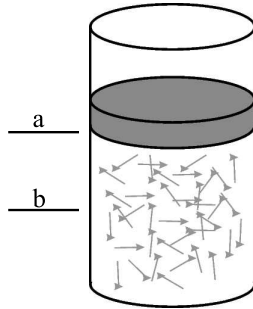


**PHY 231C, INTRODUCTORY PHYSICS I,  
EXAM IV, Dec. 3, 2003**

Choose the best answer. For T/F problems, choose only ONE answer.



1. A massive piston traps an amount of Helium gas as shown. The piston freely slides up and down. At point (a) the system equilibrates to room temperature. Weight is then added to the piston, **ADIABATICALLY** compressing the gas to half its original volume (b). Which single statement is TRUE? If all are true choose (d) and if all are false choose (e).

- (a)  $P_b = P_a$
- (b)  $U_b < U_a$  ( $U$  refers to the internal energy.)
- (c)  $T_b < T_a$ .
- (d) All of the above are true.
- (e) All of the above are false.

2. Again referring to the figure from the problem above: The piston freely slides up and down. At point (a) the system equilibrates to room temperature. The gas is then cooled **ISOBARICALLY** until the gas has half of its original volume (b). Which single statement is TRUE? If all are true choose (d) and if all are false choose (e).

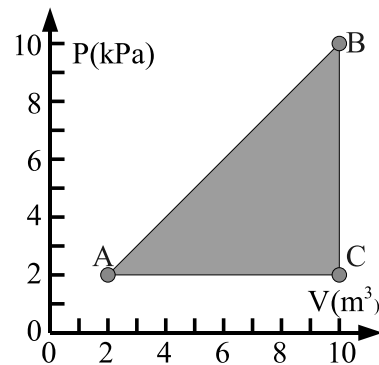
- (a)  $P_b = P_a$
- (b)  $U_b < U_a$  ( $U$  refers to the internal energy.)
- (c)  $T_b < T_a$ .
- (d) All of the above are true.
- (e) All of the above are false.

3. A pendulum has a period of 1.5 seconds on Earth's surface. What is the period of the pendulum on the surface of the moon where  $g=1.62 \text{ m/s}^2$ .

- (a) 4.92 s
- (b) 3.91 s
- (c) 3.69 s
- (d) 2.82 s
- (e) 1.05 s

4. Choose the single TRUE statement. If all statements are true, choose (e).

- (a) If heat is taken out of a container of ideal gas while the volume remains constant, no work is done by the gas.
- (b) If the temperature of a fixed mass of ideal gas increases, the internal energy must increase.
- (c) A heat pump operating between two different temperatures requires work input.
- (d) If two objects are at different temperatures initially and then are allowed to come into equilibrium without exchanging energy with the outside world (outside of the two objects), the entropy of the system must increase.
- (e) All of these statements are true.



5. A gas is taken through the cyclic process described by the figure above. How much work was done by the gas during the cycle ABCA?

- (a)  $3.20 \times 10^4 \text{ J}$
- (b)  $8.00 \times 10^4 \text{ J}$
- (c)  $1.00 \times 10^5 \text{ J}$
- (d)  $4.25 \times 10^5 \text{ J}$
- (e)  $8.00 \times 10^5 \text{ J}$

6. Select the single FALSE statement.

- (a) An object in simple harmonic motion decreases its speed the further it gets from its equilibrium point.
- (b) If a standing wave on a string has four equal loops and oscillates at 200 Hz, the frequency for two equal loops will be 100 Hz.
- (c) The expression  $x = 21.1 \sin(1.3t)$  is simple harmonic motion which begins at the origin.
- (d) The expression  $x = 21.1 \cos(1.3t)$  is simple harmonic motion which begins with zero velocity.
- (e) The frequency of simple harmonic motion of a mass on a spring depends on the amplitude.

7. A transverse wave is described by the formula  $y(x, t) = (8\text{cm}) \cdot \cos 2\pi(0.25x - 3.0t)$ , where  $x$  is required to be in cm and  $t$  is required to be in seconds. The frequency and wavelength of this wave are respectively:

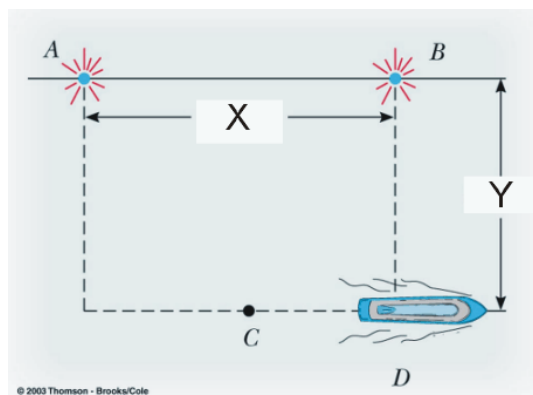
- (a) 0.333 Hz and 8.0 cm
- (b) 3.0 Hz and 4.0 cm
- (c) 18.8 Hz and 8.0 cm
- (d) 0.333 Hz and 0.25 cm
- (e) 0.333 Hz and 8.0 cm

8. The range of human hearing extends from approximately 20 Hz to 20,000 Hz. If the speed of sound is 343 m/s, what is the longest audible wavelength?

- (a) 8.32 m
- (b) 11.01 m
- (c) 17.15 m
- (d) 32.42 m
- (e) 38.23 m

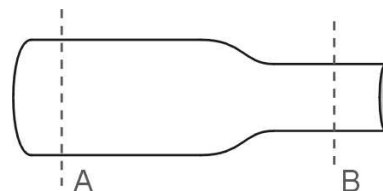
9. Two sounds have intensities  $4.5 \times 10^{-3}$  and  $7.5 \times 10^{-7}$   $\text{W}/\text{m}^2$ . What is the magnitude of the difference in intensity levels between the two sounds in dB?

- (a) 12.3 dB
- (b) 37.8 dB
- (c) 49.81 dB
- (d) 125.3 dB
- (e) 879.2 dB



10. The ship in the figure above travels along a straight line parallel to the shore and is a distance  $Y=600$  m from the shore. The ship's radio receives simultaneous signals of the same frequency from antennas at points A and B which are separated by  $X=800$  m. The signals interfere constructively at point C, which is equidistant from A and B. The signal goes through the first minimum at point D which is even with B. Determine the wavelength of the radio waves.

- (a) 18.3 cm
- (b) 4.15 m
- (c) 14.14 m
- (d) 173.2 m
- (e) 800 m



11. An incompressible fluid moves through a pipe that has a radius of 30 cm at point A and narrows to a radius of 20 cm at point B. Which ONE statement is TRUE? If all are true, choose (e). (Assume non-viscous laminar flow).

- (a) The pressure of the fluid at A is higher than the pressure at B.
- (b) The velocity of the fluid at A is lower than the velocity at B.
- (c) The amount of mass that passes A in one second equals the amount of mass that passes B in one second.
- (d) The density of the fluid at A equals the density of the fluid at B.
- (e) All of the above statements are true?