Exercise 17

Introduction to Electrodynamics

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Solution Verified

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a)

Refer to the Figure 7.28). To counteract the increasing flux to the right, the induced current in the loop will be **anticlockwise** (to the right). By Faraday's law:

$$\mathcal{E} = -\frac{d\Phi}{dt} = -\frac{d}{dt}\mu_0 n I a^2 \pi = -\mu_0 n k$$

$$\Longrightarrow \boxed{I = \frac{\mathcal{E}}{R} = -\frac{\mu_0 n a^2 \pi k}{R}}$$

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b)

Again, by Faraday's law:

$$\mathcal{E} = IR = \frac{dQ}{dt}R = -\frac{d\Phi}{dt} \implies dQ = -\frac{d\Phi}{R}$$

$$\implies \Delta Q = -\frac{\Delta\Phi}{R} = \boxed{-\frac{\mu_0 a^2 \pi n I}{R}}$$

, since at the start the flux is $\mu_0 n I a^2 \pi$, and zero far away.

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$$\textbf{a)}\ \boxed{I = -\frac{\mu_0 n a^2 \pi k}{R}}$$

$$\textbf{b)}\ \boxed{\Delta Q = -\frac{\mu_0 a^2 \pi n I}{R}}$$

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