3.020 – Thermodynamics of Materials Recitation 2

Problem 1

We are interested in calculating the entropy change of a particular closed system where we can control both volume and pressure. The system consists out of 1 mole of an ideal gas with starting state A(P_A,V_A,T_A) (see graph).

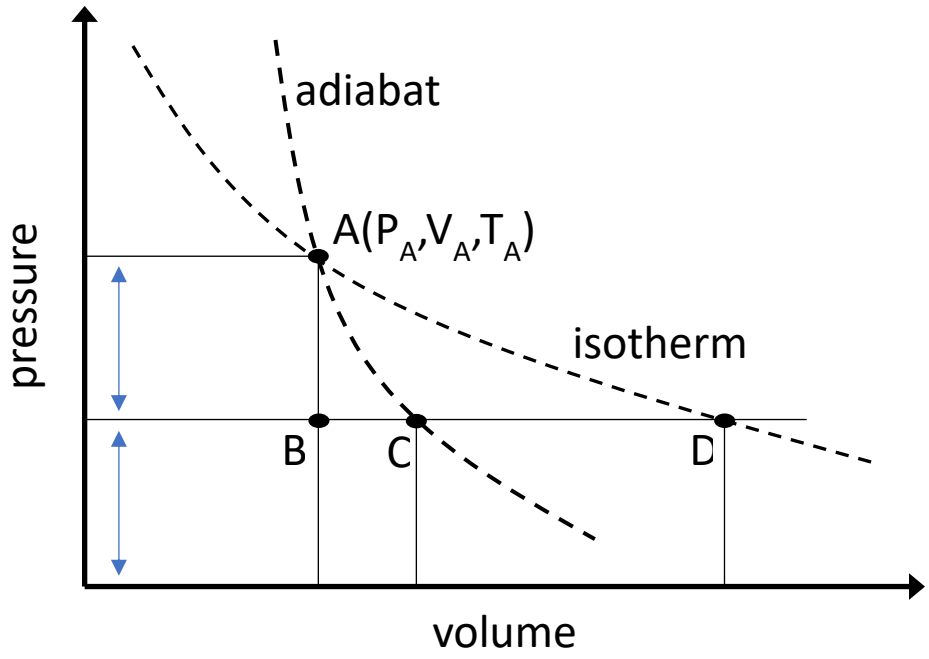
a) Derive a theoretical expression that describes the entropy change of this system. Choose the independent variables wisely. (You may use table 4.5 of DeHoff textbook.)

b) 1. Use the derived expression in (a) to calculate the entropy change from state A to state B through the reversible isochoric compression to a pressure $P_B=P_A/2$ (see graph). Is this an endothermic or exothermic process? Why?

2. Use the derived expression in (a) to calculate the entropy change from state B to state C through the reversible isobaric expansion to a volume V_c, the volume of the P_A,V_A-adiabat (see graph). Is this an endothermic or exothermic process? Why?

3. Calculate the total reversible entropy change obtained in (1) and (2) (e.g from state A to C via B) and explain the result (2 key words!).

c) Calculate the total change in energy from state A to state D through the reversible isothermal expansion to a pressure $P_D=P_A/2$. Is this a spontaneous or a forced process? Explain the result?



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