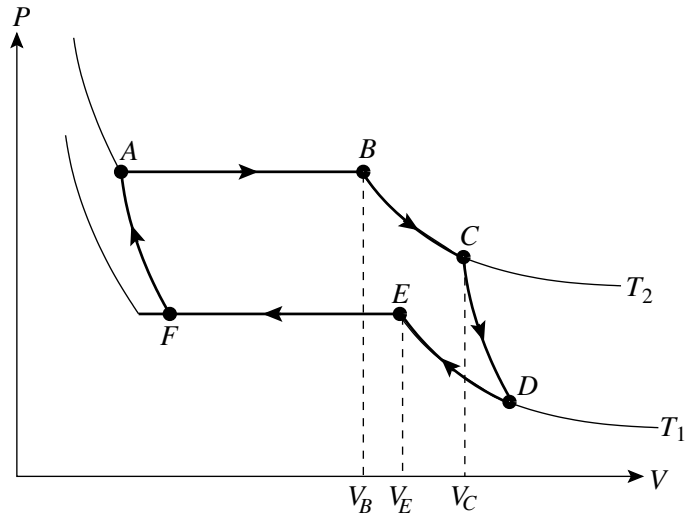
Exercise 1 (3 Points)



Consider the reversible cycle $ABCDEFA$. The following information is given: ABC and DEF are isothermal transformations. CD and FA are adiabatic transformations. In the gas phase ($BCDE$) the substance is an ideal gas, while it is pure liquid in A. The latent heat l_{AB} along the path AB, as well as the volumes V_B and V_C are known. Calculate the work performed by the cycle.

Exercise 2 (2 Points)

Calculate the fraction of particles in the liquid state at the point F assuming for this exercise that the latent heat is independent of the temperature and that the volume V_E is known in addition.

Hint: Recall that for any extensive quantity ξ (for example $U, A, G, S, ...$) the value ξ_b at any point b of the gas-liquid coexistence line is given by the average $\xi_b = n_l \xi_{\text{pure liquid}} + (1 - n_l)\xi_{\text{pure gas}}$, where n_l is the fraction of particles in the liquid phase.

Exercise 3 (5 Points)

Consider a van der Waals gas, at a temperature $T = 0.95T_c$. Calculate the vapour pressure $P_v(T)/P_c$ associated to this temperature up to 2 decimals.

Hint: You have to obtain (with a calculator, or using a cubic equation solver, as e.g. www.1728.com/cubic.htm, or a graphic program) the curve of the isotherm. Then you have to apply the criterion for the Maxwell construction to find the vapour pressure.