1.

a) $I = \frac{\Delta V}{R} = 10^5 A$

b) $B = 2 \cdot \frac{\mu_0}{4\pi} \frac{2I}{(L/2)}$

$\vec{B} = 0.16\ T$ into page

c) $\vec{F} = I \vec{L} \times \vec{B} = 8\ kN$, $\longrightarrow$

$\vec{a} = \frac{8\ kN}{10 kg} = 800\ \frac{m}{s^2}$, $\longrightarrow$

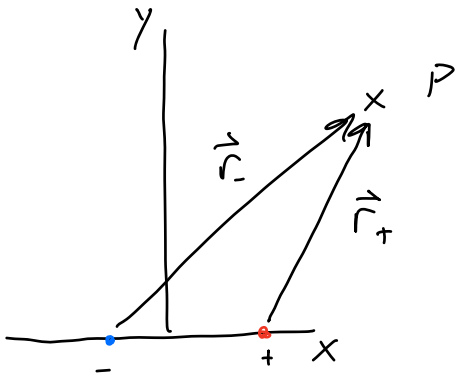
d) emf is CCW

e) $BLv = 10^5 V$

$v = \frac{10^5 V}{BL} = 1.25 \times 10^6\ \frac{m}{s}$

2. $p = qs$, $s = 4 \times 10^{-12}\ m$

$$q = \frac{p}{s} = \frac{6.0 \times 10^{-30}\ C \cdot m}{4 \times 10^{-12}\ m} = 1.5 \times 10^{-18}\ C$$



E_+

$\vec{r}_{obs} = \langle 8 \times 10^{-12}, 5 \times 10^{-12}, 0 \rangle m$

$\vec{r}_{src} = \langle 2 \times 10^{-12}, 0, 0 \rangle m$

$\vec{r} = \langle 6 \times 10^{-12}, 5 \times 10^{-12}, 0 \rangle m$

$|\vec{r}| = 7.81 \times 10^{-12}\ m$

$\hat{r} = \langle 0.768, 0.640, 0 \rangle$

$$\vec{E}_+ = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2} \hat{r} = \langle 1.70 \times 10^{14}, 1.41 \times 10^{14}, 0 \rangle \frac{N}{C}$$

E -

$$\vec{r}_{obs} = \langle 8\times10^{-12}, 5\times10^{-12}, 0\rangle \text{ m}$$

$$\vec{r}_{src} = \langle -2\times10^{-12}, 0, 0\rangle \text{ m}$$

$$\vec{r} = \langle 10\times10^{-12}, 5\times10^{-12}, 0\rangle \text{ m}$$

$$|\vec{r}| = 1.12\times10^{-11} \text{ m}$$

$$\hat{r} = \langle 0.89, 0.45, 0\rangle$$

$$\vec{E}_- = \langle -9.65\times10^{13}, -4.82\times10^{13}, 0\rangle \frac{N}{C}$$

$$\vec{E} = \vec{E}_+ + \vec{E}_- = \langle 7.33\times10^{13}, 9.33\times10^{13}, 0\rangle \frac{N}{C}$$

3.

a) $\mathcal{E} = -\frac{d\Phi}{dt}$

$\Phi = BA$

$= B_0 e^{-\frac{t}{\tau}} \pi R^2$

$\frac{d\Phi}{dt} = B_0 \pi R^2 \left(\frac{-1}{\tau}\right) e^{-\frac{t}{\tau}}$

$\mathcal{E} = -\frac{d\Phi}{dt} = \frac{B_0 \pi R^2}{\tau} e^{-\frac{t}{\tau}}$

$\mathcal{E}(0) = \frac{B_0 \pi R^2}{\tau} = \frac{(0.5\ T)\pi \cdot (.15\ m)^2}{0.02\ s}$

$\mathcal{E} = 1.77\ V$

b) ccw

4.

a) $E = 0$

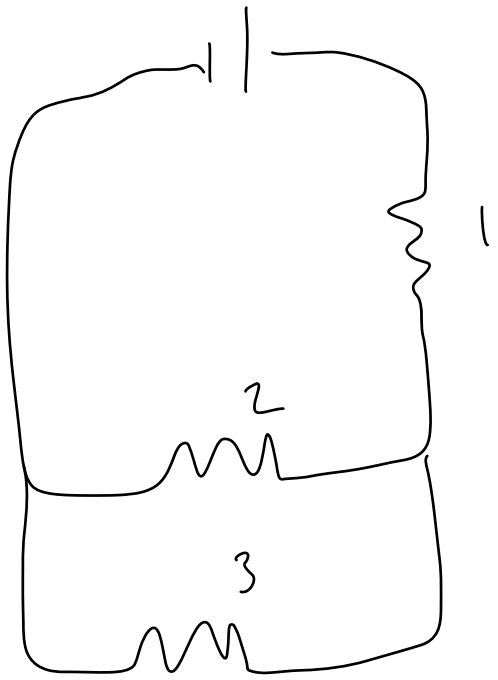
b) $\vec{E} = K \dfrac{(-25\ nC)}{0.07m^2}\ \hat{r}$

$\vec{E} = -4.59 \times 10^4\ \frac{N}{C}\ ,\ \hat{r}$

c) $\vec{E} = K \left(\dfrac{64\ nC - 25\ nC}{0.1\ m^2} \right) \hat{r}$

$\vec{E} = 3.51 \times 10^4\ \frac{N}{C}\ ,\ \hat{r}$

5.



$R_{123} = 398.75\ \Omega$

$I_1 = \frac{\mathcal{E}}{R_{123}} = 0.226\ A$

$\Delta V_1 = 7.45\ V$

$I_2 = 0.156\ A$

$I_3 = 0.007\ A$