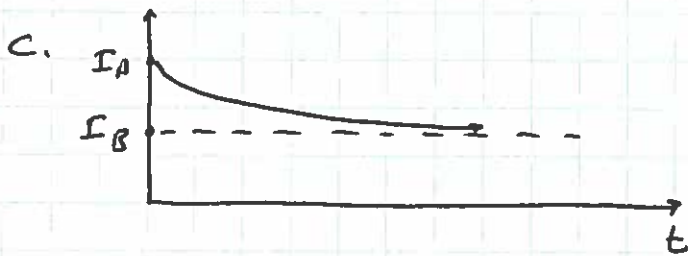


1982 EM 3

a. $I = \frac{\mathcal{E}}{R}$

b. $I = \frac{\mathcal{E}}{2R}$



d. $0 = \mathcal{E} - 2IR - L \cdot \frac{dI}{dt}$

$$\frac{dI}{dt} + \frac{2R}{L} I - \frac{\mathcal{E}}{L} = 0$$

e. $\frac{dI}{dt} + \frac{2IR - \mathcal{E}}{L} = 0$

$$\frac{dI}{dt} = \frac{\mathcal{E} - 2IR}{L}$$

$$\frac{dI}{\mathcal{E} - 2IR} = \frac{dt}{L}$$

LET $u = \mathcal{E} - 2IR$

THEN $\frac{du}{dI} = -2R$

AND $dI = \frac{du}{-2R}$

$$\int \frac{dI}{\mathcal{E} - 2IR} = \int \frac{dt}{L}$$

$$\int \frac{1}{u} \cdot \frac{du}{-2R} = \int \frac{dt}{L}$$

$$\int \frac{1}{u} du = \frac{-2R}{L} \int dt$$

$$\ln \frac{u_f}{u_i} = \frac{-2R}{L} t$$

$$u_f = u_i e^{-\frac{2R}{L} t}$$

$$\mathcal{E} - 2IR = \left[\mathcal{E} - 2\left(\frac{\mathcal{E}}{R}\right)R \right] e^{-\frac{2R}{L} t}$$

$$I = \frac{\mathcal{E}}{2R} \left(1 + e^{-\frac{2R}{L} t} \right)$$

1986 EM 2

a. $\frac{1}{R_{eq}} = \frac{1}{40} + \frac{1}{40}$

$$R_{eq} = 20$$

$$R_{circuit} = 25$$

$$I_{circuit} = \frac{25}{25} = 1 A$$

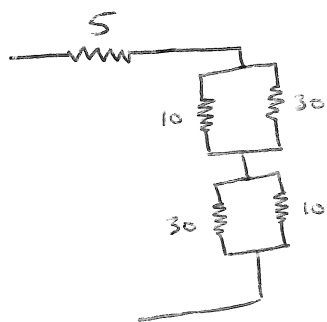
$$I_R = 0.5 A$$

b. $I_R = 0.5 A$

c. $\Delta V_{AB} = 10 V$

$$Q = C \Delta V = (10 \times 10^{-6})(10) \\ = 1 \times 10^{-4} C$$

d.



$$\frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{30} \quad R_{eq} = 7.5$$

$$R_{circuit} = 20$$

$$I_{circuit} = 1.25$$

$$I_{10} = \frac{3}{4}(1.25) = 0.9375 A$$

e.

$$I_{30} = \frac{1}{4}(1.25)$$

$$I_L = \frac{2}{4}(1.25) = 0.625 A$$

1987 EM 3

$$a. \quad I = \frac{20}{100} = 0.2 \text{ A}$$

$$V_{90} = I \cdot R = (0.2)(90) = 18 \text{ V}$$

$$b. \quad V_L = -L \frac{dI}{dt}$$

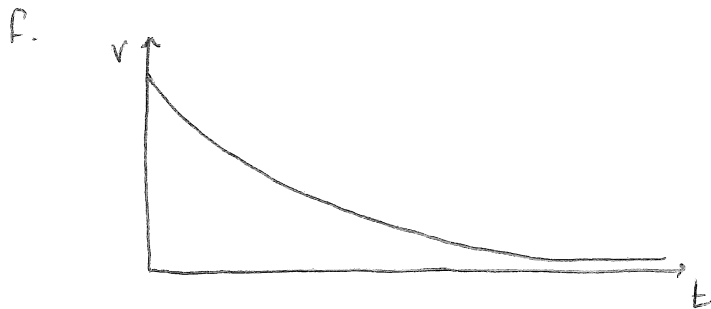
$$-18 = -(0.5) \frac{dI}{dt}$$

$$\frac{dI}{dt} = 36 \text{ A/s}$$

$$c. \quad I = \frac{20}{10} = 2 \text{ A}$$

$$d. \quad U = \frac{1}{2} L I^2 \\ = \frac{1}{2} (0.5) (2^2) \\ = 1 \text{ J}$$

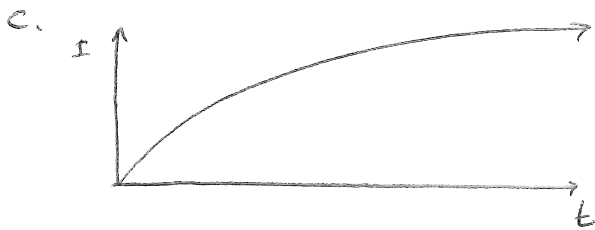
$$e. \quad V = IR = (2)(90) = 180 \text{ V}$$



1991 EM 2

a. ZERO

$$b. I = \frac{\mathcal{E}}{R} = \frac{50}{250} = 0.2 \text{ A}$$



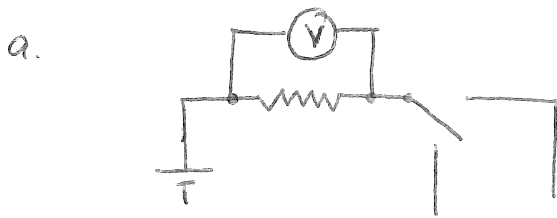
$$d. U = \frac{1}{2} I^2 \cdot L \\ = \frac{1}{2} (0.2^2) (1) \\ = 0.02 \text{ J}$$

$$e. I = 0.2 \text{ A}$$

$$f. V_L = V_R = I \cdot R = (0.2)(150) = 30 \text{ V}$$

g. IT IS DISSIPATED IN THE RESISTOR.

1998 Em 2



b. $I = \frac{\mathcal{E}}{R} = \frac{20}{30} = \frac{2}{3} \text{ A}$

$$\Delta V = I \cdot R = \left(\frac{2}{3}\right)(10) = \frac{20}{3} \text{ V}$$

c. i. $\Delta V = 0$

ii. $Q = C \Delta V = (15 \times 10^{-6})(20)$
 $= 3.0 \times 10^{-4} \text{ C}$

d. $\Delta V = 0$

e. i. $I_f = \frac{\mathcal{E}}{R} = \frac{20}{30} = \frac{2}{3} \text{ A}$

ii. $E = \frac{1}{2} L I^2$
 $= \frac{1}{2} (2) \left(\frac{2}{3}\right)^2$
 $= \frac{4}{9} \text{ J}$

f. $20 - 30I - 2 \frac{dI}{dt} = 0$

$$\frac{dI}{dt} + 15I - 10 = 0$$

2000 Em 1

a. $\frac{1}{12} + \frac{1}{6} = \frac{1}{R_{eq}}$

$R_{eq} = 4$

$R_{circuit} = 4 + 10 = 14$

$I_{circuit} = \frac{42}{14} = 3A$

$I_{12} = 1A$

$I_6 = 2A$

$P = I^2 R$

$P_{10} = 90W$

$P_{12} = 12W$

$P_6 = 24W$

so $A > C > B$

b. i. $I_A = \frac{42}{22} = 1.91A$

$I_B = 1.91A$

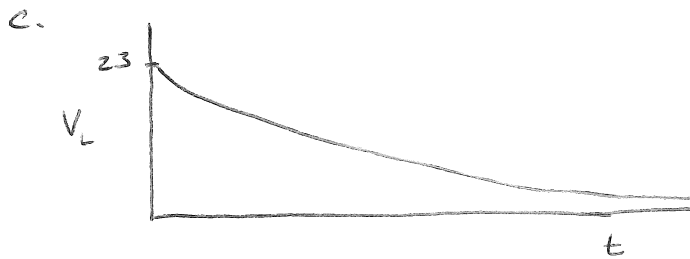
$I_C = 0A$

ii. AS IN PART (a)

$I_A = 3A$

$I_B = 1A$

$I_C = 2A$



2005 EM 2

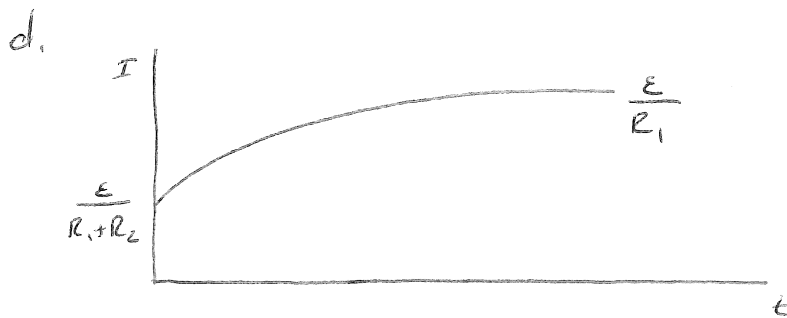
a.
$$I_1 = \frac{\mathcal{E}}{R_1 + R_2}$$

b.
$$V_L = -L \frac{dI}{dt} = V_{R_2}$$

$$-L \cdot \frac{dI}{dt} = \left[\frac{\mathcal{E}}{R_1 + R_2} \right] R_2$$

$$\frac{dI}{dt} = \frac{-\mathcal{E} R_2}{(R_1 + R_2) L}$$

c.
$$I = \frac{\mathcal{E}}{R_1}$$



e.
$$V = \left[\frac{\mathcal{E}}{R_1} \right] R_2$$

2008 EM 2

a. i. $\frac{1}{R_{eq}} = \frac{1}{300} + \frac{1}{150} \quad R_{eq} = 100$

$$R_{circuit} = 300 \quad I_{circuit} = \frac{1500}{300} = 5$$

$$\Delta V_{R1} = (-5)(200) = -1000 \text{ V}$$

$$\Delta V_{R2} = -500 \text{ V}$$

ii. $I = \frac{\mathcal{E}}{R} = \frac{1500}{500} = 3$

$$\Delta V_{R2} = (-3)(300) = -900 \text{ V}$$

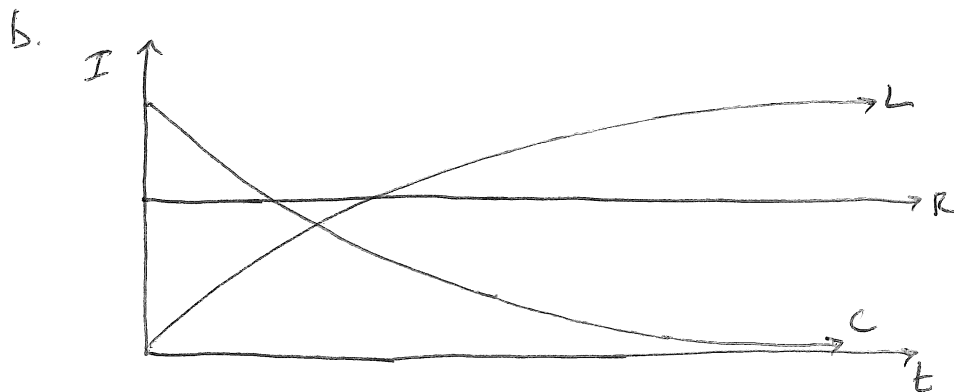
iii. $\frac{1}{R_{eq}} = \frac{1}{300} + \frac{1}{100} \quad R_{eq} = 75$

$$R_{circuit} = 275 \quad I_{circuit} = \frac{1500}{275} = 5.45$$

$$\Delta V_{R1} = (-5.45)(200)$$

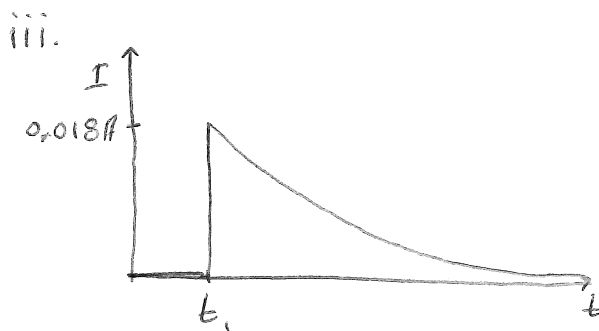
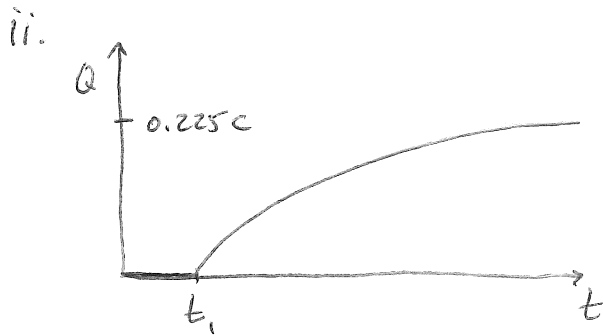
$$= -1091 \text{ V}$$

$$\Delta V_{R2} = -409 \text{ V}$$



Zoll EM 2

a. i. $Q = C \Delta V$
 $= (25 \times 10^{-3})(9)$
 $= 0.225 \text{ C}$



b. i. $U = \frac{Q^2}{2C} = \frac{(105 \times 10^{-3})^2}{2(25 \times 10^{-3})} = 0.2205 \text{ J}$

ii. $U = \frac{1}{2} L I^2$
 $0.2205 = \frac{1}{2} (5) I_m^2$
 $I_m = 0.297 \text{ A}$

iii. $V_c = \frac{Q}{C} = \frac{(50 \times 10^{-3})}{25 \times 10^{-3}} = 2 \text{ V}$

$$V_L = 2 \text{ V} = L \cdot \frac{dI}{dt}$$

$$2 = 5 \left[\frac{dI}{dt} \right]$$

$$\frac{dI}{dt} = 0.4 \frac{\text{A}}{\text{s}}$$