6.6 Consider a one-dimensional hole flux as shown in Figure 6.4. If the generation rate of holes in this differential volume is $g_p = 10^{20}$ cm^{-3}-s^{-1} and the recombination rate is 2×10^{19} cm^{-3}-s^{-1}, what must be the gradient in the particle current density to maintain a steady-state hole concentration?

Per (6.18), $\frac{\partial p}{\partial t} = -\frac{\partial F_p^+}{\partial x} + g_p - \frac{p}{\tau_{p0}}$

'Steady-state' $\Rightarrow \frac{\partial p}{\partial t} = 0$ (no change wrt time)

$$\frac{dF_p^+}{dx} = g_p - \frac{p}{\tau_{p0}} \quad \text{where } R_p = \frac{p}{\tau_{p0}} \text{ (6.35)}$$

$$= 10^{20}\,\frac{\#}{cm^3 s} - 2\times 10^{19}\,\frac{\#}{cm^3 s}$$

$$\frac{dF_p^+}{dx} = 8\times 10^{19}\,\frac{\#}{cm^3 s}$$