BROCK UNIVERSITY

Test 2: Fall 2017
Course: ASTR 1P01, Section 2
Examination date: 4 November 2017
Time of Examination: 13:00 – 13:50

Number of pages: 10
Number of students: 1300
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. There is significant evidence that ancient people used astronomical observations
   (a) for timekeeping.
   (b) to predict migrations of animals.
   (c) to determine when to plant crops.
   (d) * [All of the above.]
   (e) [None of the above.]

2. About 2200 years ago, Eratosthenes measured the angles of shadows on the summer solstice, and used geometry and the known distance between two cities to determine
   (a) the distance between the Earth and the Sun.
   (b) the distance between the Earth and the Moon.
   (c) * the size of the Earth.
   (d) the size of the Moon.

3. In about 1400 BCE, Chinese astronomers observed the sudden brightening and dimming of a "guest star." Nowadays, such an event is called
   (a) a Hollywood star.
   (b) a pulsed star, or "pulsar."
   (c) * a supernova.
   (d) a variable star.

4. About 1000 years ago, _____ accurately determined the time period of a tropical year (i.e., the time interval between a vernal equinox and the following vernal equinox).
   (a) DJ Khaled.
   (b) Wiz Khalifa.
   (c) Omri Casspi.
   (d) * Omar Khayyam.

5. Aristarchus observed that the Sun and the Moon have the same angular size and the Sun is much farther away than the Moon. From this he concluded that

   (a) it takes longer for the Sun to rotate once on its axis than the Moon.
   (b) the Sun takes longer to complete one revolution of its orbit than the Moon does.
   (c) the Sun's wavelength is greater than the Moon's wavelength.
   (d) * the Sun is much farther from us than the Moon.

6. The ancient Greek astronomer Aristotle presented arguments to support his hypothesis that the Earth is

   (a) flat.
   (b) hollow.
   (c) * spherical.
   (d) subject to intertidal forces.

7. Aristotle believed that the heavens are perfect, and that therefore the motions of celestial objects follow circular paths. About 500 years after Aristotle, the astronomer _____ deviated from Aristotle by constructing a model of the heavens that more accurately represented the actual motions of the celestial objects.

   (a) Copernicus
   (b) Galileo
   (c) Newton
   (d) * Ptolemy

8. Aristarchus determined the relative sizes of the Earth and the Moon by

   (a) * timing a lunar eclipse and using geometry.
   (b) timing a solar eclipse and using geometry.
   (c) measuring the Earth-Moon distance and using geometry.
   (d) measuring the Earth-Sun and Earth-Moon distances and using geometry.
   (e) [None of the above.]

9. Stellar parallax was not observed by ancient Greek astronomers

   (a) because stellar parallax did not exist in those times.
   (b) because they did not know about it and therefore didn't look for it.
   (c) * because they did not have the technology available to measure such extremely small angles.
   (d) because they did not have the technology available to measure such extremely small time intervals.

10. Among ancient Greek astronomers, the most prominent proponent of the heliocentric model of the solar system was

    (a) * Aristarchus.
    (b) Aristotle.
    (c) Brahe.
    (d) Copernicus.

11. Kepler lived about

    (a) 2300 years ago.
    (b) 1800 years ago.
    (c) 1000 years ago.
    (d) * 400 years ago.

12. Epicycles

    (a) are the paths traced out by precession.
    (b) * were introduced by ancient Greek astronomers in an attempt to explain the retrograde motions of planets.
    (c) are found in the interstellar medium.
    (d) were discovered by the careful observations of Tycho Brahe.

13. The ancient heliocentric hypothesis was reintroduced in the Renaissance by

    (a) Tycho Brahe.
    (b) * Nicolaus Copernicus.
    (c) Johannes Kepler.
    (d) Harpo Marx.
    (e) Johann Strauss.

14. Measuring the maximum altitude of a planet such as Mercury or Venus allowed Renaissance astronomers to determine the planet's

    (a) absolute magnitude.
    (b) * distance from the Sun in AU.
    (c) mass in terms of solar masses.
    (d) orbital period.
    (e) orbital speed.

15. Tycho Brahe is famous for his historically great skill in making observations of the heavens (and precise measurements) using

    (a) optical telescopes.
    (b) radio telescopes.
    (c) X-ray telescopes.
    (d) * the naked eye.

16. Ancient astronomers believed that planetary orbits are circles, because circles are the most perfect geometric shape. Using painstaking and lengthy calculations, based on careful observations of his predecessor _____, the astronomer _____ determined that planetary orbits are ellipses.

    (a) Aristotle / Ptolemy
    (b) * Brahe / Kepler
    (c) Copernicus / Hubble
    (d) Galileo / Newton

17. A planet normally appears to move towards the east with respect to the stars because of

    (a) the rotation of the Earth on its axis.
    (b) the Earth's orbital motion around the Sun.
    (c) the rotation of the planet on its axis.
    (d) * the planet's orbital motion around the Sun.

18. Occasionally a planet appears to move towards the west with respect to the stars (retrograde motion) because

    (a) * the Earth and the other planets travel along different orbits at different speeds.
    (b) planets sometimes travel through dense clouds of gas and dust that cause them to reverse direction temporarily.
    (c) of precession of planetary orbits.
    (d) of instabilities in the interplanetary glutino flux.

19. Kepler's second law of planetary motion states that the orbital speed of a planet varies so that an imaginary line joining the planet to the Sun sweeps over equal _____ in equal times.

    (a) * areas
    (b) distances
    (c) amounts of interplanetary dust and gas
    (d) eccentricities

20. As described by Kepler's third law of planetary motion,

    (a) * planets closer to the Sun have shorter periods.
    (b) planets closer to the Sun have longer periods.
    (c) the period of a planet does not depend on its distance from the Sun.
    (d) the period of a planet is related to its distance from the Sun, but not in a way described here.

21. This scientist is widely considered to be the originator of the modern scientific method:

    (a) Aristotle
    (b) * Galileo
    (c) Hipparchus
    (d) Elway

22. Radio waves from space

    (a) * can be detected by radio telescopes on the surface of the Earth.
    (b) are blocked by the Earth's atmosphere, and so can only be observed by radio telescopes orbiting the Earth.
    (c) [No radio waves come to the Earth from space.]

23. Who determined that gravity is responsible for keeping the Moon in its orbit around the Earth?

    (a) Copernicus.
    (b) Galileo
    (c) Kepler.
    (d) * Newton.

24. Observations by _____ provided decisive evidence for the heliocentric model of the solar system.

    (a) Brahe of the motions of the planets
    (b) * Galileo of the phases of Venus
    (c) Huygens of the rings of Saturn
    (d) Kepler of the orbit of Mars
    (e) Newton of falling apples

25. Infrared light was discovered by _____ in the 1800s.

    (a) Aristarchus
    (b) Galileo
    (c) * Herschel
    (d) Kepler

26. The two main kinds of optical telescopes are

    (a) diffractors and deflectors.
    (b) focal and confocal.
    (c) photonic and wavelike.
    (d) * refractors and reflectors.

27. Newton made great advances in the _____ with his discoveries of laws of motion, a law of gravity, and applications of them to explain many kinds of motion in the solar system.

    (a) late 1400s and early 1500s
    (b) * late 1600s and early 1700s
    (c) late 1800s and early 1900s
    (d) [None of the above.]

28. Observations during a total solar eclipse show that the angular sizes of the Sun and Moon are nearly equal. Therefore, if the Sun is about 400 times farther from us than the Moon, the diameter of the Sun must be about _____ the diameter of the Moon.

    (a) 1/400th of
    (b) 1/20th of
    (c) the same as
    (d) 20 times
    (e) * 400 times

29. When optical telescopes were first used to observe the heavens, it was noticed that planets appear as disks but stars appear as points. One can conclude from this observation that

    (a) stars are brighter than planets.
    (b) planets are brighter than stars.
    (c) * stars are farther away than planets.
    (d) planets are farther away than stars.

30. After the fall of Constantinople in 1453, many scholars travelled to _____, bringing with them the collective wisdom of centuries of _____ thought, and thereby contributed to the Renaissance.

    (a) North America / European
    (b) South America / African
    (c) Asia / North American
    (d) * Europe / Middle Eastern and Asian

31. The three important powers of an optical telescope are its

    (a) diffraction power, interference power, and adaptive power.
    (b) length, mass, and time.
    (c) optical power, fringing power, and dodecahedral power.
    (d) * light-gathering power, resolving power, and magnifying power.

32. An atom becomes excited when

    (a) its favourite celebrity appears on *Dancing with the Stars*.
    (b) one of its chemical bonds is broken.
    (c) * one of its electrons "jumps" to a higher energy level.
    (d) it undergoes de-ionization.

33. It is possible to estimate the mass of a planet from the orbital data (the period and the orbital radius) of one of its satellites.

    (a) * True.
    (b) False.

34. There are no X-ray telescopes on Earth because

    (a) no X-rays are emitted from astronomical objects.
    (b) astronomers can't afford to construct an X-ray telescope.
    (c) * X-rays from space are almost completely blocked by Earth's atmosphere.
    (d) X-ray telescopes are beyond our current level of technology.

35. A spectrograph

    (a) is a toy popular in the 1970s used to make spiral patterns.
    (b) is a graph used to plot the intensity of light received from various stars.
    (c) * is a device used to separate visible light into its separate colours.
    (d) is a device used to record very faint astronomical images.

36. Object A has twice the mass of Object B. The gravitational force that Object A exerts on Object B is _____ the gravitational force that Object B exerts on Object A.

    (a) 1/4
    (b) 1/2
    (c) * equal to
    (d) 2 times
    (e) 4 times

37. Concerning Newton's laws of gravity, Newton's laws of motion, and Kepler's laws of planetary motion,
    (a) Kepler used his laws to explain Newton's laws of gravity.
    (b) Kepler used his laws to explain Newton's laws of motion.
    (c) * Newton used his laws to explain Kepler's laws.
    (d) [The laws are all independent.]
38. One of Newton's great advances was to realize that the pull of Earth's gravity
    (a) extends only up to a few hundred kilometres above the Earth's surface.
    (b) extends only up to the top of Earth's atmosphere.
    (c) extends as far as the Moon, but no farther.
    (d) * extends as far as the Moon and beyond.
39. Light is
    (a) a nuclear radiation wave.
    (b) a hydrodynamic wave.
    (c) * an electromagnetic wave.
    (d) a charged sound wave.
40. For visible light photons, the longer the wavelength,
    (a) the greater the energy of each photon.
    (b) * the lesser the energy of each photon.
    (c) [The energy of a photon is not related to its wavelength.]
41. When an atom is excited, it typically returns to its "ground state" by
    (a) * emitting a photon of electromagnetic radiation.
    (b) emitting an electron.
    (c) emitting a neutron.
    (d) emitting a proton.
42. The colour of visible light depends on the light's
    (a) coherence.
    (b) intensity.
    (c) polarization.
    (d) * wavelength.
    (e) [None of the others.]

43. Wave particle duality

    (a) is a measure of the forces that waves exert on particles.
    (b) is a measure of the forces that particles exert on waves.
    (c) is a relationship between the energies of particles and waves.
    (d) * means that light behaves sometimes like a particle and sometimes like a wave.

44. Visible light has a variety of wavelengths, and each wavelength is related to the light's

    (a) intensity.
    (b) polarization.
    (c) * colour.
    (d) mass.

45. Chromatic aberration

    (a) is the name of a constellation seen in the southern skies in winter.
    (b) is the blurry eyesight that astronomers get when they drink too much alcohol.
    (c) refers to the traumatic cracking of very large telescope lenses.
    (d) * [None of the above.]
    (e) is the name of one layer of the Sun's atmosphere.

46. For glowing objects, such as the Sun or a star, the wavelength of peak intensity is

    (a) * shorter for hotter objects.
    (b) longer for hotter objects.
    (c) shorter for larger objects.
    (d) longer for larger objects.

47. The hottest stars are

    (a) red.
    (b) orange.
    (c) yellow.
    (d) * blue.
    (e) purple.

48. The largest refracting telescope is the Yerkes telescope at the University of Chicago, and it has an objective lens with a diameter of

    (a) * 1 m.
    (b) 100 m.
    (c) 10,000 m.
    (d) 1,000,000 m.

49. Ground-based optical telescopes are often placed near the tops of tall mountains

    (a) to avoid frequent visits from door-to-door sales people.

    (b) because it's good for astronomers' egos to feel higher than anyone else.

    (c) because most astronomers love skiing, and this way they can ski during breaks in observing and when the sky is cloudy.

    (d) * to minimize atmospheric blurring.

50. The nucleus of an atom contains the atom's

    (a) neutrons and electrons.

    (b) protons and electrons.

    (c) * protons and neutrons.

    (d) protons, neutrons, and electrons.