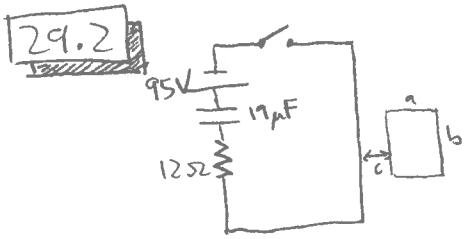
HW #13 Solutions

29.2



$i(t) = \frac{V_0}{R} e^{-t/\tau}$ $\quad \tau = RC = (12)(19\times10^{-6}) = 228\times10^{-6}$ s

find t when $i = 3.1$A

$$3.1 = \frac{95}{12} e^{-t/228\times10^{-6}}$$

$$\ln(.391) = \frac{-t}{228\times10^{-6}} \Rightarrow t = 214\times10^{-6}\ \text{s}$$

the flux through the small loop:

$$\Phi_B = \int_c^{c+a} \frac{\mu_0 i b}{2\pi r}\, dr = \frac{\mu_0 i b}{2\pi} \ln\left(1+\frac{a}{c}\right)$$

$$\varepsilon = -N\frac{d\Phi}{dt} = -N\frac{\mu_0 b}{2\pi}\ln\left(1+\frac{a}{c}\right)\frac{di}{dt}$$

$$\varepsilon(t = 214\mu s) = -(24)\frac{\left(\frac{2}{4\pi}\times10^{-7}\right)(.18)}{2\pi}\ln\left(1+\frac{11}{4}\right)\left(\frac{-3.1}{214\times10^{-6}}\right)$$

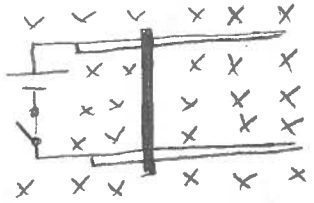
$$= 1.7\times10^{-2}\ \text{V}$$

$$i = \frac{\varepsilon}{R} = \frac{1.7\times10^{-2}}{(24)(1.3)(.58)} = \boxed{9.4\times10^{-4}\ \text{A}}$$

29.2 continued

the flux through the small loop is decreasing so the current induced will act to oppose this. Thus the current flows counter-clockwise.

29.3



$I = \frac{\varepsilon - BLv}{R}$ $\quad F = ILB$

a.) @ $t=0$ $\quad v=0 \Rightarrow I = \frac{\varepsilon}{R} = \frac{12}{5} = 2.4\,A$

$F = (2.4)(.36)(1.5) = 1.296\,N$

$= ma \rightarrow 1.296 = (.9)a \Rightarrow \boxed{a = 1.44\ m/s^2}$

b.) $a = \frac{F}{m} = \frac{ILB}{m} = \frac{\varepsilon - BLv}{mR}(LB) = \frac{[12 - (1.5)(.36)(2)](.36)(1.5)}{(.9)5}$

$= \boxed{1.3\ m/s^2}$

c.) set $a = 0 = \frac{\varepsilon - BLv}{mR}(LB)$

$\Rightarrow \varepsilon = BLv \rightarrow v = \frac{\varepsilon}{BL} = \frac{12}{(1.5)(.36)} = \boxed{22\ m/s}$