This print-out should have 14 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 in a Diesel Engine

21:03, trigonometry, numeric, > 1 min, normal.

001

Air in the cylinder of a diesel engine at 20°C is compressed from an initial pressure of 1 atm and of volume of 800 cm^3 to a volume of 60 cm^3.

Assuming that air behaves as an ideal gas ($\gamma = 1.40$) and that the compression is adiabatic and reversible, find the final pressure. Answer in units of atm.

002

Find the final temperature under the same assumptions as above. Answer in units of °C.

Compressed Helium

21:03, trigonometry, numeric, > 1 min, normal.

003

Helium gas at $T_i = 20°C$ is compressed reversibly without heat loss to one-fifth its initial volume. $\gamma_1 = 1.67$.

What is its temperature after compression? Answer in units of K.

004

What if the gas is dry air (23 percent O_2, 77 per N_2)? $\gamma_2 = 1.4$. Answer in units of K.

Diatomic Gas in Closed Cycle

21:03, trigonometry, numeric, > 1 min, normal.

005

4 L of diatomic gas ($\gamma = 1.4$) confined to a cylinder are put through a closed cycle. The gas is initially at 1 atm and at 300 K. First, its pressure is tripled under constant volume. Then it expands adiabatically to its original pressure and finally is compressed isobarically to its original volume.

Determine the volume at the end of the adiabatic expansion. Answer in units of L.

006

Find the temperature of the gas at the start of the adiabatic expansion. Answer in units of K.

007

Find the temperature at the end of the adiabatic expansion. Answer in units of K.

008

What is the net work done for this cycle? Answer in units of J.

Moles of Diatomic Molecular Gas

21:02, trigonometry, numeric, > 1 min, wording-variable.

009

Three moles of a certain diatomic molecular gas are heated at constant pressure from 300 K to 400 K.

The heat capacity of this gas under constant pressure is 28.8 J/mol · K. The universal gas constant is 8.31451 J/mol · K.

Calculate the heat transferred to the gas. Answer in units of J.

010

Calculate the increase in its internal energy. Answer in units of J.

011

Calculate the work done by the gas. Answer in units of J.

Adiabatic Expansion

21:03, trigonometry, numeric, > 1 min, normal.

012

2 mol of an idea gas ($\gamma = 1.4$) expands slowly and adiabatically from a pressure of 5 atm and a volume of 12 L to a final volume of 30 L.

The universal gas constant is 8.31451 J/K · mol.

What is the final pressure? Answer in units of atm.

013

What is the initial temperature? Answer in units of K.

014

What is the final temperature? Answer in units of K.