READ THE FOLLOWING INSTRUCTIONS CAREFULLY: Do not start working the exam until the professor states it is time to start. While you are waiting, fill out the scoring office bubble form. You must fill in your name, your student number, and sign your form. When you finish turn in both the bubble form and the exam part of this paper. IMPORTANT: If you want to see your exam score in a few days, save this top sheet, your answers, and use the CAPA ID and login to xis205-003 after the date above.
1. [1pt] In scientific notation, we would express the number 450,000 as
   A) 0.45E+04
   B) 4.5E+05
   C) 4.5E+04
   D) 4.5000
   E) 4.5 magnitude 1000

2. [1pt] A light-year is defined as
   A) the distance from the Sun to the next nearest star.
   B) the speed of light in a vacuum.
   C) the average distance from the Earth to the Sun.
   D) the distance light travels in one year.
   E) the length of a solar day.

3. [1pt] If you hold your fully opened hand at arm’s length, what angular size can be measured by comparison to the distance between the end of your thumb and little finger?
   A) 400 degrees
   B) 1 degree
   C) 20 degrees
   D) 5 arcmin
   E) 10 arcsec

4. [1pt] Why is the average daytime temperature in summer higher than in winter?
   A) The Sun is in the sky longer and the light is more perpendicular in the summer.
   B) There are less clouds in summer and therefore not as much light is reflected back into space.
   C) Weather patterns change and warm air is blown up from the equator in summer.
   D) The Sun emits more light in June.
   E) The Earth is closer to the Sun in June.

5. [1pt] If an object is moved farther away what happens to its angular size?
   A) the angular size could be larger or smaller
   B) the angular size is larger
   C) the angular size is unchanged
   D) the angular size is smaller
   E) none of these answers is correct

6. [1pt] Consider the apparent angular size of the Moon and the Sun
   A) The Sun is always larger than the Moon.
   B) The Moon is never larger during a solar eclipse.
   C) The Moon is always larger than the Sun.
   D) They are nearly the same.
   E) The Moon is only larger during a solar eclipse.
12. [1pt] Suppose we are looking down on the Earth-Sun-Moon system and can see the North pole of the Earth. Given the location of the Earth, Moon, and Sun in the picture above. What is the phase of the moon?
   A) new  
   B) full  
   C) half  
   D) 3rd quarter  
   E) 1st quarter

13. [1pt] What is the ecliptic?
   A) the motion of the Earth around the Sun.  
   B) the approximate location of Polaris on the celestial sphere  
   C) the apparent path of the Sun through the fixed background stars over the course of a year  
   D) the projection of the Earth's equator on the celestial sphere  
   E) the apparent motion of the Moon around the Earth

14. [1pt] At the present time the North Celestial pole is close to the location of Polaris. In about 14,000 years it will be close to a bright star named Vega. The reason for this change is
   A) the slow change in the direction of the Earth's rotation axis due to precession.  
   B) the apparent motion of the Sun relative to the stars.  
   C) the motion of the Earth around the Sun.  
   D) the motion of Polaris and Vega though space.  
   E) the rotation of the Earth on its axis.

15. [1pt] What is the vernal equinox? It is
   A) the beginning of spring in the southern hemisphere.  
   B) the place where the path of the Sun crosses the celestial equator from South to North.  
   C) close to the location of Polaris.  
   D) September 21st.  
   E) when the Sun is at a declination of 23.5 degrees.

16. [1pt] At the Vernal Equinox, what is the RA and declination of the Sun?
   A) 12h, 0 degrees  
   B) 0h, 23.5 degrees  
   C) 0h, 0 degrees  
   D) 0h, 90 degrees  
   E) 12h, -90 degrees

17. [1pt] The accurate observations of _____ allowed _____ to determine three laws of orbital motion of the planets. Select the best pair to fill in the blanks of the previous sentence.
   A) Kepler, Newton.  
   B) Tycho Brahe, Newton

18. [1pt] Kepler’s second law implies that
   A) planets move fastest when they are closest to the Sun.  
   B) planets move in elliptical orbits at uniform speed.  
   C) a planet twice as far from the Sun as another takes twice as long to orbit.  
   D) planets orbit at a uniform rate, but rotate at different rates.  
   E) planets move fastest when they are farthest from the Sun.

19. [1pt] The mass of the Sun is about 1.99 x 10^{30} kg. How do we know this? (Select the best answer.)
   A) It is determined from the size of the Sun.  
   B) It is determined from the color of the Sun.  
   C) It is inferred from the number of neutrinos coming from the center of the Sun.  
   D) It is determined from the orbital period of the Earth and its distance to the Sun.  
   E) It is determined from the brightness of the Sun.

20. [1pt] What do we find when we compare the strength of Earth's pull of gravity on the Moon with the strength of the Moon's pull of gravity on the Earth?
   A) The force on the Earth is almost zero.  
   B) The force on the Moon is much greater.  
   C) The force on the Earth is much greater.  
   D) The forces are the same.  
   E) The force on the Earth is just a bit less.

21. [1pt] If dropped from the same height on the Moon, which of the following objects would hit the ground first?
   A) a 1 cm diameter steel ball  
   B) a hammer  
   C) all these objects would hit at the same time  
   D) a 1 cm diameter rock  
   E) a feather

22. [1pt] If the distance between the Earth and the Sun were doubled, what would happen to the force of gravity between them?
   A) The force would be 2 times greater.  
   B) The force would be one quarter as much.  
   C) The force would be 4 times greater.  
   D) The force would remain the same.  
   E) The force would be half as much.
23. [1pt] Kepler’s third law makes it possible to find the semi-major axis of a planet’s orbit if you know
   A) the orbital period.
   B) the Sun’s mass.
   C) the Earth is 93 million miles from the Sun.
   D) Kepler’s other two laws.
   E) the planet’s mass.

24. [1pt] If you could look down on the solar system, so that you saw the north pole of the Earth, you would see the Earth orbits and spins. Pick the answer that best fills in the blanks.
   A) clockwise, counterclockwise.
   B) counterclockwise, clockwise.
   C) retrograde, non-retrograde.
   D) clockwise, clockwise.
   E) counterclockwise, counterclockwise.

25. [1pt] Which type of photon has more energy? (Select the best answer.)
   A) infrared
   B) microwave
   C) ultraviolet
   D) X-ray
   E) radio

26. [1pt] How can one distinguish a hot star from a cool star?
   A) Hot stars are usually dim.
   B) Hot stars do not emit red photons.
   C) A hot star looks more blue in color.
   D) A hot star has a red color.
   E) Hot stars move faster in the sky.

27. [1pt] What does the spectrum of a heated metal wire (like the filament in the demonstration) look like?
   A) The spectrum is continuous.
   B) The spectrum is continuous but shows strong absorption lines that are characteristic of the heated material.
   C) One cannot see the spectrum because hot objects emit only infrared photons.
   D) The spectrum shows distinct emission lines that are characteristic of the heated material.
   E) The spectrum is essentially the same as from a Neon light bulb.

28. [1pt] How does the frequency of a radio wave photon compare to a visible photon?
   A) It is not possible to compare the frequencies.
   B) It is higher.
   C) All of these answers are correct.
   D) It is the same.
   E) It is lower.

29. [1pt] If a bunch of really heavy aliens were to land on the Earth so that it now had twice the mass, what would happen to the period of its orbit around the Sun?
   A) The period would be about 6 months.
   B) It would still be 1 year.
   C) Infinite, because the Earth would fly off into space.
   D) The Earth would crash into the Sun.
   E) The period would be about 2 years.

30. [1pt] Which of the following lists orders the regions of the electromagnetic spectrum from longest to shortest wavelength?
   A) infrared, visible, radio, ultraviolet, x-ray
   B) x-ray, radio, ultraviolet, visible, infrared
   C) x-ray, radio, infrared, visible, ultraviolet
   D) radio, infrared, visible, ultraviolet, x-ray
   E) x-ray, ultraviolet, visible, infrared, radio

31. [1pt] The wavelength of a wave is
   A) 1/frequency.
   B) the distance from the middle of the wave to the largest point.
   C) the distance over which the wave repeats.
   D) the time for a wave to go up and down.
   E) the time for light to travel between peaks of the wave.

32. [1pt] Emission (bright line) spectra come from
   A) excited, thin gas.
   B) a continuum source in front of hot gas.
   C) none of the choices listed here.
   D) a hot object.
   E) cool gas in front of a continuum source.

33. [1pt] In the spectrum of visible light from our Sun,
   A) red light has the shortest wavelength.
   B) yellow light has the shortest wavelength.
   C) all colors have the same wavelength since it is a continuum source.
   D) blue light has the shortest wavelength.
   E) green light has the shortest wavelength.

34. [1pt] The photon energies which can be seen in emission spectra depend mostly on
   A) the density of the gas.
   B) the volume of excited gas.
   C) the chemical nature of the excited gas.
   D) the temperature of the gas.
   E) the smoothness of the surface of the container.
35. [1pt] A continuous spectrum emitted by a solid or liquid object depends only on
   A) the surface area of the body.
   B) the temperature of the body.
   C) the chemical nature of the body.
   D) the density of the body.
   E) the smoothness of the surface.

36. [1pt] What can we learn from the absorption spectrum from a gas cloud in space? (Choose the best answer)
   A) its age
   B) whether or not it has intelligent life
   C) its temperature
   D) its chemical composition
   E) whether or not it has electrons in it

37. [1pt] What two regions of the electromagnetic spectrum most easily pass through the Earth’s atmosphere?
   A) visible and ultraviolet
   B) microwaves and ultraviolet
   C) gamma rays and visible
   D) microwave and visible
   E) infrared and X-ray

38. [1pt] What happens to the continuum spectrum from a hot object as the temperature is increased?
   A) the brightness stays the same, but it gets more blue in color
   B) it gets dimmer and more blue in color
   C) it gets brighter and the color becomes more blue
   D) it gets brighter and more red in color
   E) it gets dimmer and stops emitting visual photons

39. [1pt] What would be the main reason for an amateur astronomer to buy a telescope with a large objective mirror? (Select the best answer.)
   A) to reduce problems with seeing
   B) so they can get really clear pictures of planets like Saturn
   C) all of these choices are correct
   D) to have a wide field of view
   E) so they can better see faint objects like galaxies

40. [1pt] By what factor does the light gathering power of a telescope increase if the size of the objective mirror is doubled?
   A) 2
   B) 16
   C) 0.25
   D) 8
   E) 4