A. (2 pts) An ideal p⁺-n step junction has light uniformly absorbed throughout the device producing a photogeneration rate of \(G_l\) electron-hole pairs per cm\(^3\) per s. Assume that low-level injection prevails. Assume that the device is many diffusion lengths long. Neglect photogeneration and recombination-generation in the depletion region.
   a) Solve the diffusion equation and obtain a general form for the IV characteristic.
   b) Give a physical interpretation for all terms in part a.
   c) Suppose there is a series resistance \(R\), how is this equation modified?

B. (2 pts) Given the simplified solar spectrum shown below:
   a) What is the short circuit current and open circuit voltage of a pn junction solar cell using one material having a bandgap of 1.4 eV and operating at room temperature. Here assume that each photon creates only one electron-hole pair, that all of these are collected, and that the diode reverse saturation current is given by

\[
J_s = A e^{-E_g/k_BT} \quad \text{where} \quad A = 6.03 \times 10^7 \text{ A/m}^2
\]

b) Estimate the room temperature efficiency of the device.