week #1 Chpt 1 # 7, 18, 26, 49, 53, 61

Note Title 9/8/2012

7) Describe the differences between n-type and p-type semiconductor materials

An n-type semiconductor material has an excess of electrons for conduction established by doping an intrinsic material with donor atoms having more valence electrons than needed to establish the covalent bonding. The majority carrier is the electrons while the minority is the hole.

An p-type semiconductor material has one (1) less electrons for conduction established by doping an intrinsic material with acceptor atoms having less valence electrons than needed to establish the covalent bonding. The majority carrier is the hole while the minority is the electron.

18) Given a diode current of 8mA and $n=1$, find I_S if the applied voltage is 0.5V and the temperature is room temperature

$$I_D = I_S\left(e^{V_D/nV_T} - 1\right)$$

I_D: 8mA; I_S: find; $V_D = 0.5V$; $n=1$

$$V_T = \frac{KT_K}{q} = \frac{(1.38\times10^{-23})(273+25)}{1.609\times10^{-19}}$$

$$V_T = 25.56\,mV$$

$$I_S = \frac{I_D}{\left(e^{V_D/nV_T} - 1\right)} = \frac{8\,mA}{e^{0.5V/25.6mV} - 1} = \frac{8mA}{303.6\times10^{6}}$$

$$I_S = 26.35\,pA$$

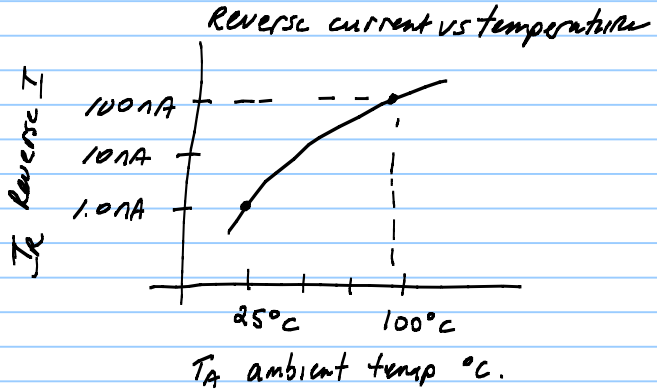
26) What is the important difference between the characteristics of a simple switch and those of an ideal diode?

The most important difference between the characteristics of a diode and a simple switch is that the switch, being mechanical, is capable of conducting current in either direction while the diode only allows charge to flow through the element in one direction.

49) For the diode of the figure below determine the level of I_R at room temperature (25°C) and at the boiling point of water (100°C). Is the change significant? Does the level just about double for every 10°C increase in temperature.

25°C → 1.0 nA
100°C → 100 nA
) 100×! significant.

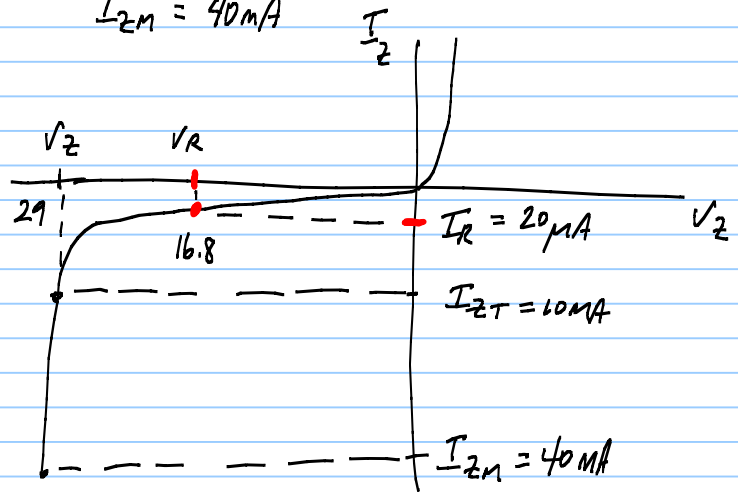
25 → 1.0 nA
35 → 2.0 nA
45 → 4.0 nA
55 → 8 nA
65 → 16 nA
75 → 32 nA
85 → 64 nA
95 → 128 nA almost 100 nA.



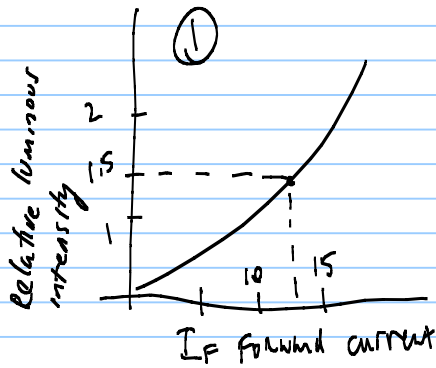
53) The following characteristics are specified for a particular Zener diode:

$V_Z = 29V$ $I_R = 20\mu A$
$V_R = 16.8V$ $I_{ZM} = 40mA$
$I_{ZT} = 10mA$

Sketch the curve



61) Using the information provided, determine the forward voltage across the diode if the relative luminous intensity is 1.5.



Forward current = 13mA

then →