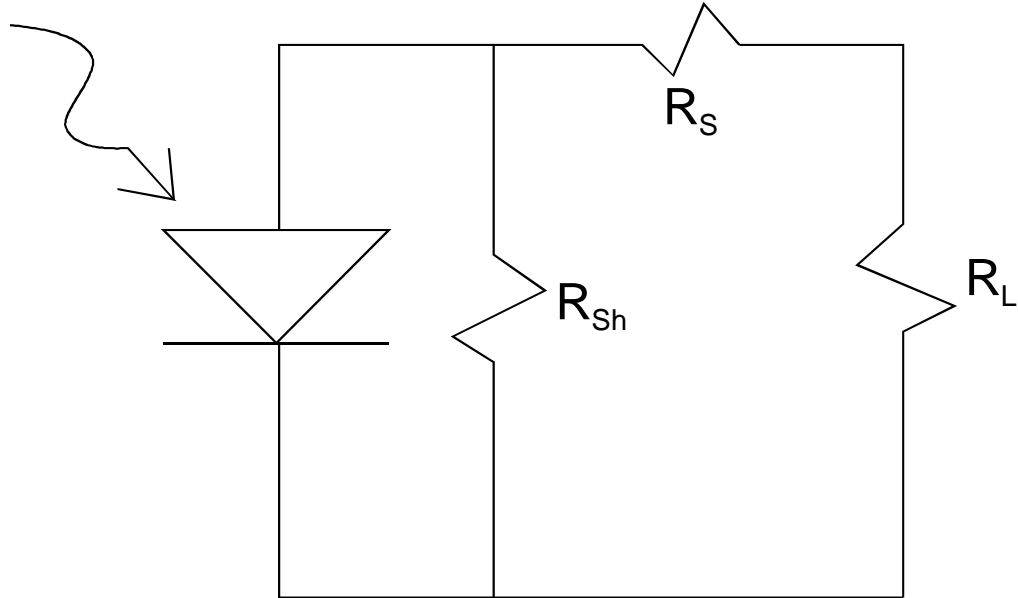


ELEG240- Spring, 2006  
Homework 10, due 5/10 at noon

1. Actual solar cells contain parasitic circuit elements such a shunt and series resistances as shown:



Assuming  $I_0=10^{-14}$  amp.,  $I_p=0.0013$  amp.,  $R_s=200$  ohms,  $R_{sh}=10000$  ohms, and  $R_L=500$  ohms, and at room temperature (300 K), calculate the power delivered to the load. Calculate it again for the ideal case of infinite shunt resistance and zero series resistance, and give the reduction in efficiency (the ratio of actual to ideal) due to the parasitic resistances.

2. An LED is a forward biased p-n junction that then emits light. If the junction is considered to be a point source of light inside the semiconductor, and the refractive index of the semiconductor is 3.5, calculate the fraction of light emitted that actually exits the device. Assume that the reflection coefficient of the surface is zero for rays less than the total internal reflection angle. Suggest a way to get more light out.