2016 Qualifying Exam Questions

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Consider the device below (first without the traps):

1. Draw the band diagram across the metal semiconductor junction (section A-A')
2. Draw the band diagram across the metal/insulator/semiconductor/insulator/metal stack (section B-B')
3. Now, add the traps in the picture. The traps can hold an electron if filled.
4. Sketch the I_D-V_{G1} curve of the device, for a finite V_D, with $V_S = V_{G2} = 0$ V
5. Sketch the I_D-V_{G2} curve of the device, for a finite V_D, with $V_S = V_{G1} = 0$ V
6. Obviously, the answer depends on whether the semiconductor is thick or thin. How would you determine whether the semiconductor is "thick" or "thin"? What are the signatures you would look for in the band diagram or in the measured characteristics?
7. Now, add the traps in the picture. The traps can hold an electron and become negatively charged if filled.
8. What do the I-V curves look like if the traps are filled with electrons?