Problem 1 (Diffusion)
A phosphorus diffusion process has yielded a wafer with the following properties: surface concentration of $5 \times 10^{18}$/cm$^3$, background concentration of the p-type wafer is $1 \times 10^{15}$/cm$^3$. The $Dt$ product of the diffusion for pre-deposition is $2 \times 10^{-8}$ cm$^2$. The $Dt$ product of the diffusion for drive-in is $7 \times 10^{-8}$ cm$^2$.
(a) Find the junction depth after drive-in
(b) Find the junction depth after pre-deposition
(c) What is the sheet resistance of the two diffusion steps, respectively?

Problem 2 (Diffusion)
(a) What is the total number of squares in the resistor shown, assuming that its geometry is specified precisely by the mask dimensions?
(b) The resistor is actually formed from a p-type base diffusion with a 6-µm junction depth. What is the actual number of squares in this resistor, assuming that the lateral diffusion is 10µm.
(c) What would be the resistance of the resistor in parts (a) and (b) if the surface concentration of the base diffusion was $5 \times 10^{18}$ boron atoms/cm$^3$, the bulk concentration $10^{15}$/cm$^3$ and the junction depth 6µm. (hint: you will need to use Fig. 4.15 & Fig. 4.16d)

Problem 3 (MEMS)
Please calculate the end deflections of the following MEMS devices under the influence of gravity. The device is fabricated by the MUMPs process and the material is polysilicon. Assuming $E = 150$ GPa,
(a) A cantilever beam with width of 2 µm, length of 400 µm and thickness of 2 µm. (you don’t need to derive the formula, cite the right formula in any book is fine)
(b) The same cantilever beam (assume it is massless now) which is to support a 100X100 µm$^2$ plate at the end (see picture). (you can assume all the weight of the plate is a point load).