There are 33 questions on this exam. Write your answer right on this exam either by circling one of the 5 choices or writing the letter corresponding to your choice next to the question. If you circle more than one answer, make sure you make clear to me which answer is your actual choice, because if I have any doubts, I will just mark the question as being wrong. Each correct answer is worth 3 points for a total of 99 points. If you write your name LEGIBLY in the space at the top of this page, you get 1 extra point for a grand total of 100. There is only one best answer to each question. There is a sheet at the end of this exam with formulas and constants that you may need. You may use a calculator. GOOD LUCK!

1. Which of the following people was NOT involved in the Copernican Revolution?
   a) Galileo
   b) Isaac Newton
   c) Tycho Brahe
   d) Thomas Aquinas
   e) Johannes Kepler
   D

2. Kepler's First Law implies that
   a) planets always travel in circular orbits.
   b) the speed of a planet varies as the planet moves around the Sun.
   c) a planet must always keep the same side towards the Sun.
   d) the distance of a planet varies as the planet moves around the Sun.
   e) all planets move around the Sun at constant rates.
   D

3. If a planet is 4 Astronomical Units (AUs) from the Sun, its period must be
   a) 52 years
   b) 27 years
   c) 14 years
   d) 8 years
   e) 3 years
   D
4. The path of the Sun along the celestial sphere is called
   a) the elliptical
   b) the parallax angle
   c) the eclipse
   d) the perihelion
   e) the ecliptic

5. Suppose the tilt of the Earth's axis was 35 degrees instead of 23.4 degrees. At what latitude would the Sun be overhead on the Summer Solstice?
   a) 11.5 degrees
   b) 23.4 degrees
   c) 35 degrees
   d) 55 degrees
   e) 90 degrees

6. In the 16th century, the heliocentric system was first re-proposed by
   a) Giordano Bruno
   b) Nicolaus Copernicus
   c) Johannes Kepler
   d) Galileo
   e) Rene Descartes

7. What is 0.00276 in scientific notation?
   a) 2.76 x 10^4
   b) 2.76 x 10^{-3}
   c) 2.76 x 10^{-2}
   d) 2.76 x 10^{-1}
   e) 2.76 x 10^0

8. What is the approximate angular size of the Sun as seen from the Earth?
   a) 80 arcseconds
   b) 150 arcseconds
   c) 450 arcseconds
   d) 1200 arcseconds
   e) 1900 arcseconds

9. What is another name for the point that marks the intersection of the 0 degrees of celestial longitude (Right Ascension) with the celestial equator?
   a) the First Point of Aries
   b) the Summer Solstice
   c) the ecliptic
   d) the Winter Solstice
   e) the Autumnal Equinox
10. What are the two conditions that must be fulfilled for a lunar eclipse to occur?  
   a) The Moon must be between the Earth and the Sun and the line of nodes must point towards the Earth.  
   b) The Earth must be between the Moon and the Sun and the line of nodes must point towards the Earth.  
   c) The Earth must be between the Moon and the Sun and the line of nodes must point towards the Sun.  
   d) The Moon must be between the Earth and the Sun and the line of nodes must point towards the Sun.  
   e) The Moon must be between the Earth and the Sun and the line of nodes must point towards the Moon.  

11. Let's say an object is moving in a straight line at constant velocity. According to Newtonian mechanics, what must be applied to it to make it deviate from its straight-line motion?  
   a) a speed  
   b) a force  
   c) a precession  
   d) a libration  
   e) none of the above  

12. Kepler's Second Law states that  
   a) \( F = ma \)  
   b) \( p^2 = a^3 \)  
   c) all objects must move in straight lines  
   d) equal areas of an orbit are swept out in equal times  
   e) mass and weight are the same  

13. The surface area of a sphere is proportional to the square of its radius. The radius of the Moon is only about one-quarter that of the Earth. How does the surface area of the Moon compare with that of the Earth?  
   a) the Moon's surface area is one-quarter that of the Earth.  
   b) the Moon's surface area is one-eight that of the Earth.  
   c) the Moon's surface area is one-sixteenth that of the Earth.  
   d) the Moon's surface area is one-thirty-second that of the Earth.  
   e) the Moon's surface area is one-sixty-fourth that of the Earth.  

14. You can define the length of the day with respect to the Sun. What other reference point(s) can be used to define the length of the day?  
   a) the stars  
   b) the Moon  
   c) one of the planets  
   d) the North Celestial Pole  
   e) all of the above
15. The Sun reaches its highest point in the sky at noon from any location in the Southern Hemisphere on
   a) the Summer Solstice
   b) the Winter Solstice
   c) the Vernal Equinox
   d) the Autumnal Equinox
   e) the perihelion of the Earth

16. The calendar that is currently used in the Western world is known as
   a) the Julian calendar
   b) the Napoleonic calendar
   c) the English calendar
   d) the Roman calendar
   e) the Gregorian calendar

17. What is the difference between the mass and weight of an object?
   a) Mass is a force and depends on the local acceleration, while weight is a quantity that remains the same.
   b) Weight is a force and depends on the local acceleration, while mass is a quantity that stays the same.
   c) Weight varies with speed while mass varies with acceleration.
   d) Mass never changes while weight varies with speed.
   e) Mass is constant except in free fall while weight remains constant.

18. Kepler’s Laws are examples of what type of science?
   a) hypothetical
   b) empirical
   c) theoretical
   d) logical
   e) canonical

19. In a geocentric system, the retrograde motion of the outer planets is explained by having
   a) the planet move around the Sun more slowly than the Earth.
   b) the planet move around the Sun more quickly than the Earth.
   c) the outer planets move on epicycles.
   d) the Sun move backwards and then forwards on the ecliptic
   e) the small angle formula
20. An ellipse that has both foci in the same place is also known as
   a) a hyperbola
   b) a parabola
   c) a circle
   d) a sine curve
   e) a straight line

21. Approximately when is the Sun on the Vernal Equinox?
   a) late March
   b) late January
   c) late December
   d) late June
   e) late September

22. Which of the following points on the celestial sphere changes its location
    because of precession?
   a) North Celestial Pole
   b) South Celestial Pole
   c) the Summer Solstice
   d) the Winter Solstice
   e) all of the above

23. What is the reason Aristotle gave for choosing the geocentric system over the
    heliocentric system?
   a) The Earth clearly does not move.
   b) The Sun clearly does not move.
   c) The motion of the planets is simpler in a geocentric system.
   d) The stars do not show a parallax shift over many months.
   e) The stars show a parallax shift over many months.

24. If a planet is 0.5 AU from the Sun, what is the period of its orbit?
   a) 54 days
   b) 129 days
   c) 182 days
   d) 312 days
   e) 548 days

25. If a planet is at its perihelion distance from the Sun, which of the following
    statements is true?
   a) The planet is closest to the Sun and moving most slowly.
   b) The planet is farthest from the Sun and moving most slowly.
   c) The planet is closest to the Sun and moving most quickly.
   d) The planet is farthest from the Sun and moving most quickly.
   e) The planet is not moving with respect to the Earth.
26. What is the name of the ancient Greek who figured out how big the Earth was?
   a) Ptolemy
   b) Aristotle
   c) Aristarchus
   d) Hipparchos
   e) Eratosthenes

27. What is the greatest angular distance that the Moon can deviate from the ecliptic?
   a) 2 degrees
   b) 5 degrees
   c) 23.4 degrees
   d) 28 degrees
   e) 37 degrees

28. The model of the Universe that puts the Sun right at the center is called?
   a) the standard model
   b) the geocentric model
   c) the heliocentric model
   d) the topocentric model
   e) the baricentric model

29. In addition to making crucial contributions to the Laws of Mechanics, Galileo also
   a) invented the astrolabe.
   b) first used the telescope to make many astronomical discoveries.
   c) deduced the laws of electromagnetism.
   d) discovered the planet Neptune.
   e) explained the Law of Universal Gravitation.

30. What is peculiar about the motion of the inner planets?
   a) They exhibit retrograde motion several times a year.
   b) They are visible throughout the night in the first half of the year.
   c) They are visible throughout the night in the second half of the year.
   d) They are always located more than 90 degrees from the Sun.
   e) They are never very far from the Sun in angular distance.

31. On what day of the year is the Sun lowest in the sky at noon from Athens, GA?
   a) the Vernal Equinox
   b) the Autumnal Equinox
   c) the Summer Solstice
   d) the Winter Solstice
   e) January 20
32. Which of the following Greek astronomers/philosophers believed that the Sun was at the center of the Universe?
   a) Erastosthenes
   b) Ptolemy
   c) Aristotle
   d) Hipparchus
   e) Aristarchus

33. When the Earth is directly between the Sun and the Moon, what is the phase of the Moon?
   a) New
   b) First Quarter
   c) Full
   d) Last Quarter
   e) Gibbous

N.B. – Did you write your name on the exam? Did you include an answer for every question? If you don’t know an answer, at least guess.