

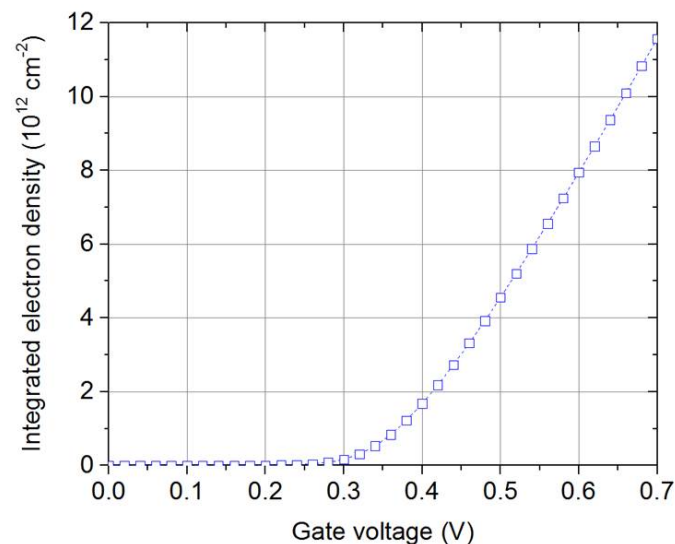
Due: 23:55, April 22 (Wednesday night)

We have 4 problems.

In your answer file, specify both the **SOLUTION PROCEDURE** and the **FINAL SOLUTION**.

1. Consider a MOS structure. The threshold voltage is 0.23 V and the P-type substrate is doped with a density of 10^{18} cm^{-3} . The gate voltage is 0.0 V. In this case, $+4 \times 10^{-7} \text{ C/cm}^2$ is found in the gate. Estimate the depth of the depleted region in the substrate.

2. Consider a MOS structure. The inversion charge per area is plotted. Estimate the threshold voltage.



3. Consider the same graph in the above problem. Calculate the thickness of the dielectric layer. The relative permittivity of the dielectric material is 25.

4. The threshold voltage of a MOS structure is dependent on the substrate doping density. Consider a certain MOS structure. The P-type doping density in the substrate region is intentionally doubled.

Except for that, every condition is unchanged. What happens to the threshold voltage? Increased? Decreased? Or doesn't change? Explain the reason.