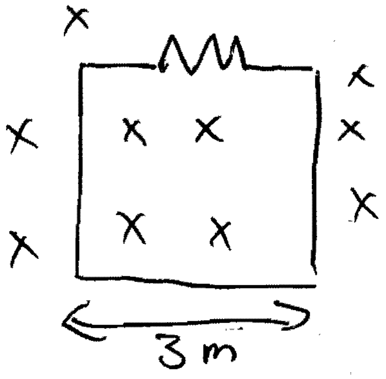
31

14



note 6V bulb $\Rightarrow \mathcal{E}_{max} = 6V$

$$\mathcal{E} = -\frac{\partial \Phi_B}{\partial t} = -9m^2 \frac{\partial B}{\partial t}$$

$$|\mathcal{E}| = 9\left|\frac{\Delta B}{\Delta t}\right|$$

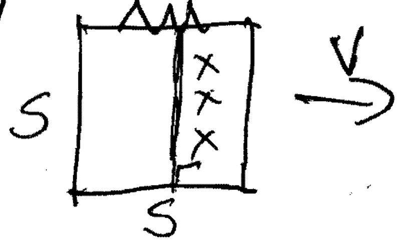
$\Delta B = +2T \Rightarrow 6 = \frac{18}{\Delta t} \Rightarrow \Delta t = 3 \text{ sec}$

(B is negative in general)

b) positive $\mathcal{E}$ = counter clockwise

$\mathcal{E} = -9\frac{(+2)}{3} = \cancel{+}6$ so ~~counterclockwise~~ clockwise

17)

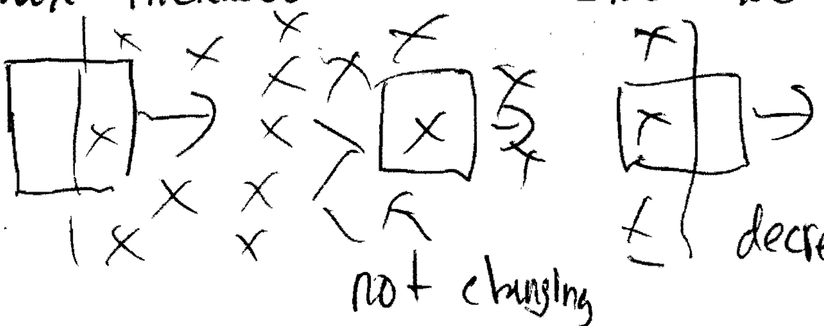


$s = .5 \quad R = 5.0$
$v = .25 \text{ m/s}$

$$\frac{\partial \Phi}{\partial t} = B\frac{\partial A}{\partial t} = Bs\frac{\partial x}{\partial t} = BsV$$

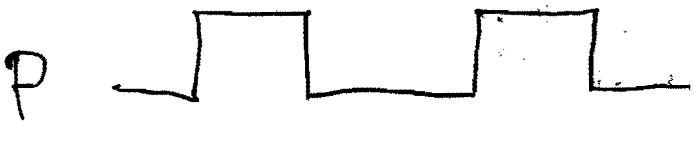
flux increases

clockwise = positive here

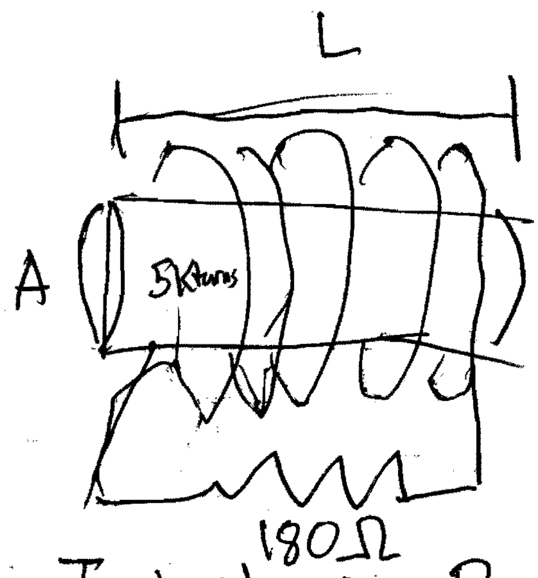


$$I = \frac{BsV}{R}$$

$$P = I^2R = \frac{B^2s^2v^2}{R}$$



21) a)



$A = .3^2\pi \ m^2$

$N = 5 \times 10^3$

$L = 2 \ m$

$\omega = 210 \ hz$

$N_2 = 5$

$I_0 = 85$

$$I_s = I_0 \sin\omega t \Rightarrow B = \mu_0 \frac{N}{L} I_0 \sin \omega t$$

$$\mathcal{E}_{\omega} = -N_2 A \frac{\partial B}{\partial t}$$

(remembe you only get flux where there are fields so the ~~fiel~~ area outside the solenoid does not matter)

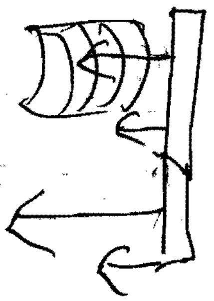
each loop is like a battery and these will add in series

$$I_\omega = \frac{\mathcal{E}_\omega}{R} = \underbrace{-\omega N_2 A I_0} \cos(\omega t)$$

b) $I_{\omega max} = |\downarrow|$

c) 0 if $\sin(\omega t) = \pm 1$ $\cos(\omega t) = 0$

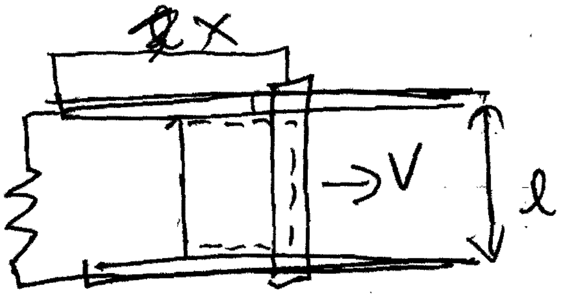
25) $\frac{\partial B}{\partial t} = 450 \mu T/ms = 450 \times 10^{-3} T/s$



$\mathcal{E} = -NA \frac{\partial B}{\partial t}$ $N = 5000$

$A = (.002)^2 \pi$

27)



$\Phi_B = \ell x B \qquad \frac{\partial \Phi_B}{\partial t} = \ell B \frac{\partial x}{\partial t} = \ell B v$

$\mathcal{E} = -\ell B v \Rightarrow I = -\frac{\ell B v}{R}$

flux increasing in down direction ⇒ current is counterclockwise

but... magnetic fields will exert forces on wires with current

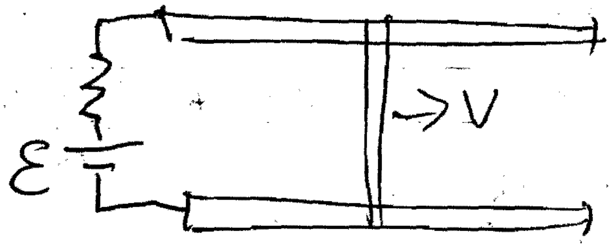
$F = \ell I B = -\frac{\ell^2 B^2 v}{R} = m\frac{dv}{dt}$

which we can use to solve for $v(t)$ etc

OR we note that power in = power out

$\frac{dW}{dt} = I^2 R = \frac{\ell^2 B^2 v^2}{R}$ assuming constant v

29)



$\mathcal{E}_{net} = \mathcal{E} - \ell B v$

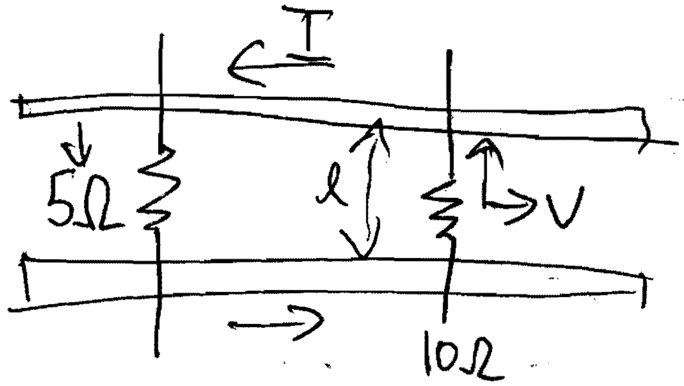
$I = \frac{\mathcal{E} - \ell B v}{R}$

$\cancel{\mathcal{E} - \ell B v = 0}$ $F = \ell B\left(\frac{\mathcal{E} - \ell B v}{R}\right)$

$F = 0$ when $\ell B v = \mathcal{E}$ after which time the speed will not change as there is no more force

$v = \frac{\mathcal{E}}{\ell B}$ R affects how quickly (in time) the bar stops

32)



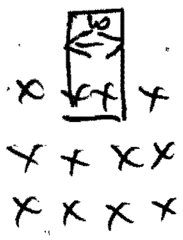
$\mathcal{E}_{\text{initial}} = -\ell v B \Rightarrow I = \frac{-\ell v B}{15}$

$F_5 = \ell I B = +\frac{\ell^2 B^2 v}{15}$ so the 5Ω resistor accelerates after the 10Ω one

when $v_5 = v$ $\frac{\partial \Phi_B}{\partial t} = 0$ (area of loop no longer changing)

so $F = 0$ since $\mathcal{E} = 0$

34)



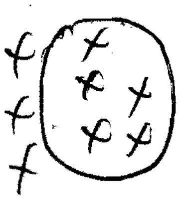
assume loop is very very tall (its always moving into the field)

$F = -mg + wIB = -mg + \frac{w^2 B^2 v}{R}$

so when $v = \frac{mgR}{w^2 B^2}$ $F = 0$

c) counter clockwise

35)



$D = .4\text{ m}$ $B = 12$ $\frac{dr}{dt} = .005\text{ m/s}$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ $|\mathcal{E}| = \left|\frac{\partial \Phi_B}{\partial t}\right| = B 2\pi r(t) \frac{dr}{dt}$

$r(t) = .2\text{m} + .005(t)$ a) 77 mV b) 95 mV