24. (a) We assume the flux is entirely due to the field generated by the long straight wire (which is given by Eq. 30-19). We integrate according to Eq. 31-3, not worrying about the possibility of an overall minus sign since we are asked to find the absolute value of the flux.

$$|\Phi_B| = \int_{r-b/2}^{r+b/2} \left(\frac{\mu_0 i}{2\pi r}\right)(a\,dr) = \frac{\mu_0 i a}{2\pi}\,\ln\left(\frac{r+\frac{b}{2}}{r-\frac{b}{2}}\right) \ .$$

(b) Implementing Faraday's law involves taking a derivative of the flux in part (a), and recognizing that $\frac{dr}{dt} = v$. The magnitude of the induced emf divided by the loop resistance then gives the induced current:

$$i_{\text{loop}} = \left|\frac{\mathcal{E}}{R}\right| = -\frac{\mu_0 i a}{2\pi R}\left|\frac{d}{dt}\,\ln\left(\frac{r+\frac{b}{2}}{r-\frac{b}{2}}\right)\right| = \frac{\mu_0 i a b v}{2\pi R\,(r^2-(b/2)^2)} \ .$$