This exam contains 6 pages (including this cover page) and 30 questions. Each question is worth 1 point, so there are 30 points total.

1. (1 point) A planet's orbit around a star has a semimajor axis of 16 AU. What is the period of the planet's orbit?

    A. 6 years

    B. 32 years

    C. 64 years

    D. 256 years

    E. 4096 years

2. (1 point) Which of the following has the longest wavelength?

    A. UV

    B. Optical

    C. Radio

    D. X-rays

    E. Microwave

3. (1 point) What is the peak wavelength in Angstroms (Å) of electromagnetic radiation emitted by a star at a temperature of 10,000 K, assuming a blackbody spectrum? (Wien's constant $\sigma_w \approx 2.9 * 10^7$ Å*K)

    A. 290 Å

    B. 2,900 Å

    C. 5,800 Å

    D. 29,000 Å

    E. 58,000 Å

4. (1 point) Determine the azimuth of Capella (Aurigae) in its upper culmination as seen from geographic latitude of $\phi = +45°58'$

    A. 0°

    B. 90°

    C. Undefined

    D. 180°

    E. 360°

5. (1 point) From which geographic latitude does the star Antares (α Scorpio, $\delta = -26°19'$) never rise?

    A. $26°19'$

    B. $63°41'$

    C. $56°19'$

    D. Never happens

    E. $53°41'$

6. (1 point) For the following problem find the range in which the answer lies: on the day of summer solstice, on which geographic latitude is the sun culminating at the angle of $+72°50'$ north of the equator?

    A. $0° - 15°$

    B. $15° - 30°$

    C. $30° - 45°$

    D. $45° - 60°$

    E. $60° - 75°$

7. (1 point) For the following problem, find the range in which the answer lies: looking from Greenwich on February 10th ($s_o = 9^h17^m48^s$) at what time is Pollux ($\alpha = 7^h42^m16^s$) at its upper culmination?

    A. 12 am - 6 am

    B. 6 am - 12 pm

    C. 12 pm - 6 pm

    D. 6 pm - 10 pm

    E. 10 pm - 12 am

8. (1 point) What is the main energy transport process in the core of the Sun?

    A. Radiation

    B. Convection

    C. Conduction

    D. Diffusion

    E. Advection

9. (1 point) What are the bright regions on the solar photosphere called?

    A. Sunspots

    B. Limbs

    C. Faculae

    D. Prominences

    E. Flares

10. (1 point) When seen from Earth, what is Venus' phase when it is at greatest elongation?

    A. New

B. Crescent

C. Quarter

D. Gibbous

E. Full

11. (1 point) Which planets have primary atmospheres?

A. Jupiter, Saturn, Uranus, and Neptune

B. Mercury, Venus, Earth, and Mars

C. Mars, Jupiter, and Saturn

D. Venus and Earth

E. Mercury and Mars

12. (1 point) Which of the following planets or dwarf planets has not been visited by a spacecraft?

A. Pluto

B. Haumea

C. Ceres

D. Mercury

E. Neptune

13. (1 point) Star A has a surface temperature of 10,000 K while Star B has a surface temperature of 4,000 K. Star B is 10 times larger than Star A and its distance from Earth is half that of Star A. What is the magnitude difference between Stars A and B?

A. -10.48

B. -7.47

C. -0.48

D. 2.53

E. 7.47

14. (1 point) What property of the interiors of stars changes at the Kraft break, around 1.6 Solar masses?

A. The dominant spin state flips

B. The dominant energy transport mechanism in the interior changes

C. The flaring activity increases

D. The core becomes iron-rich

E. Hydrogen burning ends in the core

15. (1 point) Which of the following stages will our Sun not evolve through?

A. Red giant

B. White dwarf

C. Cepheid variable

D. Planetary nebula

E. Main sequence

16. (1 point) Which of the following are not high mass stars (relative to the others)?

    A. Wolf-Rayet stars

    B. Type-II supernova progenitors

    C. Cepheid variable

    D. Red dwarfs

    E. Red supergiants

17. (1 point) On a Hertzsprung-Russell diagram, where would we find stars that are cool and dim?

    A. Upper right

    B. Lower right

    C. Upper left

    D. Lower left

    E. Middle

18. (1 point) What do the cores of low-mass and high-mass main-sequence stars have in common?

    A. Both have a uniform composition

    B. Both are burning hydrogen

    C. Both are convective

    D. Both are radiative

    E. Both are contracting

19. (1 point) The thermal pressure of a gas depends on

    A. Density only

    B. Temperature only

    C. Both density and temperature

    D. Composition

    E. Gravity

20. (1 point) What happens to the core of a star after a planetary nebula occurs?

    A. It contracts from a protostar to a main-sequence star

    B. It breaks apart in a violent explosion

    C. It becomes a white dwarf.

    D. It becomes a neutron star

    E. none of the above

21. (1 point) Find the visual magnitude of the binary star α Pisces, given that the visual magnitudes of each component in the binary system are 4.3 and 5.2. Pick the choice whose range encompasses the right answer.

    A. 0-1

    B. 1-2

    C. 2-3

  D. 3-4

  E. 4-5

22. (1 point) Which of the following is not a method used to detect exoplanets?

  A. Radial Velocity

  B. Transits

  C. Microlensing

  D. Gravitational Waves

  E. Direct Imaging

23. (1 point) Which of the following type of planet was the first to be discovered around a Solar-type star?

  A. Earth-like

  B. Super-Earth

  C. Mini-Neptune

  D. Super-Neptune

  E. Hot Jupiter

24. (1 point) A star of radius 0.72 solar radii experiences a periodic dip in brightness once every 13.8 days, thought to be a result of an orbiting exoplanet. The normalized flux during one of these dips in brightness is 0.98. What is the radius of the exoplanet?

  A. 0.014 solar radii

  B. 0.102 solar radii

  C. 0.144 solar radii

  D. 0.706 solar radii

  E. 0.713 solar radii

25. (1 point) The center of the Milky Way is a part of which zodiac constellation?

  A. Gemini

  B. Sagittarius

  C. Scorpio

  D. Cancer

  E. Virgo

26. (1 point) The youngest stars in the Milky Way are found predominantly in which part of the galaxy?

  A. In the halo

  B. In globular clusters

  C. In the thinner part of the disc closer to the galactic plane

  D. In the thicker part of the disc farther from the galactic plane

  E. In the central bulge

27. (1 point) In the 1920s Harlow Shapely estimated the size of the Milky Way galaxy using which of the following?

  A. RR Lyrae stars

  B. Pulsating asymptotic giant branch stars

  C. Type Ia supernovae

  D. Type II supernovae

  E. white dwarf stars

28. (1 point) What is the theoretical diffraction limited angular resolution in visible light (5,500 A) of a typical 20-cm (8 in) amateur telescope?

  A. 0.35 arcsec

  B. 0.69 arcsec

  C. 0.017 arcsec

  D. 1.7 arcsec

  E. 6.9 arcsec

29. (1 point) To improve the angular resolution of a telescope one must

  A. Increase the diameter of the mirror or lens

  B. Increase the telescope magnification

  C. Increase the focal length of the eyepiece

  D. Increase the focal length of the telescope

  E. All of the above

30. (1 point) Find the total sum of the binary system of the star Capella, if semi-major axis between them is 0.85 AU, and period of 0.285 years.

  A. 5.5 solar masses

  B. 6.5 solar masses

  C. 7.5 solar masses

  D. 8.5 solar masses

  E. 9.5 solar masses