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18PYB103J –Semiconductor Physics

(1) For a GaAs semiconductor at 300 K the energy of top of valence band and bottom of conduction band comes to be 0.759 eV and 2.2 eV respectively. If the bound energy E_b of shallow impurity level is 0.6 eV. Then calculate the energy of radiative photon.

Answer:

Band gap of GaAs (E_g)= E_C-E_V = 2.2-0.759=1.441 eV
E_b =0.6 eV
Energy of radiative photon= E_g-E_b = 1.441-0.6=0.841 eV

(2) Calculate the energy of free exciton in a III-V (AlAs) semiconductor compound whose is effective mass m*=0.1 m_0 and quantum number n=1.

Answer:Hint:
$E_n = 2\pi^2 m^* e^4 / h^2 \varepsilon^2 n^2$