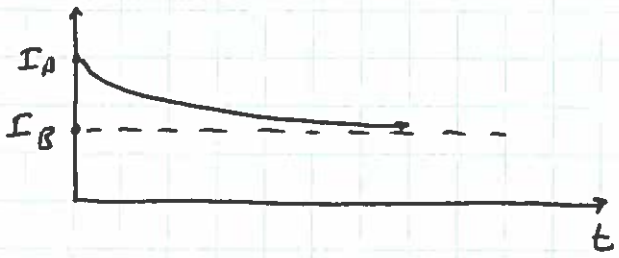
1982 Em 3

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

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

c.



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

$R_{eq} = 20$

$R_{CIRCUIT} = 25$

$I_{CIRCUIT} = \frac{25}{25} = 1\,A$

$I_R = 0.5\,A$

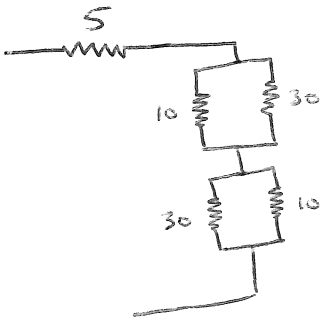
b. $I_R = 0.5\,A$

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

$Q = C\Delta V = (10\times10^{-6})(10)$

$= 1\times10^{-4}\,C$

d.



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

$R_{CIRCUIT} = 20$

$I_{CIRCUIT} = 1.25$

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

e.

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

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

1987 Em 3

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

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

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

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

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

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

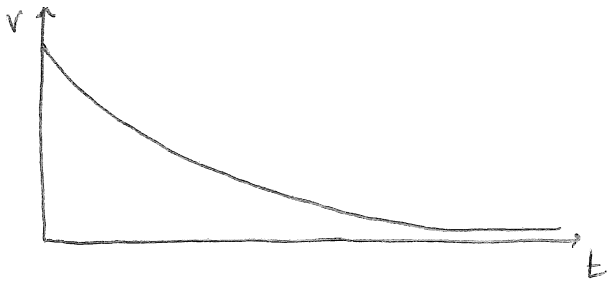
d. $U = \frac{1}{2} L I^2$

$= \frac{1}{2}(0.5)(2^2)$

$= 1\ J$

e. $V = IR = (2)(90) = 180\ V$

f.

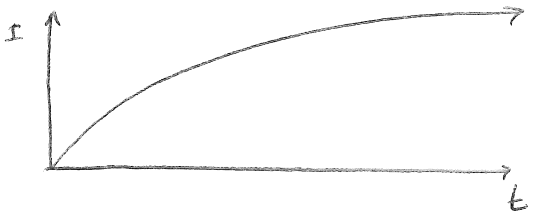


1991 EM 2

a. ZERO

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

c.



d. $U = \frac{1}{2} I^2 \cdot L$

$= \frac{1}{2}(0.2^2)(1)$

$= 0.02\ J$

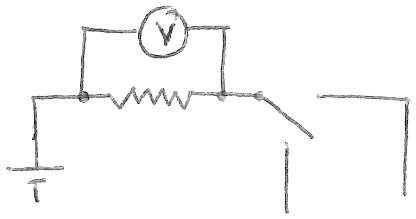
e. $I = 0.2\ A$

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

g. IT IS DISSIPATED IN THE RESISTOR.

1998 Em 2

a.



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

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

c. i. $\Delta V = 0$

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

$= 3.0 \times 10^{-4} C$

d. $\Delta V = 0$

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

ii. $E = \frac{1}{2} L I^2$

$= \frac{1}{2}(2)\left(\frac{2}{3}\right)^2$

$= \frac{4}{9} J$

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

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

2000 Em 1

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

$R_{eq} = 4$

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

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

$I_{12} = 1A$

$I_6 = 2A$

$P = I^2R$

$P_{10} = 90W$
$P_{12} = 12W$
$P_6 = 24W$

so $A > C > B$

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

$I_B = 1.91A$

$I_C = 0A$

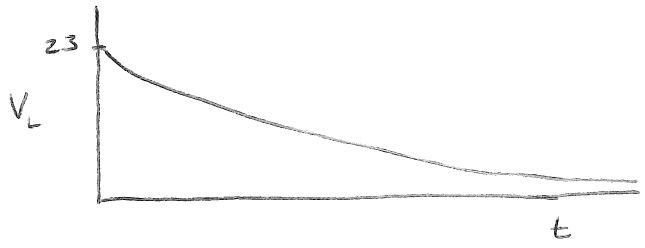
ii. AS IN PART (a)

$I_A = 3A$

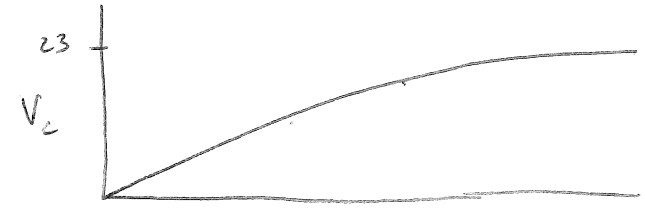
$I_B = 1A$

$I_C = 2A$

c.



d.



2005 Em 2

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

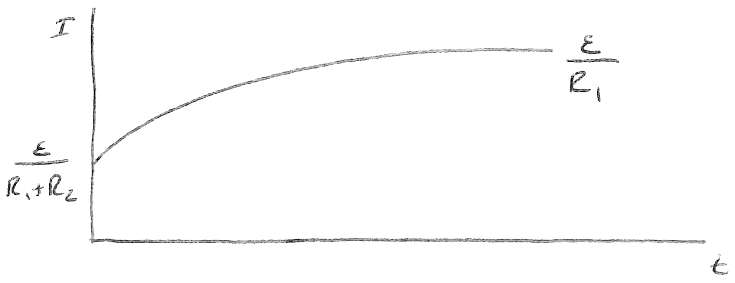
b. $V_L = -L\dfrac{dI}{dt} = V_{R2}$

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

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

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

d.



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

2008 EM 2

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

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

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

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

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

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

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

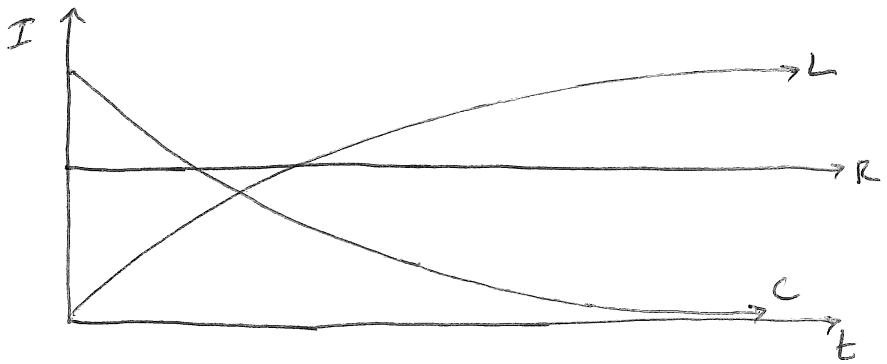
$R_{CIRCUIT} = 275 \quad I_{CIRCUIT} = \frac{1500}{275} = 5.\overline{45}$

$\Delta V_{R1} = (-5.\overline{45})(200)$

$= -1091\,V$

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

b.



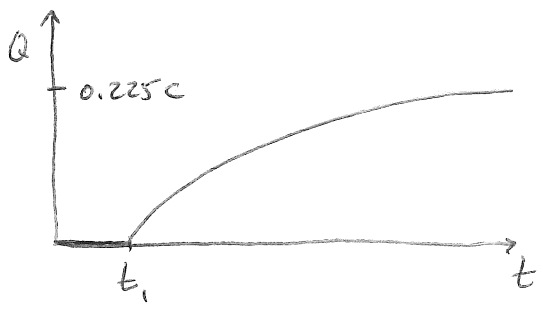
2011 Em 2

a. i. $Q = C\Delta V$

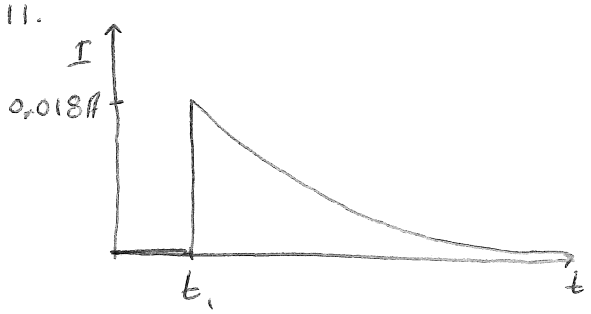
$= (25\times10^{-3})(9)$

$= 0.225\,C$

ii.



iii.



b. i. $U = \frac{Q^2}{2C} = \frac{(105\times10^{-3})^2}{2(25\times10^{-3})} = 0.2205\,J$

ii. $U = \frac{1}{2}LI^2$

$0.2205 = \frac{1}{2}(5)I_m^2$

$I_m = 0.297\,A$

iii. $V_c = \frac{Q}{C} = \frac{(50\times10^{-3})}{25\times10^{-3}} = 2\,V$

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

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

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