2. $L = 200\ km = 2 \times 10^5\ m$

$d = 2\ cm = 2 \times 10^{-2}\ m$

$r = 1\ cm = 1 \times 10^{-2}\ m$

$A = 1000\ A$

$n = 8.5 \times 10^{28}\ e/m^3$

$$V_d = \frac{I}{nqa}$$

$$= \frac{1000}{8.5 \times 10^{28} \times 1.6 \times 10^{-19} \times \pi \times (1 \times 10^{-2})^2}\ m/s$$

$=$

$$V_d = \frac{L}{\Delta t}$$

$$\Delta t = \frac{L}{V_d}$$

years $= 1.48 \times 10^{-6}$

1 year = 365 days

1 day = 24 hours

1 hr = 60 min

1 min = 60 s

$1y = 365 \times 24 \times 60 \times 60$

3. a) $J_1 = \frac{I}{A_1} = \frac{5}{(0.4 \times 10^{-2})^2 \pi} = 99471.84\ A/m^2$

b) Same

c) Smaller

d) $A_2 = 4A_1 = 4\pi (r_1)^2$

$\pi R^2 = 4\pi r^2$

$R = \sqrt{4r^2}$

$= 2r$

$r = 0.8\ cm = 8 \times 10^{-3}\ m$

e) $I = 5\ A$

f) $J = \frac{I}{A} = \frac{5}{\pi(0.8\times10^{-2})^2} = 24867.96\ A/m^2$

6. $d = 0.1\ mm = 1\times10^{-4}\ m$

$r = 5\times10^{-5}\ m$

$\vec{E} = 0.2\ V/m$

$T = 50^\circ C$

$T_0 = 20^\circ C$

$\alpha = 3.9\times10^{-3}/C$

$\rho_0 = 2.82\times10^{-8}\ \Omega m$

a) $R = \frac{\rho L}{A}$

$\frac{\rho L}{A} = \frac{\rho_0 L}{A}(1+\alpha\Delta T)$

b) $\rho = \rho_0(1+\alpha\Delta T)$

$= 2.82\times10^{-8}(1+3.9\times10^{-3}\times30)$

$= 3.15\times10^{-8}\ \Omega m$

$J = \frac{E}{\rho_0} = \frac{0.2}{3.15\times10^{-8}} = 6349206.349\ A/m^2$

$J = \frac{I}{A}$

c) $I = JA = 6349206.349\times\pi\times(5\times10^{-5})^2$

$= 997.33\ A$

d) $\Delta V = \vec{E}L$

$= 0.2 \times 2$

$= 0.4\ V$

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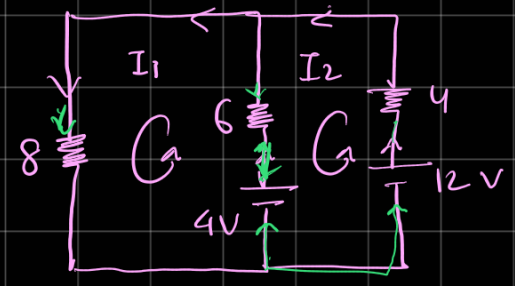
1. a) $I = 1.93\ A$

$V = 5.67\ V$

2.



$6(I_1 - I_2) + 8I_1 - 4 = 0$

$4I_2 - 6(I_2 - I_1) + 4 - 12 = 0$

$14I_1 - 6I_2 - 4 = 0$

(3) $6I_1 - 2I_2 - 8 = 0$

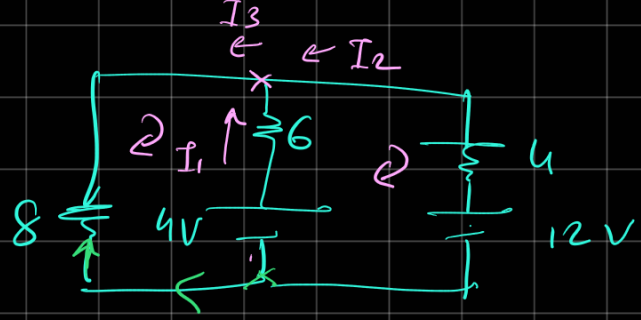
$14I_1 - 6I_2 = 4$

$18I_1 - 6I_2 = 24$

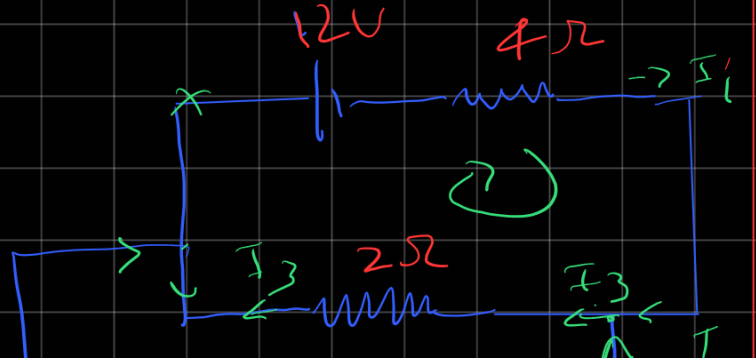
$32I_1 = 28$

$I_1 = \frac{28}{32} = \frac{7}{8}$

$I_1 + I_2 = I_3$



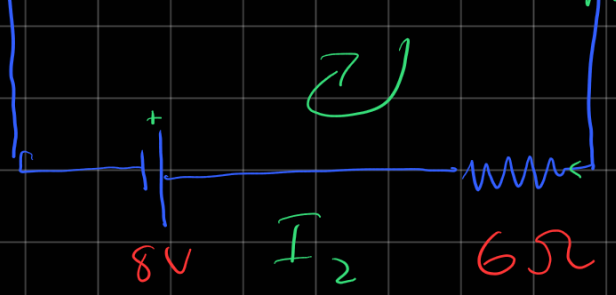
$-8I_3 - 6I_1 - 4 = 0$



$\Rightarrow I_3 = I_1 + I_2$

$6I_2 - 8 + 2I_3 = 0$

$-12 - 4I_1 - 2I_3 = 0$



$6(I_3 - I_1) - 8 + 2I_3 = 0$

$-12 - 4I_1 - 2I_3 = 0$

$8I_3 - 6I_1 - 8 = 0$

$-2I_3 - 4I_1 - 12 = 0$

$8I_3 - 6(5.6) = 8$

$8I_3 = 8 +$

$I_3 = 5.2$

$8I_3 - 6I_1 = 8$

$-8I_3 - 16I_1 = 48$

$10I_1 = 56$

$I_1 = 5.6$

$I_3 - I_1 = I_2$

$5.6 - 5.2 = 0.4$