

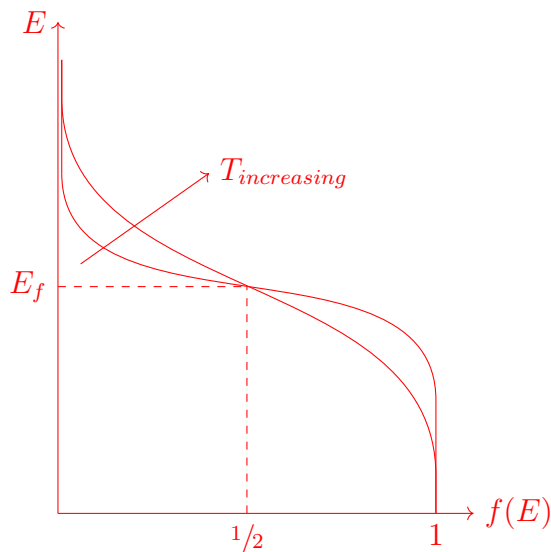
ELEC 4705 - Quiz 2

Fri. Oct. 19th 2018

Name:

Student Number:

- (6 points) Sketch the Fermi energy distribution, explain how it is affected by temperature and explain what this means for semi-conductors.



The fermi distribution has a specific shape for a given temperature, and an increase in temperature causes the distribution to shift to a flatter, more linear slope. A consequence of this is that semiconductors can have more electrons in the conduction band at higher temperatures, changing their behaviour.

Figure 1: Fermi-Dirac Distribution

- (5 points) Explain drift velocity in the context of an electron travelling through a semi conductor. What limits drift velocity? Name two factors that cause this.

Drift velocity is the average velocity of electrons in the system. It is limited by scattering, who's primary causes are deflection of the electron off of impurities and through thermal vibrations.

3. (2 points) What macroscopic quality is explained by the limit on drift velocity?

Resistance/conductivity of a material is a consequence of the drift velocity/scattering.

4. (4 points) What is the difference between P and N type semi-conductors?

P-type semi conductors are doped with acceptors (provide more holes) while N-types provide more electrons.

5. (6 points) Draw the energy band diagram for a diode; be sure to show band-bending.

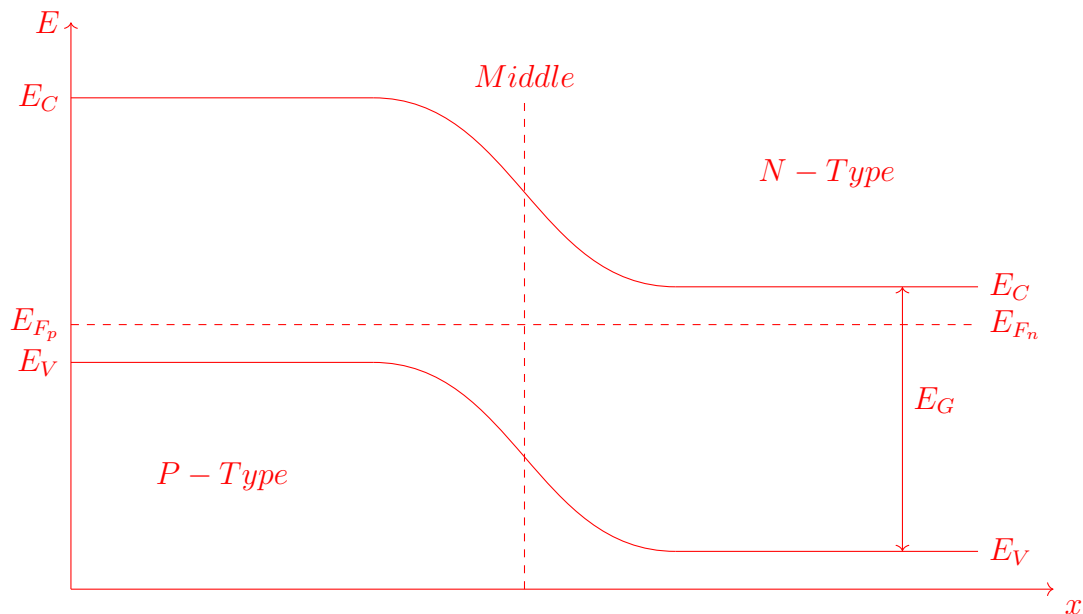


Figure 2: Diode energy band diagram showing the bandbending

6. (4 points) What device is created by combining P and N type semiconductors to create PNP or NPN junctions? Name one major electronics application for this device.

Combining N and P type semi conductors in this way creates a BJT. These are used as a transistor, (switches and gates) or as amplifiers, or even oscillators.