UM-SJTU JI Summer 2020 VE 320 Quiz 6

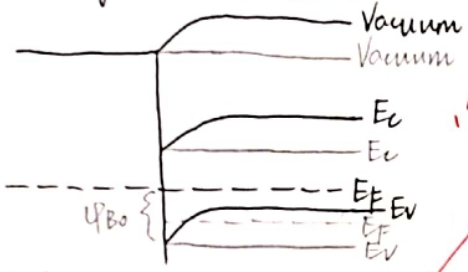
10.

Name: Student ID:

1. For a p type semiconductor in contact with a metal, when does it form a Schottky contact, and when does it form an Ohmic contact? Please draw the energy band diagram for each case, and explain using your own words.

1' (conditions).

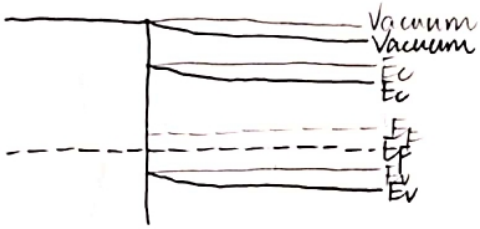
① Schottky Contact: $W_m < W_s$



1'

When $W_m < W_s$, there will be a barrier height $q\Phi_{Bo}$ between the metal and the semiconductor at thermal equilibrium. This shottky barrier will make it difficult for holes to flow from metal to the semiconductor.

② Ohmic Contact: $W_m > W_s$

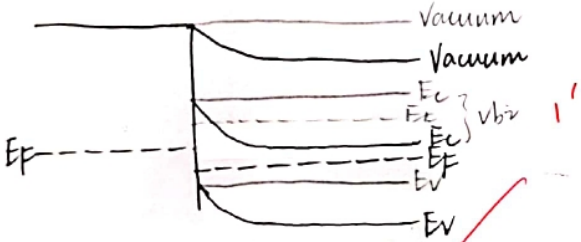


1'

When $W_m > W_s$, the barrier between the metal and the semiconductor is very low, so that no matter we apply positive voltage to the metal or to the semiconductor, the holes can transport easily, forming a low-resistance junction providing current conduction in both directions.

2. When we forward bias and reverse bias a Schottky junction, what makes the current different? Please draw the energy band diagram and explain.

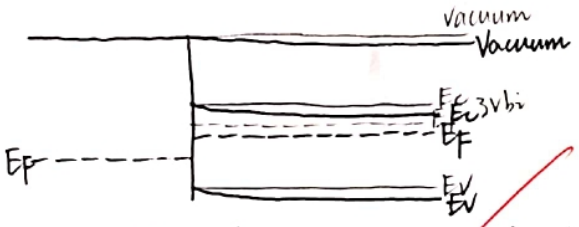
① Reverse Bias:



1'

When we reverse bias the schottky junction, the built-in potential barrier is enlarged, making electrons flow from semiconductor to metal more difficultly. So as $|V_R|$ increases, the current will not increase very much.

② Forward Bias:



1'

When we forward bias the schottky junction, the built-in potential barrier V_{bi} is lowered, making electrons flow from semiconductor to metal more easily. So as V_a increases, the current will increase rapidly.