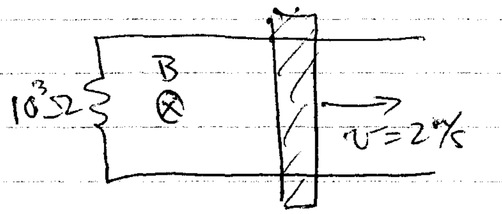
1) 

We found in AG XI.1 that ΔV along moving wire, if $\vec{l}$ & $\vec{v}$ are $\perp$ to each other and $\perp \vec{B}$,

is $\Delta V = l v B$

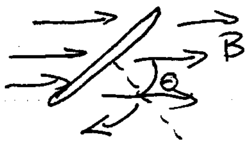
$= (.1m)(2\,m/s)(2T) = .4V$

So $I = \frac{\Delta V}{R} = \frac{.4V}{10^3\Omega} = \boxed{4\times10^{-4}A}$ (counter clockwise direction)

2) a) Reverse v, then I flows in opposite direction, same magnitude

b) Reverse B, then I flows in opposite direction, same magnitude

3) Rotating at constant angular frequency means the angle of the loop relative to B is increasing linearly $\Rightarrow \theta = \omega t$.



a) So, $\Phi = BA\cos\theta = \boxed{BA\cos\omega t}$

b) $V = -\frac{d\Phi}{dt} = -BA\frac{d}{dt}(\cos\omega t) = -BA\omega[\sin\omega t] = \boxed{BA\omega\sin\omega t}$

c) If 100 turns, then 100x flux, so $\boxed{100\text{x } V}$

4) Faraday's Law is $V = -\frac{d\Phi}{dt}$.

Since the flux through any single turn of either coil is the same (that is assumption given in the problem), lets call it Φ_o. So the flux through coil 1 is scaled by the number of turns:

$$\Phi_1 = N_1 \Phi_o$$

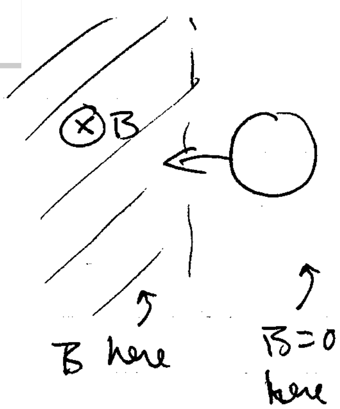
and similarly $\Phi_2 = N_2 \Phi_o$. So Faraday says

$$V_1 = -\frac{d\Phi_1}{dt} = -N_1\frac{d\Phi_o}{dt}$$

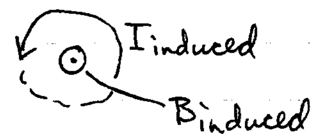
and $V_2 = -\frac{d\Phi_2}{dt} = -N_2\frac{d\Phi_o}{dt}$ so $\boxed{\frac{V_1}{V_2} = \frac{N_1}{N_2}}$

so 12 V side has 1/10 the turns, or $\boxed{10}$

5)



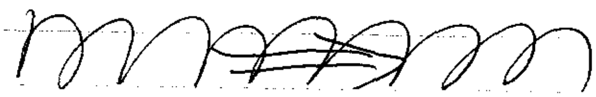
Lenz's law says current flows so as to maintain the flux. Since initial flux is zero, current will flow to oppose B:



Or use $q\vec{v}\times\vec{B}$ to find the current direction on the leading edge.

6)

$n \Rightarrow$ turns/m



$B = \cancel{\quad} \mu_0 n I$

a) Flux per turn is then $B \cdot A$

Total # of turns is $n \cdot l$ & total flux is scaled by this, so

$$\Phi = B \cdot A \cdot n l = \mu_0 n^2 I A l$$

$V = -L \frac{dI}{dt}$ and $V = -\frac{d\Phi}{dt}$, so, since $\Phi \propto I$,

$$LI = \Phi, \text{ or } \boxed{L = \frac{\Phi}{I} = \mu_0 n^2 A l}$$

turns per length! not total turns

b) $n = 10^4 \ m^{-1}$

$d = .05m \Rightarrow r = .025m \Rightarrow A = \pi r^2 = .00196 \ m^2$

$l = .5m$

So $L = \mu_0 n^2 A l = 4\pi \times 10^{-7} \cdot (10^4)^2 \cdot (.00196) \cdot (.5) = .123 \ H$

If $\frac{dI}{dt} \approx \frac{\Delta I}{\Delta t} = \frac{10A}{.001sec} = 10^4 \ A/sec$

$$V = -L\frac{dI}{dt} \boxed{= -1230V!}$$

7)

$L = 5 \times 10^{-3} H \qquad V = 5V \Rightarrow \frac{dI}{dt} = \frac{V}{L} = \frac{5V}{5 \times 10^{-3} H} = 10^3 \ A/sec$

So $I = \frac{dI}{dt} \cdot t = 10^3 A/s \cdot t = 1A$

So $\boxed{t = 10^{-3} sec}$

8) $\omega = 3\times10^{12}\,s^{-1}$ We know $v_{wave} = \frac{\omega}{k} = c = 3\times10^{8}\,m/s$

So $k = \frac{\omega}{c}$ and $k = \frac{2\pi}{\lambda}$, so

$$\lambda = \frac{2\pi}{k} = \frac{2\pi c}{\omega} = \frac{2\pi\cdot3\times10^{8}\,m/s}{3\times10^{12}\,m/s} = \boxed{6.28\times10^{-4}\,m}$$