2. An ideal gas is in a closed box with a volume of 0.05 cubic meters, a temperature of 25 degrees Celsius and is at atmospheric pressure.

(a)(10) How many moles of gas are in the box?
(b)(15) The gas is then heated to 100 degrees Celsius by putting 3146 Joules of heat into the box. Is the gas monatomic, diatomic or neither? Show how you determine the answer.

3. A small, 50 gram ice-cube is stored in liquid nitrogen at -200 C. It is removed and put into 950 grams (just under a liter) of beer at room temperature (20 C).

(a)(15) What is the final temperature of the beer? (note--it is American beer, so you may assume it is water).
(b)(10) How much ice would you have to add in order for the beer to freeze solid

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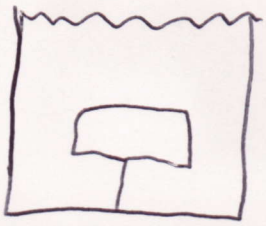
1. A 50 gram ice cube at -30.0 °C is put into 400 grams of water at 35.0 °C in a very well-insulated container. What is the final temperature?



1. A cork has a density which is 80% of the density of water, and a volume of 20 cubic centimeters. It is attached at the bottom of a beaker of water by a rope, as shown above.

(a)(5) What is the mass of the cork?
(b)(10) What is the buoyant force on the cork?
(c)(5) What is the tension in the rope?
(d)(5) Suppose the rope is cut, the cork rises to the surface and floats. What is the volume of cork that would be above the water?

Problem 6 (20 points): The legendary Dutch boy who saved Holland by placing his finger in the hole of a dike had a finger 1.2 cm in diameter. Assuming the hole was two meters below the surface of the sea (which has a density of 1.03 times that of fresh water):

(a)(10) What was the force from the water on his finger?
(b)(10) If he removed his finger from the hole, what would be the velocity of the water emanating from it?

2. A bargain hunter purchases a crown allegedly made of gold at a flea market. After she gets home, she hangs it from a scale and finds its weight to be 7.84 N. She then weighs the crown while it is totally immersed in water and now the scale reads 6.86 N

(a)(15) Determine the buoyant force on the crown, and find its volume.
(b)(10) Find the density of the crown. . Gold has a density 19.3 times that of water. Is it made of gold?

3. An IV system is supplying saline solution (viscosity $\eta = 0.001$ Pa-sec, density is that of water) to a patient at a flow rate of 0.160 cubic centimeters per second through a needle of radius 0.15 millimeters and length 2.0 centimeters.

(a)(10) What is difference between the pressure at the needle entrance, P_2, and the pressure at the entrance to the vein, P_1, needed to maintain this flow rate?
(b)(10) The pressure in the vein, P_1, is 12.00 mm-Hg. How high does the IV bottle need to be above the entrance to the needle for gravity to provide the needed pressure, P_2, at the needle entrance?
(c)(10) The moon has a mass of 0.012 times the Earth's mass and a radius of 0.27 times the Earth's radius. Find the value of "g" on the moon. If the patient were on the moon, how would your answer to part (b) be affected?

4. The roof of Small 113 is 20 meters wide and 40 meters long. A hurricane with wind speed of 66 m/sec (150 miles per hour) blows across the roof.

(a)(15) Find the pressure difference between the top of the roof and the inside of the room.
(b)(5)What is the net force on the roof?

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4. You are injecting a solution (viscosity of 1.5×10^{-3} Pa-sec) into a vein. The pressure in the vein is 15 mm-Hg (2000 Pa).

(a)(5) The plunger has an area of 0.5 cm^2, and you apply a force of 0.30 N. What is the pressure on the plunger?
(b)(8) The radius of the needle is 0.2 millimeters, and has a length of 2 centimeters. What is the flow rate of the solution?
(c)(6) The solution enters a vein with a radius of 2 millimeters. What is its speed?
(d)(6) Downstream, the vein narrows to a radius of 1 millimeter. Now what is the speed?