Midterm #3

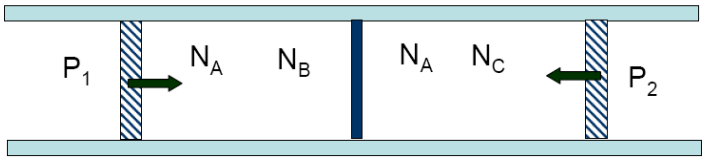
Problem#1

For three-dimensional Maxwell distribution find the average of $\left\langle bv_z^2 \right\rangle$ where b is a constant.

Problem#2

The outer shell electrons of iron ion Fe^{3+} combine together to form total orbital momentum 0 and total spin S=5/2. The projection of the spin can take values S_z=-5/2, -3/2, -1/2, 1/2, 3/2, 5/2. In magnetic field the energies of these states are $E = -\mu_B g S_z B$, where g=2 is g-factor and μ_B is the Born magneton. The iron atoms are in magnetic field B at temperature T. What is the probability to find an iron ion in the state with $S_z = \frac{3}{2}$?

Problem#3



Two pistons and a membrane separate a cylinder into two compartments that have the same volume and the same number of molecules of solvent N_A. The left compartment also contains N_B molecules of solute B, the right compartment contains N_C molecules of solute C. Molecules of solvent can penetrate through the membrane separating two compartments, but molecules of B and C solutes can not. What is the pressure difference (P_1-P_2) that keeps the system in equilibrium?

Problem#4

Describe the state of the binary alloy Au-Ge at the points indicated on the phase diagram below. The description of the state should include the aggregate state (liquid, solid or a mixture of two) as well as the chemical composition of each phase present.

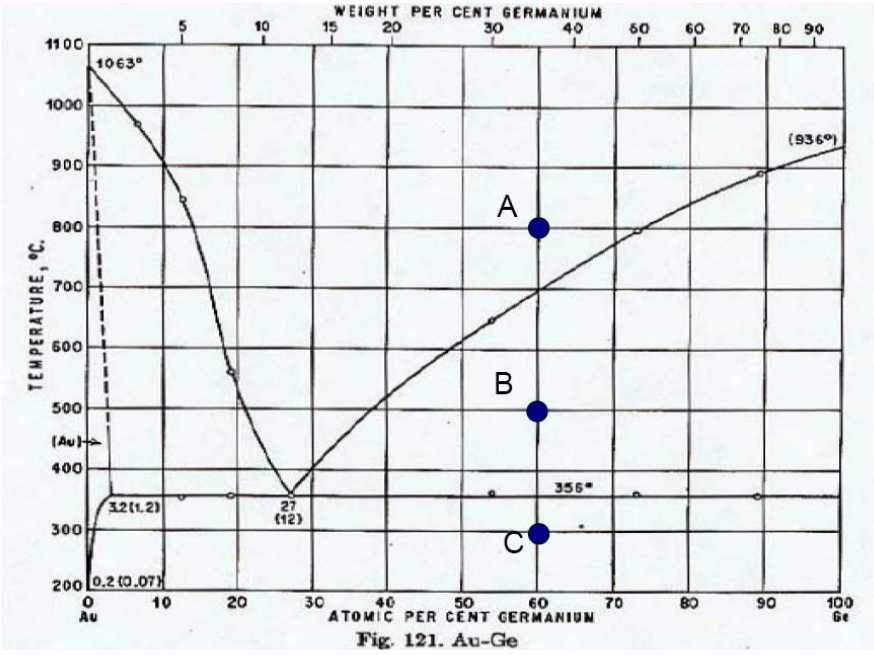


Fig. 121. Au-Ge