Astronomy II (ASTR1020) — Exam 2

Test No. 2D

2 October 2001

The answers of this multiple choice exam are to be indicated on the Scantron with a **No. 2 pencil**. Don't forget to write your name and the **Test No.** (*e.g.*, 2D) on the Scantron sheet. You may keep these test questions. There are 32 questions on this exam and you will be graded out of 30 points. As such, 2 of the questions can be considered as extra credit.

Useful Constants

G	=	6.673×10^{-11} m^3/s^2/kg	g	=	9.80 m/s^2
c	=	3.00×10^5 km/s	h	=	6.626×10^{-34} J s
k	=	1.38×10^{-23} J/K	$H_\circ$	=	50 km/sec/Mpc
$M_{\rm moon}$	=	7.35×10^{22} kg	$M_\odot$	=	1.99×10^{30} kg
$M_\oplus$	=	5.98×10^{24} kg	$R_\oplus$	=	6.38×10^6 m
$R_\odot$	=	6.96×10^8 m	$T_\odot$	=	5800 K
1 AU	=	1.50×10^{11} m	$L_\odot$	=	3.90×10^{26} W
e	=	1.60×10^{-19} C	σ	=	5.67×10^{-8} W/m^2/K^4
m_e	=	9.11×10^{31} kg	m_p	=	1.67×10^{-27} kg
1 ly	=	9.46×10^{15} m	1 pc	=	3.09×10^{16} m
1 km	=	10^3 m	1 hr	=	3600 s
1 mi	=	5280 ft	1 mi	=	1.609 km
1 day	=	24 hrs	1 yr	=	365.24 days
1 Å	=	10^{-10} m	1 nm	=	10^{-9} m
10^3	=	one thousand	10^6	=	one million
10^9	=	one billion	10^{12}	=	one trillion

Useful Equations

$D = \dfrac{\alpha\, d}{206265}$	$e = \dfrac{h}{2a} = \dfrac{a-b}{a}$	$E = mc^2$
$r_p = a(1-e)$	$r_a = a(1+e)$	$2a = r_p + r_a$
$v_t = 4.74\,\mu\, d$ (km/s)	$\dfrac{v_r}{c} = \dfrac{\lambda - \lambda_\circ}{\lambda_\circ} = \dfrac{\Delta\lambda}{\lambda_\circ}$	$\nu = c/\lambda$
$P^2 = \left[\dfrac{4\pi^2}{G(m_1+m_2)}\right] a^3$	$F = G\left(\dfrac{m_1 m_2}{r^2}\right)$	$F = \sigma T^4$
$L = 4\pi R^2 F = 4\pi\sigma R^2 T^4$	$\dfrac{L}{L_\odot} = \left(\dfrac{R}{R_\odot}\right)^2 \left(\dfrac{T}{T_\odot}\right)^4$	$d = 1/p$
$\lambda_{\max} = \dfrac{0.0029 \text{ m K}}{T}$	$E = h\nu = \dfrac{hc}{\lambda}$	$P_{\rm yr}^2 = a_{\rm AU}^3$
$m_2 - m_1 = -2.5 \log\left(\dfrac{f_2}{f_1}\right)$	$m - M = 5 \log d - 5$	$F = ma$
$M_{\rm bol} - M_{\rm bol}(\odot) = -2.5 \log\left(\dfrac{L}{L_\odot}\right)$	$M_1 + M_2 = \dfrac{a^3}{P^2}$	$v = \sqrt{v_r^2 + v_t^2}$
$t_{\rm MS} = \left(\dfrac{M_\odot}{M}\right)^3 \times 10^{10}$ yr	$v_{\rm esc} = \sqrt{\dfrac{2GM}{R}}$	$v_r = H_\circ d$
$z = \dfrac{\Delta\lambda}{\lambda_\circ} = \dfrac{\sqrt{1+v_r/c}}{\sqrt{1-v_r/c}} - 1$	$z = \dfrac{\Delta\lambda}{\lambda_\circ} = \dfrac{v_r}{c}$ $(v_r \ll c)$	$\dfrac{L}{L_\odot} = \left(\dfrac{M}{M_\odot}\right)^4$
$T = \dfrac{1 \text{ (km/s/Mpc)}}{H_\circ} \times 10^{12}$ yr	$q_\circ = \dfrac{8\pi G}{3} \dfrac{\rho}{H_\circ^2}$	

1. For stars within 10 parsecs of the solar system, we determine their distances with which method?

a) moving cluster method b) spectroscopic parallax c) radar

d) sonar e) trigonometric parallax

2. As planets form in a planetary disk surrounding a protostar, the process of building large particles out of smaller particles (*i.e.*, planetesimals) is called

a) accretion b) planetology c) plate tectonics

d) absorption e) photosynthesis

3. Which of the following processes can cause an interstellar gas cloud to start the collapse down to stellar densities?

a) Interstellar cometary impacts with the cloud.

b) Interstellar asteroidal impacts with the cloud.

c) Supernova shock wave plowing through the gas cloud.

d) Acoustic sound wave from a nearby pulsating star plowing through the gas.

e) None of these can cause such a cloud to collapse.

4. The term used to indicate the abundance of all elements heavier than helium in a star is

a) luminosity b) metalicity c) triabundance

d) tridilithium e) none of these

5. When massive stars reach the ZAMS they *light up* the surrounding gas cloud from which they formed. Such an emission line nebula is called a(n)

a) reflection nebula b) H I region c) interstellar reddening

d) supernova remnant e) none of these

6. The nearest stellar system to the solar system is α Centauri. How many stars make up this system?

a) 0 b) 3 c) 4 d) 2 e) 1

7. Starlight gets redder as it travels through the ISM, this effect is called

a) interstellar reddening b) interstellar medium c) trigonometric parallax

d) spectroscopic parallax e) Rayleigh scattering

8. What are the strongest spectral features in the Sun's visual spectrum?

a) TiO bands b) H_2O bands c) Band on the Run

d) Ca II H & K lines e) none of these

9. The distance to the galaxy M81 can be determined by comparing the apparent brightness of an O star on the main sequence to its absolute magnitude as determined from its location on the H-R Diagram. This type of distance determination is called

a) parsec determination b) trigonometric parallax c) moving cluster method

d) spectroscopic parallax e) spectral classification

10. If a neutral carbon atoms had three electrons taken away from it, which of the following spectroscopically describes this ion?

a) H III b) Ca V c) C III d) C IV e) Ca II

11. The spectral classes from coolest to hottest stars are

a) MKGFABO b) ABFGKMO c) BOFGAKM

d) OBAFGKM e) OBFAKGM

12. As cloudlets shrink in size they spin faster due to the conservation of

a) energy b) angular momentum c) linear momentum

d) hydrostatic equilibrium e) baryons

13. Which of the following techniques is <u>not</u> used in finding extrasolar planets?

a) Planet occultations of their parent star.

b) Doppler shifts in spectral lines as the star orbits the center-of-mass.

c) Detecting a trigonometric parallax.

d) Detecting a *wobble* in the proper motion of a star.

e) Direct imaging.

14. Plotting the luminosity of stars versus their temperatures produces what type of diagram?

a) stellar evolution b) theoretical H-R c) Hubble tuning fork

d) stellar distance e) observational H-R

15. By weight, approximately 1-2% of the material in the interstellar medium is composed of

a) carbon b) hydrogen c) helium d) oxygen e) dust

16. By weight, approximately 25% of gas in the interstellar medium is composed of

a) oxygen b) helium c) carbon d) hydrogen e) dust

17. Which satellite was launched by the European Space Agency to measure precise parallaxes of stars?

a) Hubble Space Telescope b) Hipparcos c) AXAF

d) Galileo e) IUE

18. $(U-B)$ and $(B-V)$ are both examples of a(n)

a) luminosity b) absolute magnitude c) apparent magnitude

d) H-R diagram e) color index

19. Which of the following equations would you use in a visual binary star system to ascertain the mass of both components?

a) $F = ma$ b) $P^2 = a^3$ c) $P^3 = a^2$

d) $E = mc^2$ e) $M_1 + M_2 = a^3/P^2$

20. Which of the following equations is the distance modulus formula?

a) $m_2 - m_1 = -2.5 \log(f_2/f_1)$ b) $d = 1/p$ c) $m - M = 5 \log d - 5$

d) $F = \sigma T^4$ e) $E = mc^2$

21. Which of the following is <u>not</u> a stellar luminosity class?

a) supergiant b) bright giant c) giant d) dwarf e) faint supergiant

22. The *spring cleaning* stage of a star during stellar birth is called the

a) Herbig-Haro stage b) Mira phase c) cocoon stage

d) T Tauri stage e) raccoon phase

23. Which of the following techniques has found the most extrasolar planets?

a) Planet occultations of their parent star.

b) Doppler shifts in spectral lines as the star orbits the center-of-mass.

c) Detecting a *wobble* in the proper motion of a star.

d) Direct imaging.

e) Detecting a trigonometric parallax.

24. Stellar nurseries are found in

a) Ursa Minor b) H-R diagrams c) Ursa Major

d) hospitals e) giant molecular clouds

25. What is the name of the effect that causes spectral lines to split into two components when photons pass through an intense magnetic field?

a) Doppler b) Zeeman c) Coriolis d) Russell e) Hertzsprung

26. Which of the following accurately describes the Doppler effect?

a) Spectral lines shift redward if a light source is traveling tangentially to our line of sight.

b) Spectral lines shift redward or blueward if a light source is traveling towards or away from us, respectively.

c) Time slows down as you approach the speed of light.

d) Spectral lines shift redward or blueward if a light source is traveling away from or towards us, respectively.

e) Mass increases without bound as you approach the speed of light.

27. As cloudlets shrink in size they spin faster. Which of the following results from this?

a) leptons b) a spherical shell c) a rectangular slab

d) a flattened disk e) baryons

28. Which of the following is a terrestrial-type planet

a) Uranus b) Venus c) Neptune d) Pluto e) Jupiter

29. The Sun's complete spectral-luminosity classification is

a) O5 Ia b) A0 V c) G2 V d) K2 III e) none of these

30. If a binary star system has an orbital plane that is in the *line-of-sight*, what type of binary system is this?

a) spectroscopic b) visual c) eclipsing d) ultraviolet e) infrared

31. In order to determine a star's tangential velocity, one must know the distance to the star and its change in position on the sky over time. This change in position is called

a) neutrino b) parallax c) George

d) proper motion e) radial velocity

32. Which star cluster is the foundation of the distance indicator method of figuring out distances to external galaxies?

a) Pleiades b) Hyades c) Praesepe d) h & χ Persei e) none of these