Astronomy 101 16 September, 2016
Introduction to Astronomy: The Solar System

Mid-term Exam 1

Practice Version

Name (written legibly): _____

Honor Pledge: ***On my honor, I have neither given nor received unauthorized aid on this examination.***

Signature: _____ Student PID: _____

Instructions:

On the scannable answer sheet (when you're taking the real version):
- Fill in your name (last name, then first name) and ID number.
- Identify the form number with the *last column* of the sequence number block.
- Answer all 40 questions using a number 2 pencil.

In addition:
- Do not open your exam until instructed to do so.
- Be sure to also answer each question in the blanks provided on this exam sheet.
- The exam ends at 1:10.
- When done, raise your hand and we will collect your exam.
- No one may leave between 12:55 and 1:10.

And of course:
- You may not use any notes, texts, calculators or communications devices.
- All work must be your own.

Score: _____ out of 40.

Useful equations:

$p^2 \propto a^3$

$F = m\,a$

$F = G\,m_1\,m_2 / r^2$

Pick the best answer to each question.

_____ 1. The influence of Muslim science can be seen in ...

a. the names of many stars.
b. technical words such as altitude and azimuth.
c. the number zero.
d. centuries of excellent observational records.
e. All of the above.

_____ 2. How was Pluto discovered?

a. By predicting its location based on irregularities in the orbit of Uranus.
b. By predicting its location based on irregularities in the orbit of Neptune.
c. By detecting its shadow on the Earth.
d. With the Hubble Space Telescope.
e. Pretty much by accident.

_____ 3. Who invoked a Counter-Earth and Central Fire to give the Solar System exactly ten objects?

a. Astronomers of the Alexandrian School.
b. Socrates.
c. Thales.
d. Aristotle.
e. The Pythagoreans.

_____ 4. The force of the Sun's gravity on the Moon ...

a. is weaker when the Moon is new than when it is full.
b. is stronger when the Moon is new than when it is full.
c. is always the same as the force of the Sun's gravity on the Earth.
d. varies as the number of sunspots on the Solar surface vary.
e. will cause it to crash into the Earth in about three billion years.

_____ 5. Who first detected the parallax in nearby stars due to the motion of the Earth around the Sun?

a. Aristotle.
b. Ptolemy.
c. Copernicus.
d. Tycho.
e. None of the above.

_____ 6. What is an Astronomical Unit (AU)?

a. The average distance between the Earth and the Sun.
b. The distance that light travels in one year.
c. The distance between the Sun and the nearest star (Proxima Centauri).
d . The amount of time that it takes for the Sun to move around the celestial sphere.
e. The average orbital speed of the Earth.

_____ 7. Missoula, Montana, has a latitude of 47 degrees north, while Chapel Hill is 36 degrees north. Which of the following statements is false?

a. In the winter, the Sun is up fewer hours in Missoula.
b. In the winter, the Sun gets higher in the sky in Chapel Hill.
c. In the summer, the Sun gets higher in the sky in Chapel Hill.
d. In the summer, the Sun is up fewer hours in Missoula.
e. On the equinoxes, the Sun is up the same length of time in both cities.

_____ 8. For which of the following was independent thought an essential part of their success as a civilization?

a. The Sumerians.
b. The Greeks.
c. The Egyptians.
d. The Assyrians.
e. The Babylonians.

_____ 9. Mr. Spock spots a black hole at a distance of 10 AU, and Captain Kirk chooses to move the USS Enterprise closer, to a distance of 1 AU. How much has the gravitational force from the black hole changed?

a. It is ten times stronger.
b. It is ten times weaker.
c. It is 100 times stonger.
d. It is 100 times weaker.
e. It has not changed.

_____ 10. Which of the following did Aristarchus NOT do (or try to do)?

a. Measure the relative sizes of the Earth, Moon and Sun.
b. Measure the relative distances of the Earth, Moon, and Sun.
c. Measure the absolute size of the Earth.
d. Measure the rate of the Earth's precession?
e. Suggest that the Earth orbited the Sun and not the other way around.

_____ 11. Who is considered to be the father of Western philosophy?

a. Sargon of Akkad
b. Thales
c. Aristarchus
d. Aristotle
e. Pythagorus

_____ 12. In the heliocentric model of Copernicus, Mercury never moves further than 22 degrees from the Sun because ...

a. its orbit is inside the Earth's.
b. it's a superior planet.
c. its deferent must move around the Earth at the same angular rate as the Sun's.
d. its rotation axis has a smaller inclination to its orbit than the Earth's.
e. its rotation axis does not precess like the Earth's.

_____ 13. Galileo's observations of the Moon showed that ...

a. it was older than the Earth.
b. it was younger than the Earth.
c. it had mountains and valleys like the Earth and was not perfectly spherical.
d. objects in the Solar System could orbit the Sun.
e. the heavenly bodies moved in elliptical orbits.

_____ 14. The Copernican model of the Solar System ...

a. retained the Ptolemaic devices of epicycles and deferents.
b. made it possible to determine the semi-major axes of all of the planetary orbits.
c. was criticized in both Protestant and Catholic Europe.
d. All of the above.
e. None of the above.

_____ 15. Kepler’s discovery that the planets had elliptical orbits improved the Copernican model by ...

a. moving the Earth from the center of the Solar System.
b. eliminating the need for epicycles, deferents, and eccentrics.
c. treating Venus and Mercury as superior planets.
d. explaining retrogade loops without using relative motion.
e. None of the above.

_____ 16. A sidereal day is the time ...

a. the Earth takes to complete one rotation of 360 degrees.
b. between two successive transits of the meridian by the Sun.
c. between two successive transits of the meridian by a star.
d. Both (a) and (b).
e. Both (a) and (c).

_____ 17. When would an obelisk in Rome cast a shadow to the southeast?

a. At sunrise in the winter.
b. At sunset in the winter.
c. At sunrise in the summer.
d. At sunset in the summer.
e. At noon any day of the year.

_____ 18. If the Moon rises roughly 12 hours after the Sun rises, it is ...

a. full.
b. new.
c. third quarter.
d. on the ecliptic.
e. above the ecliptic.

_____ 19. Which of the following are examples of efforts by ancient astronomers to track the calendar?

a. Stonehenge.
b. The Sun Dagger in Chaco Canyon, New Mexico.
c. Obelisks.
d. All of the above.
e. None of the above.

_____ 20. Which of the following was NOT part of Aristotle's model of the Universe?

a. The Earth was flat.
b. All imperfection was within the sphere of the Earth.
c. All motion in the heavens could be described with perfect circles.
d. The realm of the Earth included four elements: Earth, water, air, and fire.
e. All of the above were part of Aristotle's model.

_____ 21. As described in lecture, science ...

a. is a changing body of knowledge.
b. proceeds by making and testing falsifiable statements.
c. is a process of inquiry.
d. All of the above.
e. None of the above.

_____ 22. According to Newton's Second Law of Motion, if Object 1 exerts a force on Object 2, then Object 2 ...

a. resists that force until the force is dissipated.
b. converts that force to friction.
c. exerts a frictional force on Object 1.
d. accelerates in the direction of the force.
e. exerts an equal and opposite force on Object 1.

_____ 23. The Sun rises and sets exactly in the east and the west ...

a. always.
b. never.
c. on the Summer Solstice.
d. on the Winter Solstice.
e. on the equinoxes.

_____ 24. During a solar eclipse, what is the phase of the Moon?

a. New.
b. Either first or third quarter.
c. Full.
d. Phase is not important; what matters is if the Moon is on or off the ecliptic.
e. None of the above.

_____ 25. How did Ptolemy model the motions of the planets?

a. With homocentric spheres.
b. With epicycles, deferents, equants, and eccentrics.
c. With tangents and irreducible ratios.
d. With sticks and styrofoam balls.
e. With circles, ellipses, and other conic sections.

_____ 26. Which observations of Tycho were essential to Kepler's First and Second Laws of Planetary Motion?

a. The positions of Mars.
b. The parallax to comets.
c. New stars in the sky.
d. The parallax to the Moon.
e. All of the above.

_____ 27. The Theory of General Relativity ...

a. demonstrates that we can't prove that theories or laws are really true.
b. shows how improved technology reveals shortcomings in what we thought we knew.
c. shows how two very different theories can explain the same phenomena.
d. predicted that gravity even affects massless particles like photons.
e. All of the above.

_____ 28. How long is a synodic month (full moon to full moon)?

a. 27.3 days.
b. 29.5 days.
c. 30.5 days.
d. 365.242 days.
e. 365.256 days.

_____ 29. Which of the following was NOT observed by Galileo?

a. Mountains, valleys and craters on the Moon.
b. Four moons orbiting Jupiter.
c. The phases of Venus.
d. A moon orbiting Saturn.
e. Galileo observed all of the above.

_____ 30. How do we know the Earth is round?

a. Because new constellations become visible as one travels north or south.
b. Because local noon does not occur simultaneously everywhere.
c. Because the shadow of the Earth during lunar eclipses is always circular.
d. Because the hull of a ship sailing away disappears before its sails do.
e. All of the above.

_____ 31. How long do we have to wait after one lunar eclipse before the next one is possible?

a. One synodic month.
b. Three synodic months.
c. Six synodic months.
d. Twelve synodic months.
e. One year.

_____ 32. Newton's First Law of Motion states that ...

a. all objects are always accelerating.
b. an object remains at rest or moves at a constant velocity if not subject to a force.
c. gravity is caused by vortices in the space-time continuum.
d. the Higgs boson gives objects mass.
e. forces balance due to actions and reactions.

_____ 33. Which of the seven planets, as defined by the ancients, never undergo retrograde motion?

a. Mars and Mercury.
b. The Sun and Moon.
c. Jupiter and Saturn.
d. Mars and Venus.
e. Mars and Jupiter.

_____ 34. Murmansk in Russia has a latitude of 69 degrees. What is the highest the Sun will ever get there?

a. 21 degrees.
b. 44.5 degrees.
c. 46.5 degrees.
d. 69 degrees.
e. 90 degrees.

_____ 35. How do scientific theories become laws?

a. By a vote of the National Academy of Sciences.
b. By decisions made by the United Nations Council of Scientific Edicts.
c. They are tested and proven to be true.
d. By an appeal to the authority of respected scientists.
e. They don't.

_____ 36. What causes the seasons on Earth?

a. The official Inspector of Seasons employed by the Royal Observatory in Greenwich, England.
b. Changes in the distance between the Earth and Sun.
c. The tilt of the Earth's rotation axis compared to the axis of its orbit around the Sun.
d. Clouds of Zodiacal dust which partially obscure the Sun when the Earth is in certain portions of its orbit.
e. Seasons? There is only summer in North Carolina. There are no other seasons.

_____ 37. Who burned the Library at Alexandria?

a. The Romans.
b. The Christians.
c. The Muslims.
d. All of the above.
e. None of the above.

_____ 38. What is acceleration?

a. The rate of change of velocity.
b. The rate of change of time.
c. The rate of change of position.
d. A force.
e. None of the above.

_____ 39. What came after the reintroduction of the Greek classics to Europe?

a. The Renaissance.
b. The Dark Ages.
c. The Fall of the Roman Empire.
d. The spread of Islam through the Middle East and North Africa.
e. All of the above.

_____ 40. Eratosthenes measured the size of the Earth by ...

a. hiring someone to walk all the way around the Earth.
b. timing how long it took the Earth to rotate on its axis.
c. using shadows at two points to measure their relative latitude, then measuring their north-south distance.
d. observing the Earth's shadow during lunar eclipses.
e. consulting an astrologer.