

BROCK UNIVERSITY

Test 2: March 2019

Course: ASTR 1P02, Section 2

Examination date: 2 March 2019

Time of Examination: 11:30 – 12:20

Number of pages: 9

Number of students: 1273

Time limit: 50 min

Instructor: S. D'Agostino

Answer all questions on the answer sheet provided. No aids permitted except for a non-programmable calculator. Each question is worth 1 mark. Total number of marks: 50.

DO NOT WRITE YOUR ANSWERS ON YOUR QUESTION PAGE. DOING SO WILL RESULT IN AN ASSIGNED GRADE OF ZERO.

1. Galaxies that contain a lot of gas and dust and contain many hot, bright stars are
 - (a) coral.
 - (b) elliptical.
 - (c) spiral.
 - (d) zygmatic.
 - (e) [None of the others.]

2. Galaxies that contain mostly Population II stars and tend to be red are
 - (a) coral.
 - (b) elliptical.
 - (c) spiral.
 - (d) zygmatic.
 - (e) [None of the others.]

3. E7 galaxies appear to be much more spherical than E0 galaxies.
 - (a) True.
 - (b) False.

4. Lenticular galaxies
 - (a) are types of elliptical galaxies.
 - (b) have very large nuclei.
 - (c) have very large spiral arms.
 - (d) contain very little gas and dust.
 - (e) [None of the others.]

5. Sa galaxies
 - (a) obviously studied harder than Sb and Sc galaxies.
 - (b) feature prominently in astronomical essays.
 - (c) have large nuclei, lots of gas and dust concentrated in spiral arms, and very few hot luminous, young stars.
 - (d) have small nuclei, lots of gas and dust concentrated in spiral arms, and many hot luminous, young stars.
6. The Large Magellanic Cloud and the Small Magellanic Cloud
 - (a) both have a significant amount of gas and dust.
 - (b) both have very little gas and dust.
 - (c) both have nearly no stars.
 - (d) both have a significant number of axions.
7. Sc galaxies typically appear
 - (a) bluish.
 - (b) greenish.
 - (c) redish.
 - (d) yellowish.
8. The distances to galaxies more than about 100 million light years away can be determined using the method of
 - (a) Cepheid variables.
 - (b) globular clusters.
 - (c) echolocation.
 - (d) parallax measurements.
9. For galaxies that are not too distant, astronomers use the method of _____ to measure their distances from us.
 - (a) Cepheid variables.
 - (b) globular clusters.
 - (c) echolocation.
 - (d) parallax measurements.
10. Irregular galaxies
 - (a) contain very large nuclei.
 - (b) contain very small nuclei.
 - (c) have no obvious signs of nuclei.

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11. The relationship between the distance of a galaxy from us and its _____ was discovered by _____
- (a) dark matter content / Keres in 1629.
 - (b) luminosity / Copernicus in 1829.
 - (c) recession speed / Hubble in 1929.
 - (d) size / Gödel in 1429.
12. One of the conclusions drawn from Hubble's law is that
- (a) the decreases in rotation rates of pulsars is consistent with the predictions of general relativity.
 - (b) the large-scale structure of the universe contains filaments.
 - (c) the universe is expanding.
 - (d) the universe is infused with dark matter.
13. About _____ of spiral galaxies are barred spiral galaxies.
- (a) 90%
 - (b) 2/3
 - (c) 1/3
 - (d) 10%
14. Cosmological redshift is measured by observing
- (a) outfits on the red carpet at the *Oscars*.
 - (b) stars in our galaxy, especially distant stars.
 - (c) galaxies, especially distant galaxies.
 - (d) black holes, especially distant black holes.
15. The distances to the most distant galaxies are determined using
- (a) Cepheid variables.
 - (b) galactic parallax.
 - (c) open clusters.
 - (d) Type II supernovae.
 - (e) [None of the others.]
16. The Large Magellanic Cloud and the Small Magellanic Cloud
- (a) are lenticular galaxies.
 - (b) are nebulae within the Milky Way galaxy.
 - (c) contain large amounts of lentils and legumes.
 - (d) produce, respectively, large and small amounts of intergalactic precipitation.
 - (e) [None of the others.]

17. Elliptical galaxies account for about _____ of the galaxies that we observe.
- (a) 1/3
 - (b) 2/3
 - (c) 90%
 - (d) [None of the others.]
18. The closest galaxies to us are about _____ light years from us.
- (a) 5
 - (b) 100
 - (c) 200 thousand
 - (d) 400 million
 - (e) 600 billion
19. The size of the region responsible for the large luminosity of a quasar can be estimated from
- (a) its distance.
 - (b) the period of its luminosity variation.
 - (c) its redshift.
 - (d) its mass.
20. Olbers's paradox states that if you make a few simple assumptions, including _____, then you can conclude that the night sky should not be dark.
- (a) the bangs were trimmed in the Big Bang theory
 - (b) the clustering density of stars is approximately the same as the density of gas and dust in the dark energy sector
 - (c) the density of stars is sufficiently high that no matter where you look in the sky, your line of sight will eventually intersect one
 - (d) the baryon number density is proportional to the quasar energy
21. A simple resolution to Olbers's paradox, suggested by the poet Edgar Allan Poe, and later generally accepted after much scientific discussion, is that
- (a) the age of the universe is finite.
 - (b) interstellar dust blocks light from distant stars.
 - (c) light from very distant stars gradually loses energy over its long journey (the "tired-light" hypothesis).
 - (d) there are a lot fewer stars than astronomers say there are, an obvious error that mainstream astronomers will not admit to making.

22. Quasars are unusual because although they appear star-like, unlike stars they emit large amounts of
- (a) quarks.
 - (b) quasinos.
 - (c) quasalinos.
 - (d) radio waves.
23. The Big Bang theory
- (a) explains the structure and evolution of quasars.
 - (b) explains the structure and evolution of supernovae.
 - (c) proposes that the universe and all the particles and atoms currently in it were created in an explosion about 14 billion years ago.
 - (d) proposes that the universe and its fundamental particles (but not atoms) were created in an explosion about 14 billion years ago.
24. According to the Big Bang theory, neutral hydrogen atoms formed
- (a) as soon as the Big Bang occurred.
 - (b) about 380 days after the Big Bang.
 - (c) about 380 years after the Big Bang.
 - (d) about 380 thousand years after the Big Bang.
25. Cosmic background radiation was first observed in ____ by _____ .
- (a) 285 BC, Galileo Galilei and Isaac Newton
 - (b) 1602, Edwin Hubble and Jocelyn Bell
 - (c) 1931, Johannes Kepler and Tycho Brahe
 - (d) 1982, Monica Seleš and Fabiano Caruana
 - (e) [None of the others.]
26. Powerful evidence for the Big Bang theory was provided by the discovery of
- (a) cosmic microwave background radiation.
 - (b) dark energy.
 - (c) dark matter.
 - (d) quasars.
27. The reciprocal of the Hubble constant gives an approximate value for
- (a) the year in which the Leafs will finally win the Stanley Cup again.
 - (b) the content of gas and dust in a spiral galaxy.
 - (c) the age of the universe.
 - (d) the mass of a white dwarf stars.

28. The parameter Ω indicates the fate of the universe. If $\Omega > 1$, then the universe will
- (a) expand for a while, but slow down, reverse, and eventually collapse in a “Big Crunch.”
 - (b) continue to expand indefinitely, but the expansion rate approaches zero more and more closely as time passes.
 - (c) continue to expand indefinitely, but the expansion rate is approximately constant.
29. The parameter Ω indicates the fate of the universe. If $\Omega = 1$, then the universe will
- (a) expand for a while, but slow down, reverse, and eventually collapse in a “Big Crunch.”
 - (b) continue to expand indefinitely, but the expansion rate approaches zero more and more closely as time passes.
 - (c) continue to expand indefinitely, but the expansion rate is approximately constant.
30. The parameter Ω indicates the fate of the universe. If $\Omega < 1$, then the universe will
- (a) expand for a while, but slow down, reverse, and eventually collapse in a “Big Crunch.”
 - (b) continue to expand indefinitely, but the expansion rate approaches zero more and more closely as time passes.
 - (c) continue to expand indefinitely, but the expansion rate is approximately constant.
31. Dark energy tends to
- (a) draw matter in to itself, much like a black hole, and therefore tends to cause the universe to contract.
 - (b) be chaotic, and scatters matter in all directions, and therefore tends to increase the negentropy of the universe.
 - (c) concentrate in the darkest regions of space, the “voids” between filaments connecting super clusters of galaxies.
 - (d) oppose gravity, and therefore tends to cause the universe to expand.
32. The distance of galaxy A from us is half the distance of galaxy B. The recession speed of A is about _____ the recession speed of galaxy B.
- (a) two times
 - (b) four times
 - (c) one half of
 - (d) one fourth of

33. Observations of elliptical galaxies with multiple nuclei is evidence for
- (a) the density wave theory.
 - (b) galaxy mergers.
 - (c) the general theory of relativity.
 - (d) [There are no known elliptical galaxies with multiple nuclei.]
34. Galaxy interactions are expected to be more frequent in
- (a) irregular galaxy clusters.
 - (b) Hubble galaxy clusters.
 - (c) poor galaxy clusters.
 - (d) rich galaxy clusters.
35. Elliptical galaxies that emit large amounts of radio waves from their cores and “radio lobes” that are outside their visible regions are called
- (a) galactic bursters.
 - (b) quasars.
 - (c) radio galaxies.
 - (d) theremins.
 - (e) [None of the above.]
36. A typical quasar emits
- (a) about the same amount of power as a typical main-sequence star.
 - (b) about the same amount of power as the brightest star in our galaxy.
 - (c) about the same amount of power as an entire galaxy.
 - (d) much more power than an entire galaxy.
37. Right after the Big Bang, the universe was
- (a) very hot and dense, and it contracted and gradually warmed up.
 - (b) very hot and dense, and it expanded and gradually cooled.
 - (c) very cool and not very dense, and it expanded and gradually warmed up.
 - (d) very cool and not very dense, and it contracted and gradually cooled.
38. The universe became transparent to light
- (a) when free electrons and free protons combined.
 - (b) when neutrinos began to oscillate.
 - (c) when photons combined with anti-photons to form gamma rays.
 - (d) when stellar nucleosynthesis began.
39. The age of the universe is thought to be
- (a) finite.
 - (b) infinite.

40. The cosmic background radiation currently has its peak in the _____ part of the electromagnetic spectrum.
- (a) ultraviolet
 - (b) infrared
 - (c) microwave
 - (d) radio wave
41. The observed distribution of chemical elements in the early universe (about 75% hydrogen, about 25% helium, and a trace of lithium) is strong evidence for
- (a) Kepler's laws.
 - (b) the steady state theory.
 - (c) the Big Bang theory.
 - (d) Einstein's theory of gravity (general relativity).
42. The age of the universe is about
- (a) 14 thousand years.
 - (b) 14 million years.
 - (c) 14 billion years.
 - (d) 14 trillion years.
43. The recession speed of Galaxy A is four times the recession speed of Galaxy B. Therefore, the distance of Galaxy A from us is _____ the distance of Galaxy B from us.
- (a) one-fourth
 - (b) one-sixteenth
 - (c) four times
 - (d) sixteen times
44. Currently, the universe appears to be
- (a) expanding.
 - (b) contracting.
 - (c) maintaining approximately the same size.
 - (d) [This is currently an open question.]
45. Gas compression, and a resulting burst in star formation, can be triggered by
- (a) explosion of dark matter.
 - (b) Hubble expansion.
 - (c) oscillation of Lissajous figures.
 - (d) theremin-theremin interactions.
 - (e) [None of the others.]

46. Why might a galaxy such as M31 (Andromeda) have a blueshifted spectrum instead of a redshifted spectrum?
- (a) It is usually in a blue mood.
 - (b) The effect of its local motion is larger than the effect of the expansion of the universe.
 - (c) Most of its stars are young, and therefore blue.
 - (d) It contains more Mira stars than Cepheid variables.
47. Supermassive black holes are found
- (a) at the bottom of supermassive ditches.
 - (b) in the spiral arms of some spiral galaxies.
 - (c) in the radio lobes of some radio galaxies.
 - (d) in the nuclei of some galaxies.
 - (e) [Supermassive black holes do not exist.]
48. One of the predictions of Einstein's theory of general relativity is that light from distant stars should have its path bent by
- (a) refraction through interstellar glasses, ices, and crystals.
 - (b) scattering from interstellar gas and dust.
 - (c) destructive interference due to the Doppler effect from giant black holes.
 - (d) the gravitational effect of matter between us and the source of the light.
49. Data from the WMAP and Planck satellite observatories suggest that the the universe
- (a) is flat (overall).
 - (b) has accelerating expansion.
 - (c) will probably expand forever.
 - (d) [All of the above.]
 - (e) [None of the above.]
50. In the first minute or so after the Big Bang, atomic nuclei could not exist because
- (a) it was too hot.
 - (b) stars had not yet formed.
 - (c) galaxies had not yet formed.
 - (d) the density of quasars was too high.
 - (e) [None of the above.]