WileyPLUS Assignment 5

Chapters 11, 12, 14
Due Wednesday, December 9 at 11 pm

This Week

Experiment 5: Thermal conductivity of an insulator

PHYS 1020 Final Exam

Friday, December 18, 1:30 - 4:30 pm
The whole course, 30 multiple choice questions
Formula sheet provided

Seating:

Frank Kennedy Brown Gym: A - S
Frank Kennedy Gold Gym: T - Z

Pre-Appeal Final Exam Viewing

The Faculty of Science has introduced a policy allowing students to view copies of their final exams prior to the Appeal deadline, in order to allow students to determine whether or not they wish to appeal their final grade.

This process does not allow discussion of how exams were graded (the only exception is if there are errors in addition).

There is a $5.00 fee for viewing each exam.

Review of December 2009 Physics and Astronomy Final Exams:
January 22, 2010, 301 Allen Building

APPLICATION FORMS must be received in the period of
January 11-15, 2010

Please come to the General Office in Room 301 Allen Building
for policies and application forms.

Ideal Gas Law

The behaviour of an ideal gas is described by the ideal gas law:

$$PV = nRT$$

n = number of moles of gas
R = universal gas constant = 8.314 J/(mol.K)
T in Kelvin

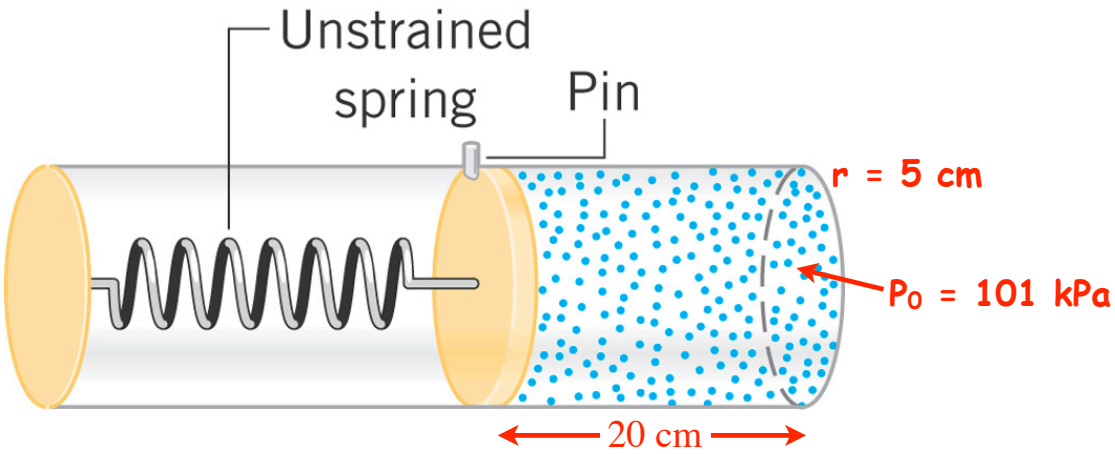
In terms of the number, N, of atoms or molecules of the gas:

$$PV = NkT$$

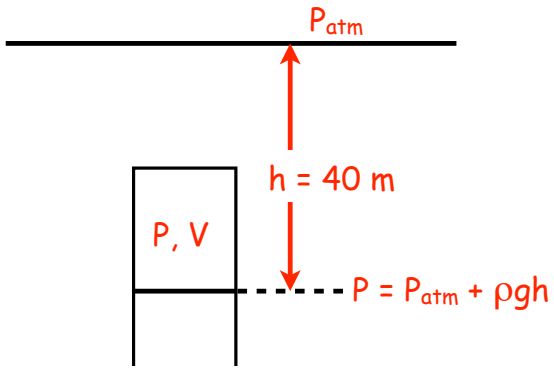
k = Boltzmann's constant = 1.38×10^{-23} J/K
$N = nN_A$, and $nRT = NkT = nN_AkT$, so

$$k = \frac{R}{N_A}$$

14.32/26: A gas fills the right-hand portion of a horizontal cylinder whose radius is 5 cm. The initial pressure of the gas is 101 kPa. A frictionless movable piston separates the gas from the left portion of the cylinder, which is evacuated and contains a spring. The piston is initially held in place by a pin and the spring is unstrained. The length of the gas-filled region is 20 cm. When the pin is removed and gas is allowed to expand, the length of the gas-filled chamber doubles. The temperature of the gas does not change. Find the spring constant of the spring.

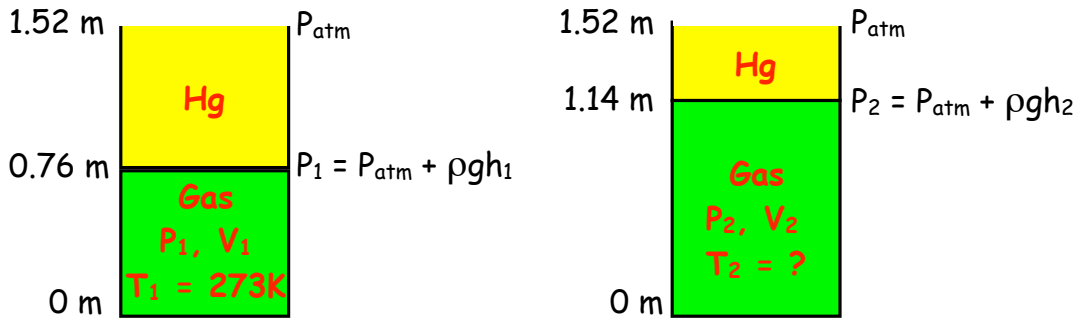


14.24/20: A diving bell consists of a cylindrical tank with one open end and one end closed. The tank is lowered into a lake with the open end downward. Water rises into the tank, compressing the trapped air, whose temperature remains constant. The tank is brought to a halt when the distance between the surface of the lake and the surface of the water in the tank is 40 m. Find the fraction of the tank's volume that is filled with air.



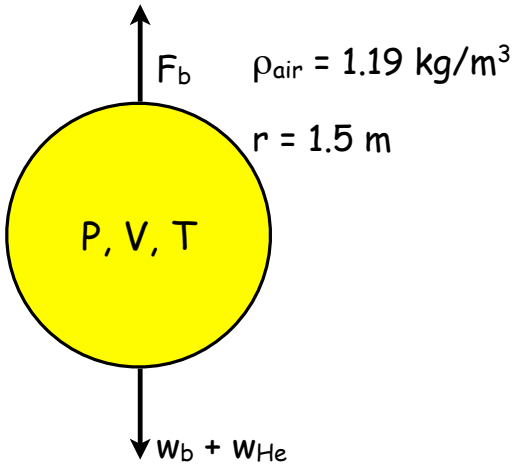
14.31/27: A cylindrical glass beaker of height 1.52 m rests on a table. The bottom half of the beaker is filled with a gas, the top half with liquid mercury exposed to the atmosphere. A frictionless piston separates the gas from the mercury.

The initial temperature is 273 K. The temperature is increased until half of the mercury has spilled out of the beaker. Find this temperature. Ignore thermal expansion of the glass and the mercury.



Prob. 14:30/57

A spherical balloon is made from a material whose mass is 3.00 kg. The thickness of the material is negligible compared to the 1.50 m radius of the balloon. The balloon is filled with helium (He) at a temperature of 305 K and just floats in air, neither rising nor falling. The density of the surrounding air is 1.19 kg/m^3. Find the absolute pressure of the helium gas.



Prob. 14.19/15

In a diesel engine, the piston compresses air at 305 K to a volume that is one-sixteenth of the original volume and a pressure that is 48.5 times the original pressure. What is the temperature of the air after the compression?