universality
- 2) Because all distant galaxies are redshifted, we infer that: 2) _____
A) we are at or close to the center of the Universe.
B) the Universe will end someday as a hot, dense state composed only of black holes
C) the Universe is expanding.
D) there was no beginning to time, the Universe has always been
E) the Universe's rate of expansion is speeding up
- 3) The location of the center of the Galaxy was determined by Shapley from observations of: 3) _____
A) Herbig-Haro objects in emission nebulae.
B) the radio emissions from Sagittarius A.
C) RR Lyrae variables in globular clusters.
D) cepheids in open clusters.
E) blue supergiants in the spiral arms.
- 4) The object located at Sgr A the center of the Milky Way galaxy, is believed to be: 4) _____
A) an enormous emission nebula.
B) a black hole of around 3.7 million solar masses.
C) a quasar of over a billion solar masses.
D) a hypernova about to happen...be very afraid.
E) a large cluster of very young and massive stars.
- 5) What is the meaning of isotropic? 5) _____
A) the same temperature everywhere
B) the same in every way throughout space
C) the same in all directions
D) the same density everywhere
E) the same at all times

- 6) While Slipher's observations showed galaxies were red shifted, the distance-velocity correlation is now known as: 6) _____
- A) the Cosmological Principle.
 - B) relativistic redshifts.
 - C) Olber's Paradox.
 - D) the Cosmological Constant.
 - E) Hubble's Law.
- 7) Homogeneity and isotropy, taken as assumptions regarding the structure and evolution of the Universe, are known as: 7) _____
- A) the Anthropic Principle
 - B) the Principle of Mediocrity
 - C) Hubble's Law.
 - D) the Cosmological Principle.
 - E) Universal law of gravitation
- 8) Which of the following paraphrases Hubble Law? 8) _____
- A) The more distant a galaxy is, the younger it appears.
 - B) The greater the distance to a galaxy, the greater its redshift.
 - C) The older the galaxy appears to us, the more luminous it is.
 - D) The faster the galaxy spins, the more massive and luminous it is.
 - E) The greater the distance to a galaxy, the fainter it is.
- 9) MACHOs have been detected through: 9) _____
- A) their effects on the orbital velocities of stars in the halo of the Milky Way
 - B) detection of X-rays produced by the Penrose Process in their ergospheres
 - C) observing duration of their eclipses of normal companions of nearby binary star systems
 - D) detection of large rings which develop around stars in the galactic center as MACHOs pass in front of them
 - E) detection of increases in the luminosity of stars in the Large Magellanic Cloud as MACHOs pass in front of them
- 10) The Sun is roughly _____ from the center of the Milky Way galaxy. 10) _____
- A) 600,000 light years
 - B) 3,000 light years
 - C) 25,000 light years
 - D) 150,000 light years
 - E) 2,100,000 light years
- 11) In the Penrose Process, a rotating black hole can radiate up to how much total mass-energy? 11) _____
- A) .08%
 - B) .7%
 - C) 1.4%
 - D) 29%
 - E) 59%
- 12) Based partially on galactic rotation curves, we think dark matter: 12) _____
- A) is a very minor component on the total mass of the Universe.
 - B) comprises between 85 % to 90% of the mass of the Universe.
 - C) exists, but has no observable effect on the visible universe.
 - D) does not exist.
 - E) is best detected by X-rays in intracluster gas clouds.

- 13) The Milky Way galaxy, in Hubble's system, is classified as: 13) _____
A) BS2. B) SIrr. C) S2B. D) BSE.5. E) SBb.
- 14) What is the most likely source of energy for active galactic nuclei? 14) _____
A) a single supermassive, superluminous star
B) numerous supernovae from rapid star formation in young galaxies
C) large clusters of very massive, luminous stars
D) collisions of large spiral galaxies
E) mass flows from disrupted stars onto supermassive black holes
- 15) In Hubble's classification, which type of galaxy has a small bulge and loose, widely spread, poorly defined spiral pattern? 15) _____
A) SBw B) S9 C) Sc D) SO E) Sa
- 16) What two observations of an object allow for a determination of the Milky Way's mass? 16) _____
A) object's age and distance from Galactic Center
B) object's mass and age
C) object's velocity and distance from the galactic center
D) object's mass and velocity
E) object's age and chemical composition
- 17) The first attempt to map the Galaxy via star counts was done by: 17) _____
A) Harlow Shapley with the RR Lyrae variables in 1920.
B) Edwin Hubble with the new 100" Mt. Wilson telescope in the 1930s.
C) Galileo in 1612.
D) Edward Barnard with long exposure photos about 1900.
E) William Herschel in the late eighteenth century.
- 18) Recent work with type Ia supernovae (which was rewarded with this year's Nobel Prize in physics) suggests the Universe may in fact be accelerating its expansion, a discovery attributed to a : 18) _____
A) repulsive charge on dark matter.
B) mass determined for the neutrinos.
C) dark energy.
D) the recently discovered negative mass associated with antimatter.
E) discovery that the number of MACHOs was severely underestimated.
- 19) The universal accelerating force could NOT be considered: 19) _____
A) Einstein's cosmological constant.
B) dark energy
C) antigravity.
D) dark matter.
E) All of the above could be considered as the universal accelerating force.

SHORT ANSWERS. Write your answer in the space provided. There are 5 questions for 40 total points. Each question carries equal weight.

20) Cosmological Constant

a. Explain how Einstein's belief in the Perfect Cosmological Principle lead to his suggestion of an unknown repulsive force which permeated the Universe.

b. What made Einstein withdraw his suggestion of a pervasive unknown repulsive force?

21) Mysteries of the Universe

a. What is the Flatness Problem?

b. What is the Horizon Problem?

22) Make-Up of the Universe

a. What are the relative proportions of dark matter, dark energy, and normal matter in our Universe?

b. Contrast dark matter and dark energy with respect to their roles in the future of the Universe.

23) Black Holes

a. What is the defining characteristic of a Black Hole?

b. What is meant by Event Horizon? What is the Schwarzschild radius for a nonrotating black hole?

24) Big Bang Thoery

a. List three pieces of evidence which offer strong support for the Big Bang Theory.

b. Explain how each piece of evidence strongly supports the Big Bang Theory.

Answer Key

Testname: ASTR123.X1

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