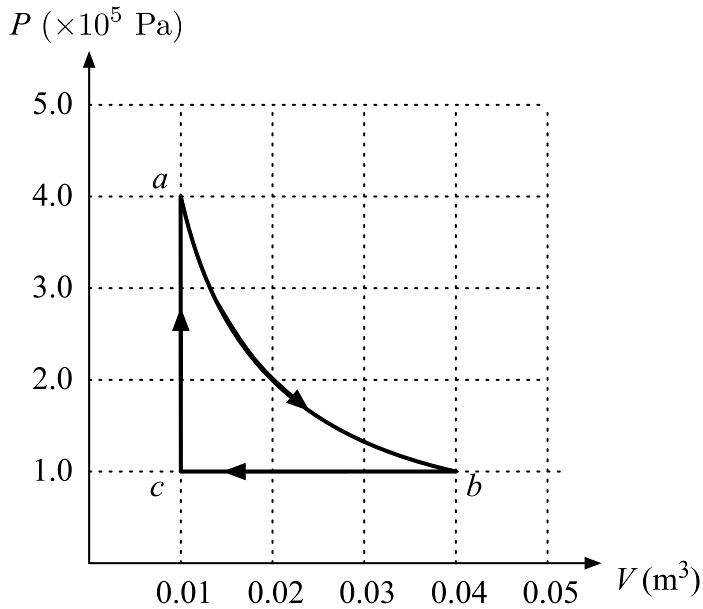

24. One mole of an ideal monatomic gas is taken through the cycle *abca* shown on the diagram above. State a has volume $V_0 = 0.01$ cubic meter and pressure 4.0×10^5 Pa, and state b has volume $V_b = 0.04$ cubic meter. The molar heat capacities for the gas are $C_p = 20.8$ J/mole K, and $C_v = 12.5$ J/mole K. Determine each of the following:

    (a) The temperatures T_a, T_b, T_c for each of these states of the gas.

    (b) Find the internal energy of the gas E (or "U" according to our text) for states a, b, and c.

    (c) Find ΔE, the change in internal energy, for the entire cycle $a \to b \to c \to a$.

    (d) The heat Q_{ca}

    (e) The work W_{bc} done by the gas on its surroundings during process bc

    For calculus scholars:

    (f) The work done during the process $a \to b$. Is this work done *on* the gas or *by* the gas?

    For non-calculus scholars: The net heat added in the entire cycle is 2500 J.

    (g) Find the net work done during the entire cycle.

    For all SPA Physics II scholars:

    (h) Is process $a \to b$ adiabatic or isothermic? Justify your claim.

    (i) If process $a \to b$ results in about 5500 J of work done by the gas, what is Q_{ab}?

    (j) The efficiency of a Carnot engine that operates between the maximum and minimum temperatures in this cycle