58. (a) From Eq. 31-51 and Eq. 31-43, the rate at which the energy is being stored in the inductor is

$$\begin{aligned}\frac{dU_B}{dt} &= \frac{d\left(\frac{1}{2}Li^2\right)}{dt} = L\,i\,\frac{di}{dt} \\ &= L\left(\frac{\mathcal{E}}{R}\left(1-e^{-t/\tau_L}\right)\right)\left(\frac{\mathcal{E}}{R}\,\frac{1}{\tau_L}\,e^{-t/\tau_L}\right) \\ &= \frac{\mathcal{E}^2}{R}\left(1-e^{-t/\tau_L}\right)e^{-t/\tau_L}\ .\end{aligned}$$

Now, $\tau_L = L/R = 2.0\,\mathrm{H}/10\,\Omega = 0.20\,\mathrm{s}$ and $\mathcal{E} = 100\,\mathrm{V}$, so the above expression yields $dU_B/dt = 2.4\times10^2$ W when $t = 0.10$ s.

(b) From Eq. 27-22 and Eq. 31-43, the rate at which the resistor is generating thermal energy is

$$P_{\text{thermal}} = i^2R = \frac{\mathcal{E}^2}{R^2}\left(1-e^{-t/\tau_L}\right)^2 R = \frac{\mathcal{E}^2}{R}\left(1-e^{-t/\tau_L}\right)^2\ .$$

At $t = 0.10$ s, this yields $P_{\text{thermal}} = 1.5\times10^2$ W.

(c) By energy conservation, the rate of energy being supplied to the circuit by the battery is

$$P_{\text{battery}} = P_{\text{thermal}} + \frac{dU_B}{dt} = 3.9\times10^2\ \mathrm{W}\ .$$

We note that this could result could alternatively have been found from Eq. 28-14 (with Eq. 31-43).