

MULTIPLE CHOICE

- 1) The law of planetary motion that relates the speed of a planet to its position in its orbit about the Sun is:
a) Kepler's first law b) Kepler's third law c) the Law of Equal Areas d) the Law of Inertia
- 2) The type of electromagnetic radiation with a wavelength just longer than that of UV radiation is:
a) radio waves b) x-rays c) visible light d) IR radiation
- 3) The apparent change in the position of an object that results from looking at it from different angles is called:
a) parallax b) retrograde motion c) conjunction d) heliacal rising
- 4) When the sun and a planet are at the same side of the earth, then the planet is in:
a) grouping b) heliacal rising c) opposition d) conjunction
- 5) The first visibility of a celestial object in the pre-down sky is called:
a) primum mobile b) heliacal rising c) visibility d) first lighting
- 6) The average distance from the earth to the sun is defined to be one:
a) light year b) solar unit c) parsec d) astronomical unit
- 7) Kepler's theory was based upon his analysis of the extremely accurate observations made by:
a) Copernicus b) Tycho Brahe c) Galileo d) Alfonso
- 8) The device that provided, in the 19th century, proof the earth actually rotates on its axis was the:
a) Foucault Pendulum b) telescope c) pendulum clock d) rotating sphere
- 9) Ptolemy's ideas about the Universe, and a summary of the ideas of his predecessors, were contained in his major work
a) Principia b) Almagest c) Epicycle d) Revolutionibus
- 10) If the planet Mars were orbiting the Sun in an orbit four times as big as its current orbit, how many times longer would it take Mars to go around the Sun than it does now?
a) 4 b) 8 c) 16 d) 24
- 11) If a satellite orbiting the Earth at two times the radius of the Earth orbits in about 4.0 hours, then how many hours would it take a satellite orbiting at 6.6 times the Earth radius to complete an orbit?
a) 4 b) 8 c) 16 d) 24
- 12) A satellite which orbits at the same speed as that at which the Earth's surface rotates underneath is a(n):
a) equant satellite b) heliocentric satellite c) synchronous satellite d) geographical satellite
- 13) The first astronomer to use a telescope to observe the sky is:
a) Tycho Brahe b) Kepler c) Galileo d) Copernicus
- 14) The line that bisects the longer axis of an ellipse and lies perpendicular to it is the:
a) major axis b) semi-major axis c) minor axis d) semi-minor axis

- 15) Compared with visible light photons, a photon of radio waves has:
- a) same energy b) less energy c) more energy d) more information needed
- 16) In order to change the period of an artificial satellite that is revolving the earth, we need to change its:
- a) orbital size b) mass c) density d) size and shape
- 17) What is the orbital speed of the Earth around the Sun?
- a) 10 km/s b) 20 km/s c) 30 km/s d) 40 km/s
- 18) The hypothesis of the universe that treats the Earth to be a planet and the Sun to be at its center is called:
- a) geocentric b) heliocentric c) heliacal d) geographical
- 19) Astronomers have found planets around a star called Upsilon Andromedae, which is at a distance of 44 light years from our solar system. Assume a spacecraft that can travel with a speed of 5×10^4 km/hr (a typical speed of a present day spacecraft), how long would it take to reach that new planetary system?
- a) 8.3×10^6 yrs. b) 4.4×10^5 yrs. c) 2.2×10^6 yrs. d) 9.5×10^5 yrs.
- 20) At what percentage of speed of light (c) should a spacecraft move so that a round trip to Proxima Centauri stellar system takes 50 years, if it is at a distance of 1.3 pc?
- a) 17 % b) 34 % c) 20 % d) 8 %
- 21) Galileo made several major discoveries by using a telescope. One of those discoveries is observing the:
- a) phases of the moon b) moons of Venus c) moons of Mars d) phases of Venus
- 22) Aristotle (350 BC) summarized the astronomical knowledge of his time into a qualitative cosmology that remained dominant for 1800 years. What modification was introduced by Ptolemy (140 AD)?
- a) Primum mobile. b) Heliacal rising c) Epicycles d) Elliptical orbits
- 23) The Greek astronomer Eratosthene (250 BC) and the Muslim astronomers Mosa Ibn Shakir and his sons at the time of Al-Mamoon (820 AD) of Abbaside State used two different techniques to measure:
- a) the strength of the gravity b) the size of the earth
c) the distance to the nearest star d) the length of the solar year
- 24) In order to find mass of the earth, Newton's laws of motion and law of Gravity are used to derive a relation between period (P) and average distance (a) of the moon from the earth, and mass (M) of the earth. Find mass of the earth M if $P = 27.4$ days, $a = 385000$ km. (neglect mass of the moon)
- a) 7.4×10^{22} kg. b) 2.0×10^{22} kg. c) 3.8×10^{24} kg. d) 6.0×10^{24} kg.
- 25) Uranus is at about twice the distance from the sun as Saturn. Saturn orbits the sun in about 29.4 yrs. How long, does Uranus take to go once around the sun?
- a) 235 yrs. b) 118 yrs. c) 83 yrs. d) 59 yrs.
- 26) The apparent path of the sun across the sky is called the:
- a) ecliptic b) eccentricity c) ellipse d) azimuth

- 27) The brightest night star in the northern hemisphere is:
- a) Canopus b) Polaris c) the Sun d) Sirius
- 28) Copernicus's hypothesis states that the center of the universe is the:
- a) Earth b) Sun c) Essence d) Primum Mobile
- 29) The point directly over head is called:
- a) Polaris b) Zenith c) Sirius d) Primum Mobile
- 30) The largest planet in the solar system is:
- a) the Sun b) Polaris c) Jupiter d) the Earth
- 31) The scientist whose observations supported the heliocentric theory and showed that Aristotle and Ptolemy didn't know everything is:
- a) Galileo b) Kepler c) Newton d) Copernicus
- 32) How long does an electromagnetic signal take to travel from the Earth to the Moon?
- a) 2.5 seconds b) 8.3 minutes c) 1.3 minutes d) 1.3 seconds
- 33) An upright stick that is allowed to cast a shadow in sunlight is called:
- a) Almagest b) Primum mobile c) equinox d) gnomon
- 34) The field that scientifically deals with the study of the universe and its contents is called:
- a) astrology b) archeology c) astronomy d) radiology
- 35) The eccentricity of the orbit of Mercury is about 0.21 and its semimajor axis is about 0.39 AU. What is the difference between the nearest (perihelion) and the farthest (aphelion) distance of Mercury from the Sun?
- a) 0.21 AU b) 0.78 AU c) 0.03 AU d) 0.16 AU
- 36) In the Ptolemaic hypothesis, the situation when the deferent is not exactly centered at the Earth is called:
- a) ecliptic b) eccentric c) rotation d) revolution
- 37) Asteroid A orbits the Sun at a distance of 2 AU while asteroid B, which is one-half as large as A, orbits at 4 AU Which asteroid will take longer to go around the Sun according to Kepler's third law?
- a. asteroid A b. neither, both will take the same time
c. asteroid B d. more information about the asteroid is required.
- 38) For any location on the northern hemisphere of the earth, the star that looks approximately fixed in position in the sky when we look toward the north is called:
- a. Polaris b. Sirius c. Canopus d. zenith
- 39) The average distance from the Earth to the Sun is about:
- a) 500 light seconds b) one light year c) 3.27 light years d) 365.25 light years
- 40) In the Ptolemaic model of the Universe planets moved uniformly around small circles, centered on larger circles, these small circles were called:
- a. epicycles b. deferents c. eccentrics d. equants

FILL IN [True (T) or False (F)]

41. Kepler could not derive his three laws of planetary motion from basic physical principles; he discovered them by analyzing experimental data. ()
42. Newton's Law of Universal Gravitation says that the force of gravity between two bodies tends to pull them together with a strength that varies inversely with the product of the two masses and directly with the distance between them. ()
43. When planets drift backward with respect to the stars the motion is Called prograde motion. ()
44. Aristotle believed in the existence of seven elements in addition to the essence.()
45. The daily motion of the stars across the sky is due to the revolution of the Earth around the Sun. ()
46. The only difference between planets and moons is that planets glow by light generated in side them while moons reflect planets light. ()
47. Reflection of sunlight from planets surfaces makes them visible to us. ()
48. Visible light occupies the major portion of the electromagnetic spectrum. ()
49. AlHassan Ibn AlHaitham was the first Muslim astronomer to measure the Earth's diameter. ()
50. Gamma rays, x-rays, and radio waves are all fundamentally same as ordinary visible light. ()
51. The seasons on the Earth are due to the large eccentricity of its orbit around the Sun.()
52. A planet is nearer to the Earth when it is in opposition with the Sun than when it is in conjunction. ()
53. Nicolaus Copernicus treated the Sun to be a planet. ()
54. One light year (ly) is about 3.27 parsec (pc). ()
55. One parsec is the average distance from the Sun and Polaris ()
56. The stars appear to be fixed because they are so far away. ()
57. Kepler's laws support circular orbits. ()
58. As the Earth revolves the Sun, its speed decreases as it gets farther from the Sun. ()

Formulas and Constants (PHYS 215, term: 011)

| Planet | Radius (km) | Mass (kg) | Ave. Distance From the Sun | Period of Revolution | Period of Rotation | Eccentricity (e) |
|---------|-------------|---------------------|----------------------------|----------------------|--------------------|------------------|
| Mercur | 2439 | 33×10^{22} | 57909000 km | 88 days | 1408 hrs. | 0.206 |
| Venus | 6052 | 49×10^{23} | 108209000 km | 225 days | 5832 hrs. | 0.007 |
| Mars | 3397 | 64×10^{22} | 227939000 km | 687 days | 25 hrs | 0.093 |
| Jupiter | 71492 | 19×10^{26} | 778298000 km | 4337 days | 10 hrs | 0.048 |
| Saturn | 60268 | 57×10^{25} | 1429394000 km | 10760 days | 11 hrs | 0.054 |
| Uranus | 25559 | 87×10^{24} | 2875039000 km | 30700 days | 17 hrs | 0.047 |
| Neptune | 24764 | 10×10^{25} | 4504450000 km | 60200 days | 16 hrs | 0.009 |
| Pluto | 1151 | 11×10^{21} | 5915799000 km | 90780 days | 153 hrs | 0.249 |

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| <p>1 hr. = 60 min 1 day = 24 hrs 1 year = 365.25 days 1 au = 1.5×10^{11} m 1 ly = 9.46×10^{15} m 1 pc = 3.09×10^{16} m $G = 6.67 \times 10^{-11}$ m³/kg-s² $M_{\text{sun}} = 2.0 \times 10^{30}$ kg $M_{\text{earth}} = 6.0 \times 10^{24}$ kg $M_{\text{moon}} = 7.4 \times 10^{22}$ kg</p> | <p>1 min. = 60 sec 1 week = 7 days 1 km = 1000 m 1 m = 100 cm 1 cm = 10 mm $c = 3.0 \times 10^8$ m/s $r_{\text{moon-earth}} = 384403$ km $R_{\text{sun}} = 7.0 \times 10^5$ km $R_{\text{earth}} = 6378$ km $R_{\text{moon}} = 1738$ km</p> |
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| <p>$P^2 = [4\pi^2 / GM] a^3$ $P_1^2 / P_2^2 = a_1^3 / a_2^3$, $P^2 = a^3$ $V = (4/3) \pi R^3$ $A = 4 \pi R^2$ $C = 2 \pi R$ $a = \pi R^2$</p> | <p>(Kepler's 3rd Law) (volume of a sphere) (surface area of a sphere) (Circumference of a circle) (Area of a circle)</p> |
| <p>Equation of an ellipse: $r = a (1 - e^2) / (1 + e \cos(\theta))$ or $x^2 / a^2 + y^2 / b^2 = 1$</p> | |
| <p>where: e is the eccentricity f_1 & f_2 are the locations of the two foci a & b are the semi major axis and semi minor axis, respectively</p> | |

