PHYS 122 Midterm Exam

Time: 50 minutes
Total Points: 100

Full Name: _____

Instructions

- Show all work clearly. Answers with no justification may receive little or no credit.
- Diagrams (including PV diagrams) must be drawn by the student when appropriate.

Useful Equations

- $PV = nRT$
- $W_{\text{env}} = -\int P\,dV$
- $\Delta E_{\text{th}} = Q + W_{\text{env}}$
- $\Delta E_{\text{th}} = 3/2nR\Delta T$
- $v_{rms} = \sqrt{\frac{3K_BT}{m}}$
- $\Delta L = \alpha L \Delta T$
- $\Delta V = \beta V \Delta T$

Question 1 [60 points]

A sample of an ideal gas undergoes a thermodynamic process. It starts with a Volume of 0.1 m^3 and a pressure of 1.0 kPa and then both of its vulme and pressure get doubled. Assume $R \simeq 8 \frac{J}{mol.K}$

(a) Draw a P-V diagram, with labels and units.

(b) Calculate the work of the environment during the process.

(c) Find the initial and final tempreture of the gas.

(d) Determine the change in thermal energy of the gas.

(e) How much heat was transfered to or from the gas?

(f) What is the ratio of final to initial root mean sqaure velocities of the gas?

Question 2 [20 points]

An 100 m aluminum rod is cooled down from 220 C to 120 C. The linear thermal expansion of the aluminum is $2.3 \times 10^{-5} C^{-1}$ and the volume expansion coefficent is $6.9 \times 10^{-5} C^{-1}$.

(a) What is the new length of the rod?

(b) Explain why the length of rod changes.

Question 3 [20 points]

You have a container and put some ice and hot water in it. You close its door and cover it with an insulator and wait for 1 hour. Then you open it and see there is more ice and some hot steam in the container. Will you get surprized or you think it's possible? Explain.