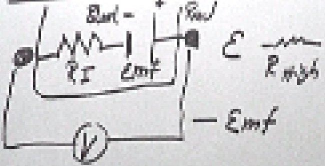
Q50

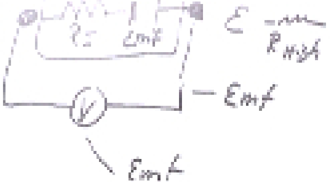
$U = qV$ $\Leftrightarrow$ qV

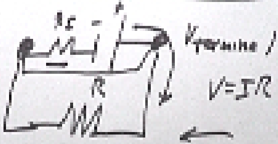
$P = \frac{dU}{dt} = V \frac{dq}{dt} = IV$ $\quad P = V\frac{dq}{dt}$

$V = IR \Leftrightarrow I = V/R$

$P = I^2 R$ $\quad P = \frac{V^2}{R}$







$$\mathcal{E}mf - IR - IR_I = 0$$

$$V_{terminal} = \mathcal{E} - IR_I$$

$$Emf = I(R+R_I)$$

$$I = \frac{emf}{R+R_I}$$

$C = \frac{Q}{V}$

Q

$V_C + V_R = 0$

$V_C = \frac{Q}{C} \quad V_R = IR$

$\frac{Q}{C} + IR = 0 \Rightarrow Q + I(RC) = 0$

$R\,[\Omega]\ \frac{V}{A} \qquad RC = \frac{C}{A} = \frac{C}{C/s} = s$

$C \quad \frac{C}{V}$

$$V_C + V_R = 0$$

$$Q + I\,(RC) = 0$$

$$I = \frac{dQ}{dt}$$

$$Q + \frac{dQ}{dt}\,(RC) = 0$$

$$Q = -(RC)\,\frac{dQ}{dt}$$

$$\int -\frac{dt}{RC} = \int \frac{dQ}{Q}$$

$$\frac{t}{RC} \qquad q\ln\left(\frac{Q}{Q_0}\right)$$

$$Q = -(RC)\frac{dQ}{dt}$$

$$\int -\frac{dt}{RC} = \int \frac{dQ}{Q}$$

$$-\frac{t}{RC} \qquad \ln\left(\frac{Q}{Q_0}\right)$$

$$\ln\left(\frac{Q}{Q_0}\right) = -\frac{t}{RC}$$

$$\frac{Q}{Q_0} = e^{-t/RC} \qquad RC = \tau$$

$$Q = Q_0 e^{-t/RC}$$

$$I = \frac{dQ}{dt} = -\frac{Q_0}{RC} \cdot e^{-t/RC}$$

$$C = \frac{Q}{V} \Rightarrow V = \frac{Q}{C} = \frac{Q_0}{C} e^{-t/RC}$$

$$V_C + V_R = 0$$

$$Q + I\,(RC) = 0$$

$$I = \frac{dQ}{dt}$$

$$Q + \frac{dQ}{dt}(RC) = 0$$

$$Q = -(RC)\frac{dQ}{dt}$$

$$\int -\frac{dt}{RC} = \int \frac{dQ}{Q}$$

$$t \qquad q\ln\left(\frac{Q}{Q_0}\right)$$

$$\frac{t}{RC}$$

$$\ln\left(\frac{Q}{Q_0}\right) = -\frac{t}{RC}$$

$$\frac{Q}{Q_0} = e^{-t/RC} \qquad RC = \tau$$

$$Q = Q_0 e^{-t/RC}$$

$$I = \frac{dQ}{dt} = -\frac{Q_0}{RC} \cdot e^{-t/RC}$$

$$C = \frac{Q}{V} \Rightarrow V = \frac{Q}{C} = \frac{Q_0}{C} e^{-t/RC}$$

$\vec{J}$ $\frac{B}{m}$

$\vec{J} = \frac{I}{A}\hat{e}$

$I = \oint \vec{J} \cdot d\vec{A}$

$V = IR$

$\boxed{\vec{J} = \sigma \vec{E}}$

conduction

$U = \frac{1}{2}CV^2$

$P = I^2R$

$\vec{J}$ $\qquad \frac{B}{m}$

$\vec{J} = \frac{I}{A}\hat{z}$

$I = \oiint \vec{J} \cdot d\vec{A}$

$V = IR \qquad \boxed{\vec{J} = \sigma \vec{E}}$

conductivity

$U = \frac{1}{2} C V^2$

$P = I^2 R$

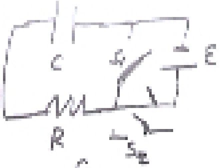
$U_R = \int_{t=0}^{\infty} I^2 R \, dt \quad \left(P = \frac{dU}{dt} \right)$

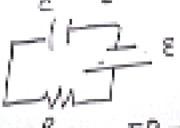
$= \int^{\infty} \Big(Q_0 \; e^{-t/RC} \Big)^2 \ldots$

$$U_R = \int_{t=0}^{\infty} i^2 R\,dt \quad \left(P = \frac{dU}{dt}\right)$$

$$= \int_0^{\infty} \left(-\frac{V_0}{RC} e^{-t/RC}\right)^2 R\,dt$$

$$\vdots \quad \int_0^{\infty} e^{-2t/RC}\,dt \to \frac{1}{2} C V^2$$





$$C = \frac{Q}{V}$$

$$\mathcal{E} - IR - \frac{Q}{C} = 0$$

$$\frac{V}{C} = \mathcal{E} - \frac{Q_0}{C} e^{-t/RC}$$

$$C = \frac{Q}{V} \Rightarrow V = QC$$

$$Q = C\left[\mathcal{E} - \frac{Q}{C} e^{-t/RC}\right]$$

$$I = \frac{Q}{C} \cdot \frac{1}{RC} e^{-t/RC}$$

(1)

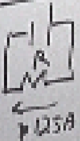
$$P = I^2 R$$

$$P_{R_1} = (.1)^2 \times 10 = .1\,W$$

$$P_{R_2} = (.1)^2 \times 100 = 1\,W$$

$$P = P_1 + P_2 = 1.1\,W$$

$$E = 1.5V$$



$$E - IR_I - IR = 0$$

$$E - IR = IR_I$$

$$R_I = \frac{E - IR}{I} = \frac{1.5 - .125(10)}{.125}$$

$$P_{R_2} = (-1)^2 \times 100 = 1\,W$$

$$P = P_1 + P_2 = 1.1\,W$$

$E = 1.5V$

$I = .125A$

$$E - IR_I - IR = 0$$

$$E - IR = IR_I$$

$$R_I = \frac{E - IR}{I} = \frac{1.5 - .125(10)}{.125}$$