

1) [13 points] A certain semiconductor has an energy gap of 0.8 eV and a quantum density of  $1 \times 10^{25} \text{ m}^{-3}$  at a temperature of 300 K. The law of mass action is  $n_e n_h = n_Q^2 e^{-\epsilon_g/kT}$ .

a) [6 points] What is the density of free electrons in a pure (undoped) crystal at  $T = 300 \text{ K}$ ?

$$n_i =$$

b) [7 points] If the crystal were doped with impurities that set the electron density at  $1 \times 10^{24} \text{ m}^{-3}$ , what would be the hole density?

$$n_h =$$

2) [7 points] Compute the entropy of 150 *identical* atoms located on  $10^4$  surface sites of a solid (assuming single occupancy).

$$S =$$