

ECE 320 - Homework #2

Semiconductors, PN Junction, Diode VI Characteristics. Due Wednesday, January 27th

Please make the subject "ECE 320 HW#2" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

Semiconductors

- 1) Why does the resistance of silicon decrease as temperature goes up?
- 2) What doping of Boron (p-type) do you need to make an 0805 resistor have a resistance of 2000 Ohms? The dimensions of an 0805 resistor are

$$L = 2.0\text{mm}, W = 1.25\text{mm}, H = 0.95\text{mm}$$

- 3) A thermistor has the following resistance - voltage relationship

$$R = 1000 \exp\left(\frac{3905}{T} - \frac{3905}{298}\right) \Omega$$

where T is the temperature in degrees Kelvin. What is the resistance you'll read at

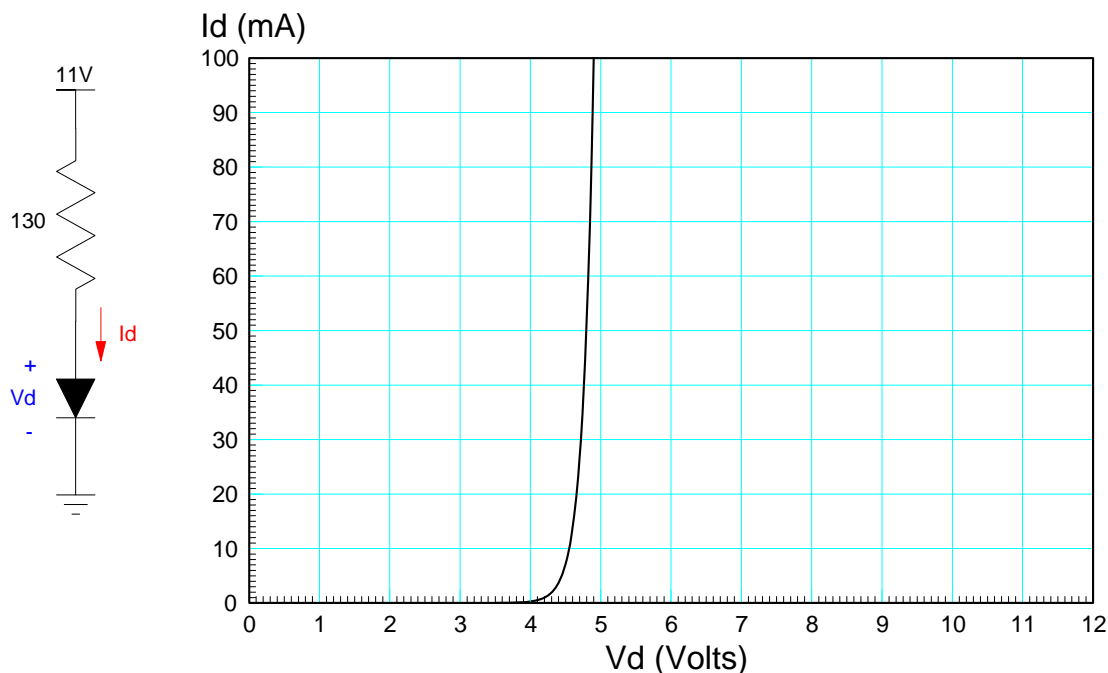
- +96.1F (hottest day in Fargo in 2019)
- -32.8F (coldest day in Fargo in 2019)
- +43.1F (average temperature in Fargo in 2019)

PN Junction

- 4) Why can current flow p to n but not n to p?

Diode VI Characteristics

- 5) Draw the load line for the following circuit and compute I_d and V_d . The diode VI curve is shown on the graph.



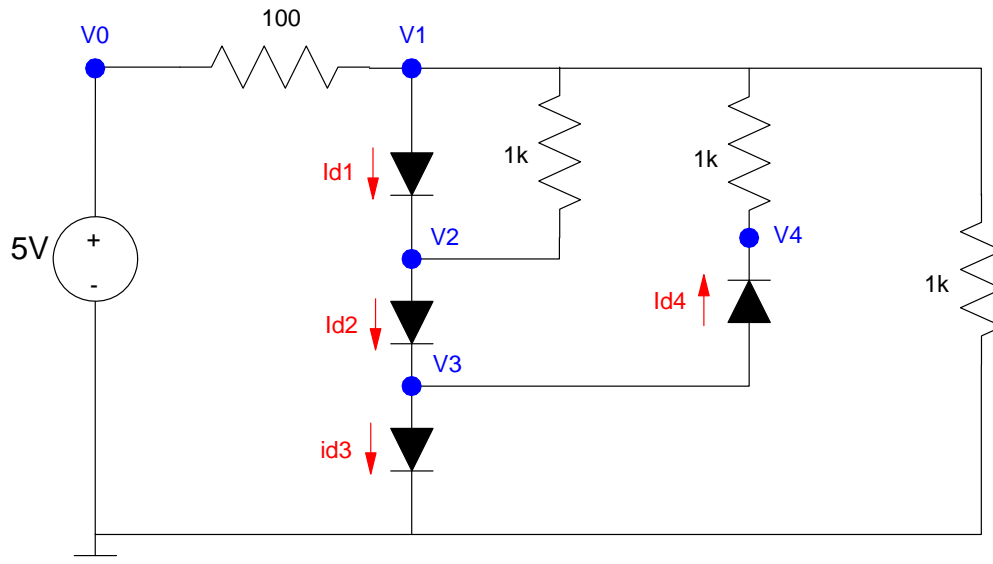
Assume the VI characteristics for a diode are

$$V_d = 0.052 \cdot \ln\left(\frac{I_d}{10^{-8}} + 1\right) \quad I_d = 10^{-8} \left(\exp\left(\frac{V_d}{0.052}\right) - 1 \right)$$

6) Write the voltage node equations for the following circuit. Solve for {V1, V2, V3, V4}

7) Check your answer in PartSim. (use Fairchild, Rectifier Diode, 1N4005)

8) Build this circuit and measure V1. (Use 4004 silicon diodes in room 211)



9) Write the voltage node equations for the following circuit. Solve for { V1, V2, V3, V4 }

10) Check your results in PartSim. (use Fairchild, Rectifier Diode, 1N4005)

11) Build this circuit and measure the voltages, Use a 4004 diode (in room 211 - or any silicon diode)

