Chapter 23

2. The sides of the box are parallel to the field, so the magnetic flux through the
sides is \( \text{zero} \). The magnetic flux through the bottom is
\[
\Phi = BA \cos \theta = (0.025 \text{ T})(0.325 \text{ m})(0.120 \text{ m}) \cos 0° = 9.75 \times 10^{-4} \text{ Wb}
\]

9. \[|\mathcal{E}| = N \frac{\Delta \Phi}{\Delta t} = N \frac{BA}{\Delta t} = \frac{(50)(0.25 \text{ T})(0.15 \text{ m})^2}{0.12 \text{ s}} = 7.4 \text{ V} \]

11. (a) \[\mathcal{E} = -N \frac{\Delta \Phi}{\Delta t} = -(5 \text{ Wb}) = 0 \]

(b) \[\mathcal{E} = 0 \] because \[\frac{\Delta \Phi}{\Delta t} = 0 \].

(c) \[\mathcal{E} = -(5 \text{ Wb}) = 50 \text{ V} \]

18. (a) Since the current in the wire is constant, the magnetic field through the circuit
does not vary with time, so the induced current is \( \text{zero} \).

(b) Since the current in the wire is increasing, the magnetic field through the
circuit is increasing. And, since the magnetic field is directed out of the page,
the induced current in the circuit will induce a magnetic field into the page.
So, the current in the circuit flows \( \text{clockwise} \).

24. \[\mathcal{E} = vB\ell \]
\[
B = \frac{\mathcal{E}}{v\ell} = \frac{0.75 \text{ V}}{(2.0 \text{ m/s})(0.50 \text{ m})} = 0.75 \text{ T}
\]

26. (a) \[|\mathcal{E}| = IR = vBL \]
\[
v = \frac{IR}{BL} = \frac{(0.125 \text{ A})(12.5 \text{ \Omega})}{(0.750 \text{ T})(0.45 \text{ m})} = 4.6 \text{ m/s} \]

(b) The equation for \( v \) is independent of the direction of motion of the bar, so
the answer to part (a) would not change.

35. \[\mathcal{E} = -L \frac{\Delta I}{\Delta t} = -(55.0 \times 10^{-3} \text{ H}) \frac{515 \times 10^{-3} \text{ A}}{16.5 \times 10^{-3} \text{ s}} = -1.72 \text{ V} \]

55. \[I_p = I_s \left(\frac{N_s}{N_p}\right) = (12 \times 10^{-3} \text{ A}) \left(\frac{500}{25}\right) = 0.2 \text{ A} \]
\[V_p = V_s \left(\frac{N_p}{N_s}\right) = (4800 \text{ V}) \left(\frac{25}{500}\right) = 200 \text{ V} \]