

Name:

Physics 2130: Example Exam Chapters 12-14,22
Real Exam Date 19 November 2003
20 multiple choice questions worth 5 points each.

1. According to the first law of thermodynamics, the sum of the heat gained by a system and the work done on that same system is equivalent to which of the following?
 - a. entropy change
 - b. internal energy change
 - c. temperature change
 - d. specific heat
2. Heat is applied to an ice-water mixture to melt some of the ice. In this process:
 - a. work is done by the ice-water mixture.
 - b. the temperature increases.
 - c. the internal energy increases.
 - d. all of the above are correct.
3. A heat engine exhausts 3 000 J of heat while performing 1 500 J of useful work. What is the efficiency of the engine?
 - a. 15%
 - b. 33%
 - c. 50%
 - d. 60%
4. The maximum theoretical thermodynamic efficiency of a heat engine operating between hot and cold reservoirs is a function of which of the following?
 - a. hot reservoir temperature only
 - b. cold reservoir temperature only
 - c. both hot and cold reservoir temperatures
 - d. None of the above choices are valid.

5. A turbine takes in 1000-K steam and exhausts the steam at a temperature of 500 K. What is the maximum theoretical efficiency of this system?
- 24%
 - 33%
 - 50%
 - 67%
6. The kinetic energy of the bob on a simple pendulum swinging in simple harmonic motion has its maximum value when the displacement from equilibrium is at what point in its swing?
- zero displacement
 - 1/4 the amplitude
 - 1/2 the amplitude
 - equal the amplitude
7. A 0.20-kg object is attached to a spring with spring constant $k = 10 \text{ N/m}$ and moves with simple harmonic motion over a horizontal frictionless surface. At the instant that it is displaced from equilibrium by -0.050 m , what is its acceleration?
- $1\,000 \text{ m/s}^2$
 - 40 m/s^2
 - 0.1 m/s^2
 - 2.5 m/s^2
8. A mass of 0.40 kg, hanging from a spring with a spring constant of 80 N/m , is set into an up-and-down simple harmonic motion. What is the speed of the mass when moving through the equilibrium point? The starting displacement from equilibrium is 0.10 m .
- zero
 - 1.4 m/s
 - 2.0 m/s
 - 3.4 m/s

9. A mass on a spring vibrates in simple harmonic motion at a frequency of 4.0 Hz and an amplitude of 4.0 cm. If a timer is started when its displacement is a maximum (hence $x = 4$ cm when $t = 0$), what is the speed of the mass when $t = 3$ s?
- a. zero
 - b. 0.006 5 m/s
 - c. 0.015 m/s
 - d. 0.024 m/s
10. A traveling wave train has wavelength 0.50 m, speed 20 m/s. Find the wave frequency.
- a. 0.025 Hz
 - b. 20 Hz
 - c. 40 Hz
 - d. 10 Hz
11. The speed of sound in air is a function of which one of the following?
- a. wavelength
 - b. frequency
 - c. temperature
 - d. amplitude
12. If I triple the mass per unit length of guitar string, its natural frequency changes by what factor?
- a. 0.58
 - b. 1.0
 - c. 1.7
 - d. 3.0

13. A 2.50-m-long organ pipe is open at one end and closed at the other. Its fundamental tone has wavelength:
- a. 1.25 m
 - b. 5.00 m
 - c. 10.0 m
 - d. 16.25 m
14. What is the intensity level of a sound with intensity of $5.0 \times 10^{-10} \text{ W/m}^2$? ($I_0 = 10^{-12} \text{ W/m}^2$)
- a. 74 dB
 - b. 54 dB
 - c. 2.7 dB
 - d. 27 dB
15. A sound source of frequency 1 000 Hz moves at 50.0 m/s toward a listener who is at rest. What is the apparent frequency heard by the listener? (speed of sound = 340 m/s)
- a. 853 Hz
 - b. 872 Hz
 - c. 1 150 Hz
 - d. 1 170 Hz
16. A ray of light strikes a thick sheet of glass ($n = 1.5$) at an angle of 25° with the normal. Find the angle of the ray reflected off the glass surface with respect to the normal.
- a. 56°
 - b. 46°
 - c. 39°
 - d. 25°

17. A beam of light in air is incident at an angle of 30° to the surface of a rectangular block of clear plastic ($n = 1.46$). The light beam first passes through the block and re-emerges from the opposite side into air at what angle to the normal to that surface?
- a. 42°
 - b. 23°
 - c. 30°
 - d. 59°
18. Which of the following describes what will happen to a light ray incident on a glass-to-air boundary at greater than the critical angle?
- a. total reflection
 - b. total transmission
 - c. partial reflection, partial transmission
 - d. partial reflection, total transmission
19. Tripling the wavelength of the radiation from a monochromatic source will change the energy content of the individually radiated photons by what factor?
- a. 0.33
 - b. 1.0
 - c. 1.73
 - d. 3.0
20. One phenomenon that demonstrates the wave nature of light is:
- a. the photoelectric effect
 - b. quantization effects
 - c. absorption of light by an electron
 - d. interference effects