

PHYSICS 1B TEST FIVE

PLEASE EXPLAIN LOTS!!!!!!!!!!!!!!!!!!!!!!!!!!!!

1. SNOW POWER

You want to run an engine using the temperature difference between your room, 24 C, and the snow outside, -24 C. What is the maximum percent efficiency?

$$2 \times 24 / (273 + 24) \times 100$$

A. 4.78, B. (16.2), C. 23.6, D. 52.7, E. 70.8

2. DERIVE GAS LAW

Derive the Gas Law starting with the force produced by molecules and ending with $PV = nRT$. Explain carefully. You can use proportionalities instead of integrals during the derivation.

3. EVERYTHING

You burn hydrogen and oxygen to make water, just the right amount so the final pressure is low enough so the water is all in the gas phase. If the temperature goes from 300 C to 1,600 C, the chamber expands enough to increase the volume 22%, and the initial pressure is 1 atmosphere, what is the final pressure?

$$2 \times .89 \times (1,600 + 273) / (3 \times (1 + 22/100) \times (300 + 273))$$

A. .38, B. .853, C. 1.11, D. 1.37, E. (1.59)

4. MOST PROBABLE VELOCITY

Starting from the Maxwell-Boltzmann equation derive the most probable velocity. $\Delta N = \Delta v \times N \times v \times \text{SQR}(2/\pi) \times (m/kT)^{3/2} \times \text{EXP}(-mv^2/2kT)$

5. TRIANGLE CYCLE

An engine uses a cycle with three parts: (1) An isotherm going from a volume of 13 times 5.7 liters to 5.7 liters, (2) going from the high pressure side of the isotherm, (3) An isobar going down from the high volume end of the isobar to the low pressure end of the isobar! Find the % efficiency for 15 moles of gas, $C_v = 5$, $R = 2 \text{ cal/mole degree K}$.

$$100 \times (13 - 1 - \text{LOG}(13)) / (3.5 \times (13 - 1))$$

A. 12.2, B. (22.5), C. 40.9, D. 64.7, E. 77.5

6. ENTROPY POSITIVE

Show why the change in entropy for the system is positive when ice melts and cools water.

7. CARNOT

Explain why the Carnot cycle is as efficient as any cycle. Be sure to include the second law.

8. DNA

Suppose an energy of 2.1 eV ($1 \text{ eV} = 1.6 \times 10^{-19} \text{ Joules}$) will damage a molecule. What percent of the molecules are within 5.9 percent of that energy at a temperature of 310 K?

$$5.9 \times \text{SQR}(2.54648) \times (2.1 \times 23357 / 310)^{-1.5} \times \text{EXP}(-2.1 \times 11678.8 / 310)$$

A. 1.92×10^{-31} , B. 3.8×10^{-31} , C. 5.74×10^{-31} , D. 6.94×10^{-31} , E. (8.2×10^{-31})

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that velocity at a temperature of 310 K?