BROCK UNIVERSITY

Test 2: March 2018
Course: ASTR 1P02, Section 2
Examination date: 10 March 2018
Time of Examination: 13:00 – 13:50

Number of pages: 9
Number of students: 1157
Time limit: 50 min
Instructor: S. D'Agostino

Answer all questions on the scantron 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. Elliptical galaxies appear to be shaped somewhat like
   (a) elephants.
   (b) elm trees.
   (c) * eggs.
   (d) pears.
2. Elliptical galaxies contain mostly
   (a) Population I stars and tend to be red.
   (b) Population I stars and tend to be blue.
   (c) * Population II stars and tend to be red.
   (d) Population II stars and tend to be blue.
3. Elliptical galaxies typically contain
   (a) a lot of gas and dust.
   (b) a lot of dust, but very little gas.
   (c) an unusually large amount of gas, but very little dust.
   (d) * very little gas and dust.
4. A spiral galaxy
   (a) is a rotating ellipsoid, much like a spiral-thrown football pass.
   (b) has spiral arms that appear much like a DNA molecule, or a wood screw.
   (c) has a spherical membrane surrounding a spiral nucleus.
   (d) * has a nucleus, with spiral arms emanating from the nucleus, all lying approximately in a disk.

5. Sc galaxies
   (a) obviously didn't study as hard as Sa and Sb galaxies.
   (b) featured prominently, along with other Canadian stars, on SCTV.
   (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. Barred spiral galaxies differ from spiral galaxies because a barred spiral galaxy
   (a) resembles Darth Vader's batmobile.
   (b) is not allowed entry to intergalactic hot spots unless it is at least 19 eons old.
   (c) has between 10 and 20 spoke-like bars emanating from the central bulge, so that it looks somewhat like a wheel.
   (d) * has an elongated central bulge (i.e., a "bar").

7. For galaxies that are not too distant, astronomers use _____ to measure their distances from us.
   (a) echolocation.
   (b) parallax measurements.
   (c) * the method of Cepheid variables.
   (d) the method of globular clusters.

8. The distances to galaxies more than about 100 million light years away can be determined using
   (a) echolocation.
   (b) parallax measurements.
   (c) the method of Cepheid variables.
   (d) * the method of globular clusters.

9. In 1929, Hubble discovered a relationship between the _____ of a galaxy and its _____ .
   (a) height, shooting percentage
   (b) size, mass
   (c) * distance from us, recession speed
   (d) red-shift, blue-shift

10. One of the conclusions drawn from Hubble's law is that
   (a) * the universe is expanding.
   (b) the decreases in rotation rates of pulsars is consistent with the predictions of general relativity.
   (c) the universe is infused with dark matter.
   (d) the large-scale structure of the universe contains filaments.

11. An irregular galaxy
    (a) needs to be a little more careful with its diet.
    (b) moves chaotically around the local group, with no simple pattern of motion.
    (c) * contains a chaotic mix of gas and dust with no obvious nucleus and no spiral arms.
    (d) contains a chaotic mix of constellations, where the stars in each constellation do not conform to any recognizable patterns.
12. 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.
13. The distances to the most distant galaxies are determined using
    (a) * Type Ia supernovae.
    (b) Type II supernovae.
    (c) galactic parallax.
    (d) open clusters.
14. The Large Magellanic Cloud and the Small Magellanic Cloud
    (a) produce, respectively, large and small amounts of intergalactic precipitation.
    (b) are lenticular galaxies.
    (c) contain large amounts of lentils and legumes.
    (d) * are irregular galaxies in the Local Group.
15. Collisions between galaxies are
    (a) * much more frequent than collisions between stars.
    (b) about as frequent as collisions between stars.
    (c) much less frequent than collisions between stars.
    (d) [It depends how long the galaxies have been in the bar.]
16. One possible result of a galaxy collision is
    (a) the two galaxies might unfriend each other on *Cosmosbook*.
    (b) one of the galaxies might give birth to an infant galaxy nine eons later.
    (c) * one of the galaxies might strip gas and dust away from the other galaxy.
    (d) the dark matter in one of the galaxies might absorb dark energy from the other galaxy.

17. A spiral galaxy has a small bright central region, and the intensity of its radiation varies on a time scale of minutes. It is most likely a _____ galaxy.

    (a) barred spiral
    (b) irregular
    (c) intense
    (d) * Seyfert

18. 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.

19. 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) Shaqtin' a fool
    (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 quasalino energy

20. 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.

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. The Big Bang theory

    (a) describes what happens after Sheldon and Amy go out on a date.
    (b) originated when Shawn Kemp banged on Alton Lister (the "Lister Blister").
    (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.

23. 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.

24. 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) * 1964, Arno Penzias and Robert Wilson
    (e) [Cosmic microwave background radiation has never been observed.]

25. Cosmic background radiation

    (a) * provides strong evidence for the Big Bang theory.
    (b) is inconsistent with the Big Bang theory, but can be explained by fudging data.
    (c) provides strong evidence for the Steady State theory.
    (d) is still unexplained and is currently being re-evaluated by astronomers.

26. 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.

27. 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.

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. 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.

31. The distance of galaxy A is two times 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

32. Rich galaxy clusters consist mostly of

    (a) spiral Sc galaxies.

    (b) barred spiral galaxies.

    (c) * elliptical galaxies and Sa spirals.

    (d) active galaxies.

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. Radio galaxies are typically certain _____ that emit large amounts of radio waves.

    (a) spiral galaxies
    (b) * elliptical galaxies
    (c) irregular galaxies
    (d) Hubble galaxies

35. The standard explanation for the powerful emission of radio waves from the core of a radio galaxy is that the radio galaxy contains _____ at its core.

    (a) a bompin' party with DJ Khaled
    (b) a super giant quasar
    (c) a super giant pulsar
    (d) * a super giant black hole

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 cosmic background radiation currently has its peak in the _____ part of the electromagnetic spectrum.

    (a) ultraviolet
    (b) infrared
    (c) * microwave
    (d) radio wave

40. 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).

41. The age of the universe is about

    (a) 14 thousand years.
    (b) 14 million years.
    (c) * 14 billion years.
    (d) 14 trillion years.

42. The redshift of Galaxy A is three times the redshift of Galaxy B. Therefore, the recession speed of Galaxy A is _____ the recession speed of Galaxy B.

    (a) * three times
    (b) nine times
    (c) one-third
    (d) one-ninth

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. 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.

46. A head-on collision between two elliptical galaxies is most likely to produce
    (a) complete destruction of most of the stars.
    (b) a single spiral galaxy.
    (c) a single open cluster.
    (d) * a ring galaxy.
    (e) [Galaxy collisions are unknown.]

47. 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.

48. 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.]

49. 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.]

50. The Higgs boson was first detected
    (a) by the WMAP satellite in 2005.
    (b) by the Planck satellite in 2007.
    (c) by the COBE satellite in 2009.
    (d) * by the LHC in 2012.