

Astronomy II (ASTR-1020) — Homework 1

Due: 27 January 2009

The answers of this multiple choice homework are to be indicated on a Scantron sheet Form # 822 N-E (which you are to buy at the bookstore) with a **No. 2 pencil**. Don't forget to write your name and the **Homework No.** (*e.g.*, 1) on the Scantron sheet. You are to turn in this Scantron at the beginning of class on the date indicated above. There are 20 questions on this homework assignment.

Useful Constants

$G = 6.673 \times 10^{-11} \text{ m}^3/\text{s}^2/\text{kg}$	$g = 9.80 \text{ m/s}^2$
$c = 3.00 \times 10^5 \text{ km/s}$	$h = 6.626 \times 10^{-34} \text{ J s}$
$k = 1.38 \times 10^{-23} \text{ J/K}$	$H_\odot = 50 \text{ km/sec/Mpc}$
$M_{\text{moon}} = 7.35 \times 10^{22} \text{ kg}$	$M_\odot = 1.99 \times 10^{30} \text{ kg}$
$M_\oplus = 5.98 \times 10^{24} \text{ kg}$	$R_\oplus = 6.38 \times 10^6 \text{ m}$
$R_\odot = 6.96 \times 10^8 \text{ m}$	$T_\odot = 5800 \text{ K}$
1 AU = $1.50 \times 10^{11} \text{ m}$	$L_\odot = 3.90 \times 10^{26} \text{ W}$
$e = 1.60 \times 10^{-19} \text{ C}$	$\sigma = 5.67 \times 10^{-8} \text{ W/m}^2/\text{K}^4$
$m_e = 9.11 \times 10^{-31} \text{ kg}$	$m_p = 1.67 \times 10^{-27} \text{ kg}$
1 ly = $9.46 \times 10^{15} \text{ m}$	1 pc = $3.09 \times 10^{16} \text{ m}$
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

1. The theory of relativity is a theory because

- a) Einstein said so.
- b) its model was the simplest.
- c) its equations are known by all scientists.
- d) it has been validated through repeated experiments.
- e) force is equal to mass times acceleration.

2. Which of the following is not part of the scientific method?

- a) A hypothesis is made, which is an *educated guess* as to how something works.
- b) The hypothesis is debated by scientists, and if debated successfully, becomes a theory.
- c) The hypothesis is tested through repeated experimentation and/or observations.
- d) If the hypothesis passes these experiments/observations, it becomes a theory.
- e) None of these are part of the scientific method.

3. The length of the Earth's semimajor axis is called the

- a) Ångstrom
- b) astronomical unit
- c) eccentricity
- d) parsec
- e) light year

4. If one knew the actual (linear) size of an object and measured the angular size that the object makes on the sky, which of the following formulae would you use to compute the distance to the object?

- a) $r_p = a(1 - e)$
- b) $d = 206265 D/\alpha$
- c) $d = \theta r$
- d) $E = mc^2$
- e) $F = ma$

5. For the number 0.000326, which of the digits are considered significant?

- a) The zero preceding the decimal point.
- b) The zero following the decimal point.
- c) The three zeros following the decimal point.
- d) The “326” at the end of the number.
- e) The number “3”.

6. The farthest point from the Sun in a planetary orbit is called

- a) aphelion
- b) perihelion
- c) semiminor axis
- d) semimajor axis
- e) eccentricity

7. The evil Death Star has gone into elliptical orbit about the Sun with an eccentricity 0.80. At closest approach to the Sun, it comes within 0.8 AU from our star. What would be the orbital period of the Death Star?

- a) 1 yr
- b) 4 yrs
- c) 8 yrs
- d) 11.1 yrs
- e) 64 yrs

8. A force of 100 newtons is applied to a body which causes it to accelerate at 20 m/s^2 . What must be the mass of the body?

- a) 100 gm
- b) 100 kg
- c) 20 kg
- d) 5 kg
- e) 1 kg

9. A photon with a frequency of $4.00 \times 10^{15} \text{ Hz}$ (note $1 \text{ Hz} = 1 \text{ sec}^{-1}$), has a wavelength of

- a) 0
- b) 400 \AA
- c) 750 \AA
- d) 3000 \AA
- e) 4000 \AA

10. If an object is at 0 K in temperature, which of the following is true?

- a) It emits most of its light at visual wavelengths.
- b) It emits most of its light at X-ray wavelengths.
- c) The atoms that compose the object are not moving.
- d) The atoms that compose the object are ionized.
- e) None of the above.

11. Which best describes the solar constant?

- a) The constant h in the equation $E = h\nu$.
- b) The energy flux of the Sun at the top of the Earth's atmosphere.
- c) The steady brightness of the Sun's surface.
- d) The constant σ in the equation $F = \sigma T^4$
- e) None of these are correct.

12. Which of the following is true about the Sun's radiative zone?

- a) Nuclear reactions take place in the inner region of this zone.
- b) Energy is transported by the flow of photons.
- c) It is the hottest region of the Sun.
- d) It is the densest region of the Sun.
- e) All of the above are valid statements of the Sun's radiation zone.

13. Which of the following best describes hydrostatic equilibrium?

- a) The higher the temperature, the higher the pressure.
- b) The higher the temperature, the lower the pressure.
- c) The weight on a layer in a gaseous body is balanced by the internal pressure of that layer.
- d) The weight on a layer in a gaseous body is balanced by the temperature of that layer.
- e) None of these are correct.

14. Energy flow via individual particle motions in an object is known as

- a) radiation transport
- b) convection
- c) conduction
- d) advection
- e) Bob

15. Which of the following is not a conservation law used in determining nuclear reactions?

- a) Mass-energy must be conserved.
- b) Charge must be conserved.
- c) Baryon number must be conserved.
- d) Lepton number must be conserved.
- e) All of these are used.

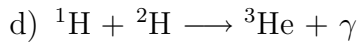
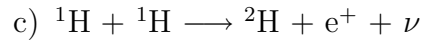
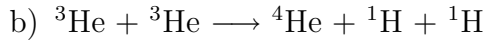
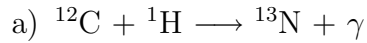
16. How many hydrogen nuclei are fused into one helium nucleus in the proton-proton chain?

- a) 1
- b) 2
- c) 4
- d) 8
- e) 16

17. Main sequence stars are burning hydrogen into helium through thermonuclear reactions in their cores. In the high-mass main sequence stars, the dominant reaction process is

- a) proton-proton chain
- b) CNO cycle
- c) HCO chain
- d) HCN cycle
- e) hydrogen cycle

18. Of the following reaction chains, which is not part of the proton-proton chain?



e) All of the above reactions are part of the proton-proton chain.

19. Determining the internal structure of the Sun through photospheric sound waves is called

a) geology b) seismology c) helioseismology

d) topology e) wavology

20. We only detect 1/3 the number of neutrinos that theory predicts from the proton-proton reaction chain occurring at the center of the Sun. This peculiarity is known as the

a) CNO problem b) p-p problem c) solar neutrino problem

d) CNO cycle e) none of these