Fundamentals of Nanotransistors L2.4 Quiz <u>ANSWERS</u> Mark Lundstrom

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Lecture 2.4: Flatband Voltage

- 1) If the metal-semiconductor workfunction difference is $F_M F_s = -0.8$ eV, what is the built-in potential of the metal gate? (Assume that the semiconductor bulk is at V = 0 V.)
 - a) -0.8 V.
 - b) +0.8 V.
 - c) -0.4 V.
 - d) +0.4 V.
 - e) -1.6 V.
- 2) For the same gate voltage, $V_G = 0$, what is different if there is a positive fixed charge at the oxidesemiconductor interface (as compared to the case of no fixed charge)? Assume a p-type semiconductor.
 - a) The surface potential, ${\mathcal Y}_{\mathrm{s}}$, is more positive.
 - b) The surface potential, \mathcal{Y}_s , is more negative.
 - c) The charge in the oxide increases.
 - d) The charge in the oxide decreases.
 - e) The electric field in the semiconductor decreases in magnitude.
- 3) Consider an n-type semiconductor with a metal gate having a workfunction larger than the semiconductor. Which of the following is true in equilibrium?
 - a) The semiconductor is at the flatband condition.
 - b) The semiconductor is in accumulation.
 - c) The semiconductor is in deep depletion.
 - d) The semiconductor is in breakdown.
 - e) The semiconductor is in depletion or inversion depending on the magnitude of $\mathsf{F}_{_M}$ $\mathsf{F}_{_{\mathbf{S}}}$.