Astronomy 1 NAME: Final

Sample

Part I: Multiple Choice (2 points. ea.) Choose the best answer for each question

Questions 1-5 refer to the schematic model of the Milky Way Galaxy shown at right

<u>1</u>. The Galactic nucleus

2. The Galactic bulge

____3. The disk

____4. Globular clusters and stars in the galactic halo

5. The Sun's location in the galaxy



- 6. What keeps the matter in an HII region ionized?
- (A) ultraviolet radiation from a nearby young/massive O or B star
 - (B) chemical reactions
 - (C) collisions between gas clouds
 - (D) beams of electrons

_7. We cannot see the other side of the galaxy primarily because our view is blocked by

- (A) too many stars.
- (B) glowing interstellar gas.
- (C) planetary nebulae and supernova remnants.
- (D) interstellar dust.
- _8. Interstellar dust grains produce
 - (A) radio emission at a wavelength of 21 cm.
 - (B) interstellar absorption lines in the spectra of distant stars.
 - (C) extinction and reddening of the light from distant stars.
 - (D) ultraviolet radiation responsible for HII regions.
- _9. Which of the following combinations of information about the sun and its orbit within the galaxy could be used to determine the amount of galactic mass that lies within the sun's orbit?
 - (A) distance from the center and orbital period.
 - (B) sun's mass and orbital speed.
 - (C) distance from the center and age.
 - (D) sun's mass and age.

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- _10. How did Harlow Shapley discover that our Sun is not at the center of the galaxy?
 - (A) by detecting radio radiation from the galactic center.
 - (B) by measuring the orbital speed of the Sun around the galactic center.
 - (C) by determining the distribution of globular clusters.
 - (D) by comparing our galaxy with the Andromeda galaxy.
- 11. Which of the following must be known in order to determine the amount of galactic mass that lies within the Sun's orbit?
 - (A) the Sun's distance from the center and orbital period
 - (B) the Sun's mass and orbital speed
 - (C) the Sun's distance from the center and the size of its orbit
 - (D) the Sun's mass and its distance from the center
- ____12. Why are most O and B stars (more massive main sequence stars) found in the arms of the galaxy?
 - (A) They are short-lived stars that form in spiral arms.
 - (B) They are magnetically bound to the spiral arms.
 - (C) They ride on the crests of the density wave.
 - (D) They have been ejected recently from the center of the galaxy.
- ____13. Which of the following is a true statement about the spiral arms of our galaxy?
 - (A) Spiral arms are the crests of density waves.
 - (B) Star formation occurs in the spiral arms.
 - (C) They contain H II powered by the ultraviolet light from hot O and B stars
 - (D) all of the above
- 14. Hubble's original classification of galaxies was based on
 - (A) the visual appearance of the galaxies.
 - (B) the physical shape and size of the galaxies.
 - (C) the dominant spectral class of stars.
 - (D) a completely random selection.
- ____15. A primary difference between spiral and elliptical galaxies is
 - (A) star formation has ceased in ellipticals, but not in spirals.
 - (B) all ellipticals are more massive than spirals.
 - (C) ellipticals have more extensive interstellar media than spirals.
 - (D) spirals have more stars than ellipticals.
- 16. Which of the following is **not** one of the main categories for the classification of galaxies?
 - (A) orthogonal
 - (B) elliptical
 - (C) spiral
 - (D) irregular

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- _17. What evidence do we have that galaxies have extended haloes of dark matter?
 - (A) Orbital speed in the rotation curve doesn't fall off for the outer parts of galaxies.
 - (B) The outer parts of galaxies are intense infrared sources.
 - (C) Light from background galaxies is blocked by the dark matter.
 - (D) The orbits of distant globular clusters are distorted by the dark matter.
- 18. The most massive known galaxies are
 - (A) ellipticals.
 - (B) spirals.
 - (C) barred spirals.
 - (D) irregulars.

19. Which of the following would not be useful in determining the distance to another galaxy?

- (A) parallax
- (B) Cepheid variables
- (C) radar
- (D) the sizes of HII regions
- ____20. Hubble's relationship between the distance to a galaxy and its speed of recession is interpreted as evidence for
 - (A) the expansion of the universe.
 - (B) galaxies being outside the Milky Way.
 - (C) the evolution of galaxies.
 - (D) the Doppler effect.

____21. Which of the following is a good description of a Seyfert galaxy?

- (A) a spiral with a small bright nucleus
- (B) a giant elliptical
- (C) a tidally distorted irregular galaxy
- (D) a galaxy in which star formation has ceased
- 22. For a typical luminous radio galaxy, the radio emission comes primarily from
 - (A) the central few hundred parsecs of the galaxy
 - (B) large lobes on opposite sides of the visible galaxy.
 - (C) a large halo with a radius of about ten kiloparsecs.
 - (D) the disk, where most of the stars are concentrated
- ____23. How do we know that quasars are no larger than the solar system?
 - (A) They are too luminous to be very large
 - (B) They appear pointlike when viewed through a telescope
 - (C) They contain black holes, which must be small
 - (D) They vary in brightness on a timescale of days or weeks
- ____24. Since quasars are thought to be at cosmological distances, we see them as they were when (A) the universe was much older than it is today
 - (B) the universe was relatively young
 - (C) the universe was contracting
 - (D) the universe was much larger than it is today

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- _25. According to current theories, the energy source of radio galaxies and quasars is
 - (A) a one thousand solar mass pulsar in each of two radio lobes.
 - (B) a one hundred million solar mass black hole accreting matter at the center of the object.
 - (C) the conversion of hydrogen to helium via nuclear reactions.
 - (D) gravitational contraction of massive stars near the spiral arms.
- _26. Quasars are currently believed to be
 - (A) an early phase of intense activity in the centers of galaxies.
 - (B) the brightest elliptical galaxies.
 - (C) the most luminous supernova remnants.
 - (D) structures larger than clusters of galaxies.
- _27. The brightest quasars are
 - (A) about 1% as bright as the Milky Way
 - (B) as bright as the Milky Way
 - (C) as bright as 10,000 Milky Way galaxies
 - (D) about as bright as the Sun
- ____28 Quasars all have great distances. Why are there no nearby quasars?
 - (A) No quasars have existed in the recent past.
 - (B) Quasars avoid spiral galaxies.
 - (C) Quasars are found only in clusters of galaxies.
 - (D) If quasars are too close to us, they look like pulsars.
- _____29. Which of the these describes the tendency of galaxies to form in groups
 - (A) galaxies are found both in small groups and large clusters.
 - (B) galaxies are only found singly.
 - (C) galaxies are found only in small groups of a few members.
 - (D) galaxies were in groups only in the early universe.
- ____30. The Local Group is:
 - (A) a group of about 30-50 galaxies containing the Milky Way galaxy.
 - (B) the local group of Population II stars in the solar neighborhood.
 - (C) a large supercluster of galaxies centered on the Milky Way.
 - (D) all stars within 10 pc. of the sun
- ____31. The richness of a cluster of a galaxies is a measure of
 - (A) how many galaxies it contains.
 - (B) its age.
 - (C) its distance.
 - (D) its redshift
- ____32. What type of galaxy is frequently found at the center of a rich cluster of galaxies?
 - (A) giant elliptical
 - (B) spiral
 - (C) dwarf elliptical
 - (D) irregular

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- _33. The model of cluster formation in which galaxies form first and then collect into cluster is called the
 - (A) pancake model.
 - (B) explosion model.
 - (C) hierarchical clustering model.
 - (D) top-down model.
- _34. The point in space towards which nearby clusters of galaxies appear to be moving is referred to as
 - (A) "The Great Attractor".
 - (B) "The Whole Shebang".
 - (C) "LGM".
 - (D) "The Big Crunch".
- _35.In which part of the sky is the cosmic background radiation brightest?
 - (A) equally bright in all parts of the sky.
 - (B) toward the Virgo cluster
 - (C) toward the center of the universe
 - (D) toward the spot where the Big Bang took place
- ___36. What is the origin of the cosmic background radiation?
 - (A) glowing gas at the time the universe became transparent.
 - (B) gamma rays produced during the first second of the big bang.
 - (C) the first stars that formed in the universe.
 - (D) neutrinos produced in nuclear reactions within the first 200 seconds.
- _____37. An observer now located at a distance of 3 billion light years from us could look in our general direction and see
 - (A) most of the galaxies approaching him or her.
 - (B) the same Hubble's law that we see.
 - (C) about equal numbers of red and blue shifted galaxies.
 - (D) everything rushing away from a point near the Milky Way galaxy.
- ____38. The expansion age of the universe is about
 - (A) 12 to 14 million years.
 - (B) 12 to 14 billion years.
 - (C) 120 to 140 billion years.
 - (D) 1200 to 1400 billion years.
- ____39. What was the universe made of one hour after it began to expand?
 - (A) hydrogen and helium
 - (B) carbon and oxygen
 - (C) iron and nickel
 - (D) potassium and carbon

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- _40. The conversion of hydrogen into helium began about 2 minutes after the beginning of the expansion of the universe. Why was there no helium in the universe during the first 2 minutes?
 - (A) There was no matter in the universe during the first 2 minutes.
 - (B) Collisions were too violent for helium to be stable during that time.
 - (C) No collisions occurred during the first two minutes.
 - (D) Neutrino disruption dominated during the first two minutes.
- ____41. What evidence do we have for the existence of "dark energy"?
 - (A) It blocks our view of distant parts of the universe.
 - (B) The universe contains more light than has ever been emitted by stars.
 - (C) Expansion seems to be accelerating.
 - (D) We see the cosmic background radiation in all directions.
- ____42. Where in the universe did the Big Bang occur?
 - (A) very close to the Milky Way galaxy
 - (B) at the center
 - (C) near the Virgo cluster.
 - (D) everywhere.
- ____43. What do we need to know in order to predict whether the expansion of the universe will continue forever?
 - (A) the curvature of space-time
 - (B) the age of the universe and the speed of light
 - (C) the lifetime of the proton and the distance to the Virgo cluster
 - (D) the temperature of the cosmic background radiation and the age of the universe
- ____44. The planets discovered to be orbiting other solar-type stars have masses that are similar to that of
 - (A) the Sun.
 - (B) Jupiter.
 - (C) Earth.
 - (D) the Moon.

____45. The oldest fossils date from about how long after Earth formed?

- (A) 10 million years
- (B) 100 million years
- (C) 1 billion years
- (D) 10 billion years

____46. A "habitable zone"

- (A) is a region around a star where an earth sized planet *could* have liquid water on its surface.
- (B) is a region on a particular planet where life might exist comfortably.
- (C) is a region in the galaxy where alien civilizations have been detected by their radio emissions.
- (D) is the region in a supercluster where galaxy formation is currently taking place.

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- _47. Billions of years from now, the habitable zone of the solar system will not include the Earth but will include
 - (A) Mars.
 - (B) Mercury.
 - (C) Venus.
 - (D) the Moon.

48. As with life on earth, we expect that life on other planets would most likely be chemically based upon (A) carbon and methanol.

(B) carbon and ethanol.

(C) silicon and carbon.

(D) carbon and water.

- 49. The Drake Equation is
 - (A) a relation between the distance of a galaxy and the red shift in its spectrum.
 - (B) a description of the expansion of the universe.
 - (C) a relationship between the size of a neutron star and its radius.
 - (D) an attempt to estimate the probability of finding extraterrestrial life.

___50. SETI stands for

- (A) Signal Enhancement Through Interferometry.
- (B) Search for Extraterrestrial Intelligence.
- (C) Satellite Examination of Technological Images.
- (D) Studies of Europa's Tidal Icefields.

____(you're half-way done!)_

- __51. The great circle 90° from the point directly over an observer's head is that observer's
 - (A) horizon.
 - (B) zenith.
 - (C) equator.
 - (D) azimuth.
- 52. During a night in Schuylkill Haven, most of the stars in the sky
 - (A) are stationary through the night.
 - (B) the actual motion depends upon the season.
 - (C) rise in the west and set in the east.
 - $(D)\;$ rise in the east and set in the west.

53. The Sun returns the same position among the stars once every

- (A) day.
- (B) week.
- (C) month.
- (D) year.



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- __54. The occurrence of seasons on the Earth is due to
 - (A) the Earth being closer to the Sun in summer
 - (B) the Earth changing its rotation rate during the year
 - (C) the Earth's axis pointing in different directions during the year
 - (D) the Earth's axis being inclined (tilted) to the ecliptic
 - 55. In which of the following circumstances is it possible to observe the full moon?
 - (A) setting at sunrise
 - (B) rising at noon
 - (C) high in the sky at dawn
 - (D) setting at midnight
- _56. A shift in the direction of an object caused by a change in the position of an observer is called
 - (A) parallax.
 - (B) epicycle motion.
 - (C) precession.
 - (D) the Coriolis effect.
- ____57. Why did Tycho Brahe reject Copernicus's model of the solar system?
 - (A) He could not detect stellar parallax
 - (B) He could not detect retrograde motion for Mars
 - (C) The ellipse had not been discovered yet
 - (D) Tycho found mistakes in Copernicus's calculations
- ____58. Ptolemy used epicycles (illustrated at right) to explain
 - (A) retrograde motion.
 - (B) the equation of time.
 - (C) circumpolar motion.
 - (D) eclipses.



- ____59. Newton's great breakthrough in how he viewed the *cosmos* was that he
 - (A) viewed gravity as a mysterious force between masses.
 - (B) thought that natural motion was distinct from forced motion.
 - (C) determined that the universe as infinite in extent.
 - (D) applied the same physical laws in the sky and on Earth.

(for 60-63) Match the element of the Copernican model below with its observation consequence:

- A. Earth's motion around object.
- B. Motion of object around earth.
- C. Object overtakes Earth.
- D. Earth rotates.
- 60. The moon's monthly motion
- 61. Venus undergoing retrograde motion
- 62. The sun moves west to east along the ecliptic
- 63. The sun moves east to west daily

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- ____64. According to Kepler's Laws, a planet which is **closer to** the Sun than the Earth
 - (A) will take less than a year to orbit the Sun.
 - (B) will take more than a year to orbit the Sun.
 - (C) will have a more elliptical orbit around the Sun than Earth's orbit.
 - (D) will eventually begin orbiting the Earth.
- _65. Which of the following principles from Optics are relevant to telescopes?
 - (A) Refraction (light rays bend at interfaces).
 - (B) Reflection (light rays bounce at surfaces).
 - (C) Diffraction (light waves bend around corners).
 - (D) all of the above

_66. Newton's theory of Universal Gravitation, combined with mechanics

- (A) was important because it described both earthly and cosmic phenomena using the same principles.
- (B) explained falling objects and projectile motion.
- (C) explained Kepler's Laws.
- (D) all of the above.
- _67. If the distance between two objects is *decreased*, the force of gravity they exert on each other will
 - (A) remain the same
 - (B) increase
 - (C) decrease
 - (D) vanish
- 68. Which of the following occurs because of the *orbit of the Earth about the Sun* and cannot be accounted for in geocentric models of the solar system?
 - (A) Coriolis effect.
 - (B) The phenomena of day and night.
 - (C) the aberration of starlight and stellar parallax.
 - (D) planetary retrograde motion.
- _____69. The age of the earth is estimated at roughly:
 - (A) older than 10 billion years.
 - (B) 4.6 billion years.
 - (C) 4.6 million years.
 - (D) 4.6 thousand years.
- ____70. The Moon always faces the Earth because of
 - (A) tidal locking.
 - (B) Kepler's third law.
 - (C) retrograde motion of the Moon's orbit.
 - (D) electromagnetic coupling between the Earth and lunar magnetic fields.
- ____71. The lunar maria were formed by
 - (A) the action of ancient seas.
 - (B) tectonic uplifts.
 - (C) volcanic calderas.
 - (D) lava flows into low areas.

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_72. How can craters tell us about the ages of surface regions of planets?

- (A) Impacts produce carbon 14, which can be dated by radioactive methods.
- (B) Material blasted from the craters sometimes reaches Earth and can be dated.
- (C) Craters shrink in size at a predictable rate
- (D) Crater density increases with time, so older surfaces have more craters.
- 73. Both the moon and Mercury have very large temperature variations between day and night. The main reason for this large variation is:
 - (A) lack of atmosphere.
 - (B) rocky composition.
 - (C) distance from the sun.
 - (D) small mass.

____74. Which planet is most like Venus in size and mass?

- (A) Earth.
- (B) Mars.
- (C) Mercury.
- (D) Neptune.
- ____75. Why does the thick atmosphere of Venus lead to a high temperature at its surface?
 - (A) The atmosphere reflects most sunlight back into space.
 - (B) High winds in the thick atmosphere generate frictional heating.
 - (C) The atmosphere blocks the *escape* of infrared radiation from Venus.
 - (D) There are heat-producing chemical reactions in Venus's.
- ____76. In which of the following forms can water NOT exist on Mars today?
 - (A) lakes
 - (B) atmospheric ice crystals
 - (C) underground ice deposits
 - (D) atmospheric gas
- ____77. Which of the following sets of planets has large diameters, locations in the outer solar system, and extensive gaseous atmospheres?
 - (A) Earth, Mars, Jupiter, Saturn.
 - (B) Mercury, Venus, Earth, Mars.
 - (C) Jupiter, Saturn, Uranus, Neptune.
 - (D) Mercury, Venus, Uranus, Pluto.
- _____78. The variation between pole and equatorial rotation rates for a Jovian planet
 - (A) is called differential rotation.
 - (B) is evidence that the planet is fluid.
 - (C) has never actually been observed.
 - (D) both (A) and (B) above.

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- ____79. Which of the following statements correctly describes the chemical composition of the Jovian (Jupiter-like) and Terrestrial (Earth-like) planets?
 - (A) The Jovian planets more closely resemble the Sun and stars (i.e. they have the "solar mix").
 - (B) The Jovian and terrestrial planets have similar compositions.
 - (C) The Jovian planets have more silicon and iron than terrestrial planets.
 - (D) The terrestrial planets have more hydrogen than the Jovian planets.
- ____80. What would happened to an asteroid that came within the Roche limit of a planet?
 - (A) It would be ejected at twice the speed it originally had.
 - (B) It would be destroyed by tides.
 - (C) It would be captured and become a satellite.
 - (D) It would be burned up in the atmosphere of the planet.
- ____81. Why are the inner Galilean satellites denser than the outer ones?
 - (A) the outer ones contain more icy material.
 - (B) the inner ones contain more iron.
 - (C) the inner ones are larger.
 - (D) the outer ones are made mainly of gas.
 - _82. How was the mass of Pluto determined?
 - (A) by measuring the effect of its gravity on Neptune
 - (B) by observing the effect on the motion of a probe that flew past Pluto
 - (C) by measuring how it bends light rays passing near it
 - (D) by determining the orbit of its satellite, Charon
- ___83. The heat that keeps the interior of Io molten is due to
 - (A) tides
 - (B) radioactive materials
 - (C) frequent meteoroid impacts
 - (D) a large greenhouse effect

84. A measurement of the parallax of a star allows us to determine the star's

- (A) rotation rate.
- (B) temperature.
- (C) distance.
- (D) age.

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Questions 85-89 refer to the figure below which is a graphical representation of a group of stars. Identify each type of star by its labeled location on the diagram.

____85. White Dwarf stars.

- 86. Main Sequence stars.
- ____87. Giants stars.
- ____88. Supergiants (Asymptotic Giant Branch) stars.



Temperature

Cold

Hot

- ___89. The color of a star is most directly related to its:
 - (A) mass.
 - (B) surface temperature.
 - (C) central (core) temperature.
 - (D) luminosity.
- ____90. Which are the two most abundant elements in the sun?
 - (A) hydrogen and helium.
 - (B) helium and uranium.
 - (C) hydrogen and sodium.
 - (D) hydrogen and iron

____91. The most important factor affecting a star's main-sequence lifetime is

- (A) radius
- (B) percentage of metals
- (C) hydrogen to helium ratio
- (D) mass
- ____92.What marks the transition from protostar to star?
 - (A) the star begins to rotate
 - (B) hydrogen fusion begins
 - (C) the star first becomes luminous
 - (D) the star becomes hot enough to ionize hydrogen
- ____93. Why are there more main sequence stars than giant stars?
 - (A) the main sequence stage for a star is longer than the giant stage
 - (B) most giant stars are drawn to the core of the galaxy
 - (C) giants are dim and hard to see
 - (D) few stars first form as giants rather than main sequence stars

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For Ques	stions 94-97: Match the type of star with the neutron degeneracy pressure	type of pressure which supports (A) Neutron Star	it:
95.	normal gas pressure	(B) Main Sequence Star	
96.	electron degeneracy pressure	(C) White Dwarf	
97.	none: object has collapsed gravitationally	(D) Black Hole	

____98. The Algol "Paradox" is

- (A) a close binary star system consisting of a red giant and a less massive main sequence star
- (B) a close binary star system consisting of a red giant and a more massive main sequence star
- (C) the mysterious radio navigation beacons called pulsars
- (D) the event horizon of a black hole
- ____99. Gas shed by the companion of a neutron star or black hole normally
 - (A) flows out of the binary system.
 - (B) falls directly onto the neutron star or black hole.
 - (C) flows into an accretion disk.
 - (D) collects above the poles of the neutron star or black hole.
 - _100. The Schwarzschild radius describes the size of a
 - (A) black hole.
 - (B) neutron star.
 - (C) accretion disk.
 - (D) white dwarf.