Name: _____

Physics 202 Exam 1

May 1, 2013

Word Problems

Show all your work and circle your final answer. (Ten points each.)

1. If 2.4 m^3 of a gas initially at STP is compressed to 1.6 m^3 and its temperature raised to 30 °C, what is the final pressure?

2. What is the average speed of the molecules in low-density oxygen gas at 0 °C? (The mass of an oxygen molecule, O_2, is 5.31×10^{-26} kg.)

3. A popgun uses an ideal spring for which $k = 2000$ N/m. When cocked, the spring is compressed 3.0 centimeters. How high can the gun shoot a 5.0-gram projectile?

4. A platform is suspended by four wires at its corners. The wires are 3.0 meters long and have a diameter of 2.0 millimeters. Young's modulus for the material of the wires is 1.8×10^{11} N/m^2. How far will the platform drop (due to elongation of the wires) if a 50-kilogram load is placed at the center of the platform?

5. A molten plastic flows out of a tube that is 8.0 centimeters long at a rate of 13 cm^3/min when the pressure differential between the two ends of the tube is 0.24 atm. Find the viscosity of the plastic. The inner diameter of the tube 1.30 millimeters.

6. Determine the temperature that results when 1.0 kilograms of ice at exactly 0 °C is mixed with 9.0 kilograms of water at 50 °C and no heat is lost.

Name: _____

Physics 202 Exam 2

Jun 10, 2013

Word Problems

Show all your work and circle your final answer. (Ten points each.)

1. A water tower is a familiar sight in many towns. The purpose of such a tower is to provide storage capacity and to provide sufficient pressure in the pipes that deliver the water to customers. Figure 1 shows a spherical reservoir that contains 5.25×10^5 kilograms of water when full. The reservoir is vented to the atmosphere at the top. For a full reservoir, find the gauge pressure that the water has at the faucet in (a) house A and (b) house B. Ignore the diameter of the delivery pipes.

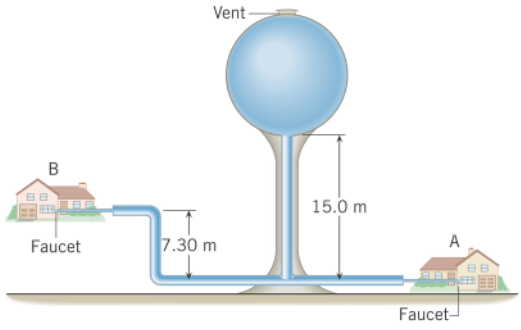

Figure 1: Problem 11.27

2. Figure 2 shows a hydraulic system used with disc brakes. The force $\vec{F}$ is applied perpendicularly to the brake pedal. The pedal rotates about the axis shown in the drawing and causes a force to be applied perpendicularly to the input piston (radius = 9.50 mm) in the master cylinder. The resulting pressure is transmitted by the brake fluid to the output plungers (radii = 19.0 mm), which are covered with the brake linings. The linings are pressed against both sides of a disc attached to the rotating wheel. Suppose that the magnitude of $\vec{F}$ is 9.00 newtons. Assume that the input piston and the output plungers are at the same vertical level, and find the force applied to each side of the rotating disc.

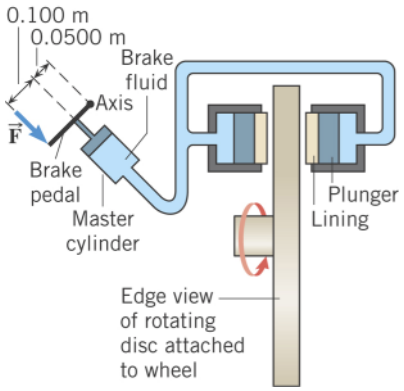

Figure 2: Problem 11.37

3. In an aluminum pot, 0.15 kilograms of water at 100 °C boils away in four minutes. The bottom of the pot is 3.1 mm thick and has a surface area of 0.015 m^2. To prevent the water from boiling too rapidly, a stainless steel plate has been placed between the pot and the heating element. The plate is 1.4 mm thick, and its area matches that of the pot. Assuming that heat is conducted into the water only through the bottom of the pot, find the temperature at (a) the aluminum-steel interface and (b) the steel surface in contact with the heating element.

4. When one person shouts at a football game, the sound intensity level at the center of the field is 60.0 dB. When all the people shout together, the intensity level increases to 109 dB. Assuming that each person generates the same sound intensity at the center of the field, how many people are at the game?

5. The transmitting antenna for a radio station is 7.00 km from your house. The frequency of the electromagnetic wave broad cast by this station is 536 kHz. The station builds a second transmitting antenna that broadcasts an identical electromagnetic wave in phase with the original one. The new antenna is 8.12 km from your house. Does constructive or destructive interference occur at the receiving antenna of your radio? Show your calculations.

6. A spotlight sends red light (wavelength of 694.3 nm) to the moon. At the surface of the moon, which is 3.77×10^8 meters away, the light strikes a reflector left there by astronauts. The reflected light returns to the earth, where it is detected. When it leaves the spotlight, the circular beam of light has a diameter of about 0.20 meters, and diffraction causes the beam to spread as the light travels to the moon. In effect, the first circular dark fringe in the diffraction pattern defines the size of the central bright spot on the moon. Determine the diameter (not the radius) of the central bright spot on the moon.