1. Consider metal-oxide-semiconductor (MOS) capacitors on p-type substrates that are ideal, meaning the workfunction of the metal and semiconductor are equal. Assume no charge inside the oxide or at the interfaces. Then the gate voltage V_G may be written as the sum of the voltage drops in the semiconductor and the oxide: $V_G = \psi_s + V_{ox}$.

(a) Assume the MOS is in depletion. How does the voltage drop in the semiconductor vary (qualitatively) as a function of the oxide thickness t_{ox} for a given V_G? Share your reasoning.

(b) Suppose the semiconductor substrate is silicon, with doping of $N_a = 10^{16} cm^{-3}$; and the oxide is SiO_2, with $\varepsilon_r(SiO_2) = 4$, and thickness $t = 10nm$. Calculate the threshold voltage V_T. How do you expect V_T to vary with temperature? Share your reasoning.