Physics 2B Name: _____
Cascarano 1/26/05

Midterm Exam #1

1) Closed book and notes, except for one 3" x 5" note card (both sides ok)
2) You may use a scientific calculator
3) Please ask me if anything is unclear and let me know right away if you see a typo

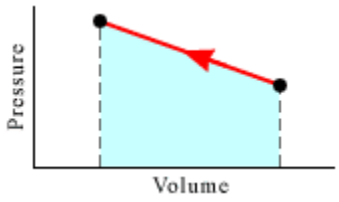
Problem 1 (10 points)

a) Two different objects are supplied with equal amounts of heat. Give the reason(s) why their temperature changes would not necessarily be the same.

b) Two different surfaces, one metal and one plastic, are at the same temperature. Why does one feel colder to the touch? Which feels colder?

Problem 2 (5 points)

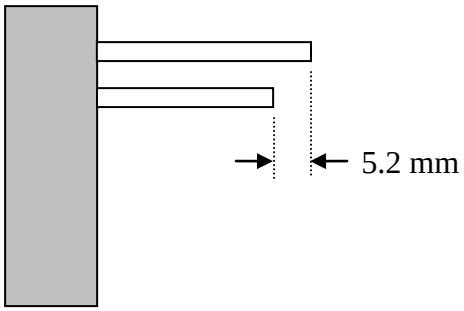
The drawing shows a pressure-volume graph for a gas being compressed. The area under the curve represents _____



- the change in the internal energy of the gas.
- the work done *by* the gas.
- the work done *on* the gas.
- the heat gained by the gas.
- the heat lost by the gas.

Problem 3 (15 points)

Two aluminum rods of different lengths are mounted on one side of a wall, as shown. There is a gap between the ends of the rods, as one rod is 5.2 mm longer than the other rod at the current temperature of 23°C. What change occurs in the gap when the rods are heated to 81°C? The thermal expansion coefficient of aluminum is $\alpha = 2.3 \times 10^{-5}\ (C°)^{-1}$



Problem 4 (10 points)

While running, 5.7×10^5 *J* of work is done by a jogger and 3.9×10^5 *J* of heat is lost by the jogger. What is the change ΔU in the jogger's internal energy? Be sure to include the correct algebraic sign.

Problem 5 (18 points)

1.0 kg of ice at -15°C and 8.0 kg of water at 90°C are brought together at atmospheric pressure in a perfectly insulated container. Find the final temperature (ignoring the container and any equilibrium vapor pressure of the liquid at the final temperature).

c_{ice} = 2000 J/(kg °C)
c_{water} = 4186 J/(kg °C)
$L_f = 3.35 \times 10^5$ J/kg
$L_v = 2.26 \times 10^6$ J/kg

Problem 6 (12 points)

You have a spare Carnot refrigerator in your garage. The inside of the refrigerator is kept at 275 K year round. During the summer the room temperature is 305 K, while the winter room temperature is 285 K.

a) Using 2000 J of work, how much heat can this refrigerator remove from its inside compartment during the summer?

b) Using 2000 J of work, how much heat can this refrigerator remove from its inside compartment during the winter?

Problem 7 (10 points)

5.0 kg of lead melts slowly (reversibly) at a pressure of one atmosphere and a temperature of 600 K. Find the change in entropy of the lead.

For lead:

$L_f = 2.32 \times 10^4$ J/kg

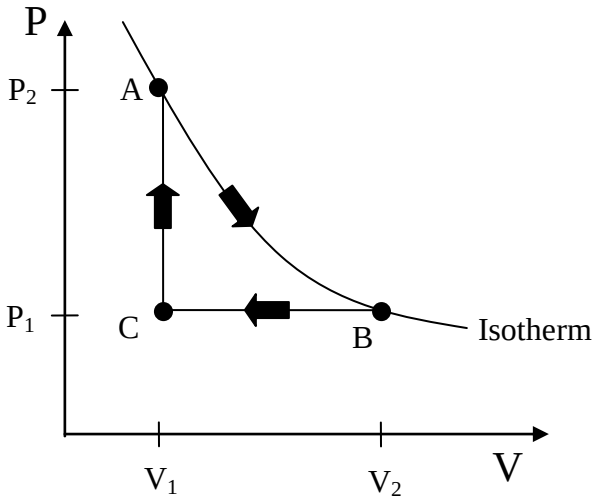
$L_v = 8.59 \times 10^5$ J/kg

Problem 8 (20 points)

The pressure and volume of an ideal monatomic gas change from A to B to C and back to A, as the drawing shows. The curved line between points A and B is an isotherm.

$P_2 = 6 \times 10^4$ Pa
$V_1 = 1 \times 10^{-3}$ m^3
$V_2 = 3 \times 10^{-3}$ m^3

PV = nRT
R = 8.31 J/(mol K)



a) If the system contains 1 mole of gas, what is the temperature of the isotherm?

b) Fill in the chart for ΔU, Q, and W for this process, including the sign of each.

Path	ΔU	Q	W
A to B			
B to C			
C to A			