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Week 11 Quiz ANSWERS: MOS Fundamentals
ECE 305: Semiconductor Devices
Mark Lundstrom, Purdue University, Spring 2015

Answer the **multiple choice questions** below by choosing the **one, best answer**.

- 1) When majority carriers pile up at the oxide-Si interface, what is the bias condition?
a) **Accumulation.**
b) Flatband.
c) Depletion.
d) Deep depletion.
e) Inversion

- 2) When majority carriers are pushed away from the oxide-Si interface, what is the bias condition?
a) Accumulation.
b) Flatband.
c) **Depletion.**
d) Deep depletion.
e) Inversion

- 3) When minority carriers pile up at the oxide-Si interface, what is the bias condition?
a) Accumulation.
b) Flatband.
c) Depletion.
d) Deep depletion.
e) **Inversion**

- 4) When the charge density is zero in the semiconductor, what is the bias condition?
a) Accumulation.
b) **Flatband.**
c) Depletion.
d) Deep depletion.
e) Inversion.

- 5) What is the parameter, ϕ_F ?
a) A measure of the bandbending in the semiconductor.
b) A measure of the volt drop across the oxide.
c) **A measure of how far below the intrinsic level the Fermi level is.**
d) A measure of how far above the intrinsic level the Fermi level is.
e) The metal workfunction.

- 6) An MOS capacitor can be thought of as:
- Two constant capacitors in series.
 - Two constant capacitors in parallel.
 - One constant and one bias dependent capacitor in series.**
 - One constant and one bias dependent capacitor in parallel.
 - Two bias dependent capacitors in series.
- 7) When $V_G = V_T$, what is the bandbending in the semiconductor?
- $\phi_F/2$.
 - ϕ_F .
 - $3\phi_F/2$.
 - $2\phi_F$.**
 - $5\phi_F/2$.
- 8) If the oxide capacitance per cm^2 is C_{ox} , and the charge per cm^2 in the semiconductor is Q_s , what is the voltage drop across the oxide?
- $Q_s C_{ox}$
 - $-C_{ox}/Q_s$
 - $-Q_s/C_{ox}$.**
 - $Q_s + C_{ox}$.
 - $Q_s - C_{ox}$.
- 9) How are “high” and “low -frequency” MOS C-V characteristics different?
- In accumulation. the high-frequency cap is lower than the low-frequency cap.
 - At flatband, the high-frequency cap is lower than the low-frequency capacitance.
 - In depletion, the high-frequency cap is lower than the low-frequency capacitance.
 - In depletion, the high-frequency cap is higher than the low-frequency capacitance.
 - In inversion the high-frequency cap is lower than the low-frequency capacitance.**
- 10) What is a typical thickness of an SiO_2 layer in modern MOS technology?
- 0.1 – 0.2 nm.
 - 1-2 nm.**
 - 5-6 nm.
 - 10-20 nm.
 - 100-200 nm.