This print-out should have 11 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

Please notice that for your homework to be considered towards your grade, it needs to be submitted one hour before the corresponding recitation starts.

PLEASE REMEMBER THAT YOU MUST CARRY OUT YOUR CALCULATIONS TO AT LEAST THREE SIGNIFICANT FIGURES. YOUR ANSWER MUST BE WITHIN ONE PERCENT OF THE CORRECT RESULT TO BE MARKED AS CORRECT BY THE SERVER.

001 (part 1 of 2) 4 points
An air bubble originating from a under-water diver has a radius of 5 mm at some depth h. When the bubble reaches the surface of the water, it has a radius of 8 mm.

The acceleration of gravity is 9.8 m/s^2.

Assuming the temperature of the air in the bubble remains constant, determine the depth h of the diver. Answer in units of m.

002 (part 2 of 2) 5 points
Determine the absolute pressure at this depth. Answer in units of kPa.

003 (part 1 of 1) 5 points
Pure helium gas is admitted into a tank containing a movable piston. The initial volume, pressure, and temperature of the gas are 0.052 m^3, 175 kPa, and 308 K.

If the volume is decreased to 0.009 m^3 and the pressure is increased to 354 kPa, find the final temperature of the gas. Answer in units of K.

004 (part 1 of 2) 4 points
A sphere 15 cm in diameter contains an ideal gas at 0.4 atm and 20°C. As the sphere is heated to 148 °C, gas is allowed to escape. The valve is closed and the sphere is placed in an ice-water bath.

How many moles of gas escape from the sphere as it warms? Answer in units of mol.

005 (part 2 of 2) 5 points
What is the pressure in the sphere when it is in the ice water? Answer in units of Pa.

006 (part 1 of 1) 5 points
An auditorium has dimensions 14 m height, 9 m length, and 39 m width.

How many molecules of air are needed to fill the auditorium at 10°C and 99.1 kPa pressure?

007 (part 1 of 2) 4 points
A tank of volume 0.487 m^3 contains 2.64 mol of helium gas at 44 °C. Assume that the helium behaves like as an ideal gas.

The universal gas constant is 8.31451 J/K mol, and Boltzmann's constant is 1.38066×10^{-23} J/K.

Find the total thermal energy of the system. Answer in units of J.

008 (part 2 of 2) 5 points
What is the average kinetic energy per molecule? Answer in units of J.

009 (part 1 of 1) 5 points
Gaseous helium is in thermal equilibrium with liquid helium at 1 K.

The mass of a helium atom is 6.65×10^{-27} kg. Boltzmann's constant is 1.38066×10^{-23} J/K.

Determine the most probable speed of a helium atom. Answer in units of m/s.

010 (part 1 of 2) 4 points
Boltzmann's constant is 1.38066×10^{-23} J/K. Avogadro's number is 6.02214×10^{23} /mol.

Determine the temperature at which the rms speed of an He atom equals 940 m/s. Answer in units of K.

011 (part 2 of 2) 4 points
What is the rms speed of He on the surface of a certain star, where the temperature is 5482 K? Answer in units of m/s.