

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. Work submitted after this time, but before the DUE DATE on top of this page, will be accepted but not graded.

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.

Air Bubble From the Deep

19:07, trigonometry, numeric, > 1 min, normal.

001

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 7 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

Determine the absolute pressure at this depth. Answer in units of kPa.

Helium in Piston

19:07, trigonometry, numeric, > 1 min, normal.

003

Pure helium gas is admitted into a tank containing a movable piston. The initial volume, pressure, and temperature of the gas are 0.015 m^3 , 200 kPa, and 300 K.

If the volume is decreased to 0.012 m^3 and the pressure is increased to 350 kPa, find the final temperature of the gas. Answer in units of K.

Ideal Gas in Sphere

19:07, trigonometry, numeric, > 1 min, normal.

004

A sphere 10 cm in diameter contains an ideal gas at 1 atm and 20°C . As the sphere is heated to 100°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

What is the pressure in the sphere when it is in the ice water? Answer in units of Pa.

Molecules in an Auditorium 02

19:07, trigonometry, numeric, > 1 min, normal.

006

An auditorium has dimensions 10 m height, 20 m length, and 30 m width.

How many molecules of air are needed to fill the auditorium at 20°C and 101 kPa pressure?

Helium Gas

21:01, trigonometry, numeric, > 1 min, normal.

007

A tank of volume 0.3 m^3 contains 2 mol of helium gas at 20°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 $1.38066 \times 10^{-23} \text{ J/K}$.

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

008

What is the average kinetic energy per molecule? Answer in units of J.

Most Probable Speed

21:06, trigonometry, numeric, > 1 min, normal.

009

Gaseous helium is in thermal equilibrium with liquid helium at 4.2 K.

The mass of a helium atom is $6.65 \times$

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.

RMS Speed of Helium

21:06, trigonometry, numeric, > 1 min, normal.

010

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 500 m/s. Answer in units of K.

011

What is the rms speed of He on the surface of a certain star, where the temperature is 5800 K? Answer in units of m/s.