In the name of Allah, The compassionate, the merciful

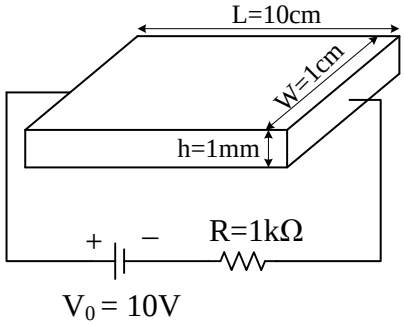
Electronics 1, Assignment #2, Physics of diodes and analysis of diode circuits.

Shahrood University of Technology

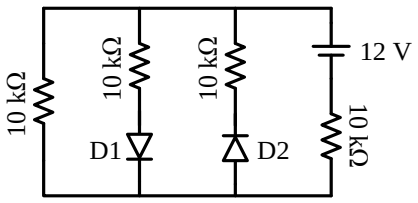
1. An n-type impurity with a concentration of $2\times10^{14}cm^{-3}$ is added to a piece of Germanium crystal. The temperature is supposed to be 300˚K.
   a) Determine the density of free electrons and holes.
   b) How much does the specific conductivity change compared to the intrinsic Germanium?

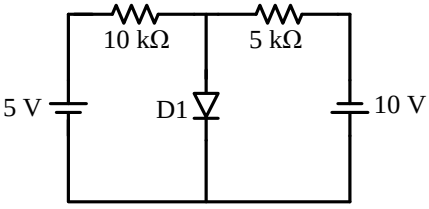
2. A current of 5 mA is flowed through a silicon diode in room temperature. The forward voltage across the diode is 0.7 V. If the voltage increases to 0.8 V, estimate the current of the diode. Determine I_S. Suppose $\eta = 2$.

3. a) A piece of crystalline silicon is doped with a Phosphorus impurity with a concentration of 10^{17} 1/cm^3. Calculate the density of electrons and holes in 400 ˚K.
   b) Determine the specific resistance of the semiconductor.
   c) Obtain the current in the following circuit. Suppose that the cubic material has specifications according to (a) and (b).

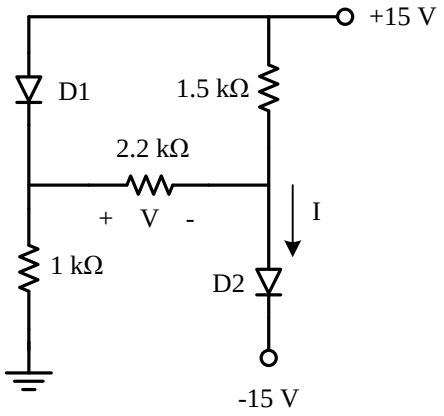


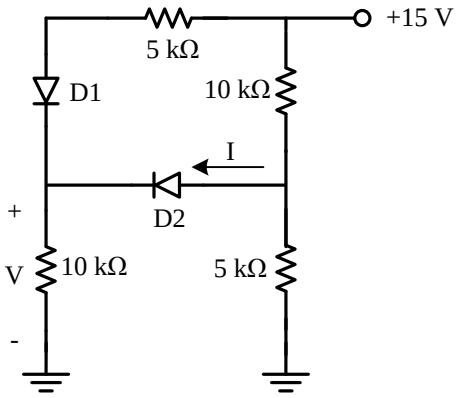
4. In the following circuits, calculate the currents of the diodes. Suppose:
   a) The diodes are ideal ones.
   b) The diodes are modeled by a 0.7-V constant voltage source.



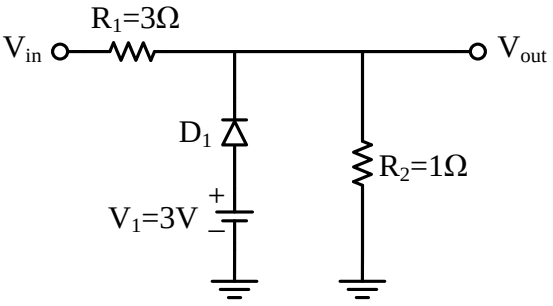


5. Determine I and V in the circuits shown below. Assume ideal diodes.





6. In the following circuit, model the diode by a 0.8 V constant voltage source.
   a) Specify the corresponding values for V_{in}, for which the diode will be on.
   b) Draw the input-output characteristic of the circuit.
   c) Suppose that the input voltage is a sinusoidal signal with an amplitude of 10 V. plot the output voltage as a function of time.



Good Luck- M.R. Ashraf