第九次物理作業 F74094083 資訊系113 林欣誼

CH30

17.

a/ $B=\mu_0 nI$

$=4\pi\times10^{-7}\times\frac{400}{0.25}\times80$

$=0.161$

b/ $u=\frac{B^2}{2\mu_0}$

$=\frac{(0.161)^2}{2\times4\pi\times10^{-7}}$

$=1.03\times10^4$

c/ $U=u\times l/A$

$=1.03\times10^4\times0.25\times0.5\times10^{-4}$

$=0.129$

d/ $U=\frac{1}{2}LI^2$

$L=\frac{2U}{I^2}$

$=\frac{2\times0.129}{(90)^2}$

$=4.02\times10^{-5}$

23.

a/ $I=I_0(1-e^{-t/\tau})$

$\frac{I}{I_0}=\frac{1}{2}$

$\frac{1}{2}=1-e^{-t/\tau}$

$\frac{1}{2}=e^{-t/\tau}$

$t=\frac{L}{R}\ln 2$

$=\frac{1.25\times10^{-3}}{50}\ln 2=1.73\times10^{-5}$

b/ $U=\frac{1}{2}U_0$

$=\frac{1}{4}LI_0^2=\frac{1}{2}LI^2$

$\frac{I}{I_0}=\frac{1}{\sqrt{2}}$

$\frac{1}{\sqrt{2}}=1-e^{-t/\tau}$

$e^{-t/\tau}=0.2929$

$t=\frac{L}{R}\ln\frac{1}{0.2929}$

$=3.07\times10^{-5}$

35.

a/ $\omega=\frac{1}{\sqrt{LC}}=\frac{1}{\sqrt{1.5\times6\times10^{-3}}}=105.4$

$T=\frac{2\pi}{\omega}=\frac{2\pi}{105.4}=0.0596$

b/ $Q=VC$

$=12\times6\times10^{-5}$

$=7.2\times10^{-4}$

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

$=\frac{1}{2}\times6\times10^{-5}\times12^2$

$=4.32\times10^{-3}$

d/ $q(0.023)$

$=Q_0\cos(0.023\omega)$

$=7.2\times10^{-4}\cos(0.023\times105.4)$

$=-5.42\times10^{-4}$

e/ $i(0.023)$

$=-\omega Q_0\sin\omega t$

$=-105.4\times7.2\times10^{-4}\times\sin(0.023\times105.4)$

$=-0.05$

f/ $V_c=\frac{q}{C}$

$U_0=\frac{1}{2}CV^2=\frac{1}{2}\cdot\frac{q^2}{C}$

$=\frac{(-5.42\times10^{-4})^2}{2\times6\times10^{-5}}$

$=2.45\times10^{-3}$

$U_L=\frac{1}{2}Li^2$

$=\frac{1}{2}\cdot1.5\cdot(0.05)^2$

$=1.87\times10^{-3}$

43.

a/ $\Phi=BA$

$A=\pi r^2$

$B=\frac{\mu_0 I}{2r}$

$\Phi=\pi r^2\cdot\frac{\mu_0 I}{2r}$

$=\frac{\mu_0 I\pi r}{2}$

$L=\frac{N\Phi}{I}=\frac{\mu_0\pi r}{2}$

$=\frac{4\pi\times10^{-7}\times\pi\times0.03}{2}$

$=5.9\times10^{-8}$

b/ $\mathcal{E}=L\frac{dI}{dt}$

$\frac{dI}{dt}=\frac{d}{dt}I_0\sin(2\pi ft)$

$=2\pi fI_0\cos(2\pi ft)$

$L=\frac{\mu_0\pi r}{2}$

$\mathcal{E}=\frac{\mu_0\pi r}{2}\cdot2\pi fI_0\cos(2\pi ft)$

∴ max emf

$\Rightarrow\cos(2\pi ft)=1$

$\Rightarrow\mathcal{E}_{max}=\mu_0\pi^2 rfI_0$

$=4\pi\times10^{-7}\times\pi^2\times0.03\times60\times1.2$

$=2.68\times10^{-6}$

46.

a/ $\int\vec{B}\cdot d\vec{l}=\mu_0 I$

$B\cdot2\pi r=\mu_0 I$

$B=\frac{\mu_0 I}{2\pi r}$

b/ $\Phi_B=BA$

$d\Phi_B=BdA$

$=\frac{\mu_0 I}{2\pi r}l\cdot dr$

$=\frac{\mu_0 il}{2\pi r}dr$

c/ $\Phi_B=\int d\Phi_B$

$=\int_a^b\frac{\mu_0 il}{2\pi r}dr$

$=\frac{\mu_0 il}{2\pi}\ln(\frac{b}{a})$

d/ $L=\frac{N\Phi_B}{i}$

$=\frac{\mu_0 l}{2\pi}\ln(\frac{b}{a})$

e/ $U=\frac{1}{2}LI^2$

$=\frac{1}{2}\cdot\frac{\mu_0 l}{2\pi}\ln(\frac{b}{a})i^2$

$=\frac{\mu_0 li^2}{4\pi}\ln(\frac{b}{a})$

48.

a)

$i = I_0(1 - e^{-Rt/L})$

$P_R = i^2 R$

$= I_0^2 (1 - e^{-Rt/L})^2 \cdot R$

$= \frac{\varepsilon^2}{R}(1 - e^{-Rt/L})^2$

when $t = \infty$

$\Rightarrow P_{R(max)} = \frac{\varepsilon^2}{R}(1)$

$= \frac{\varepsilon^2}{R}$

b)

$P_L = iL\frac{di}{dt}$

$= (\frac{\varepsilon}{R}(1 - e^{-Rt/L})) \cdot L \cdot [\frac{\varepsilon}{L}(e^{-Rt/L})]$

$= \frac{\varepsilon^2}{R}(1 - e^{-Rt/L})(e^{-Rt/L})$

c)

when $t = 0$

$P_L = 0$

when $t \to \infty$

$P_L = 0$

d)

$\frac{dP_L}{dt} = 0$

$\Rightarrow \frac{\varepsilon^2}{R}[(\frac{R}{L}e^{-Rt/L})(e^{-Rt/L}) + (1 - e^{-Rt/L})(-\frac{R}{L}e^{-Rt/L})] = 0$

$\Rightarrow \frac{\varepsilon^2}{L}(e^{-Rt/L})[e^{-Rt/L} - 1 + e^{-Rt/L}] = 0$

$\Rightarrow 2e^{-Rt/L} = 1$

$\Rightarrow e^{-Rt/L} = \frac{1}{2}$

$\Rightarrow t = 0.69\frac{L}{R}$

$\Rightarrow P_{L(max)} = 0.25\frac{\varepsilon^2}{R}$

e)

$P_\varepsilon = i \cdot \varepsilon$

$= \frac{\varepsilon}{R}(1 - e^{-Rt/L}) \cdot \varepsilon$

$= \frac{\varepsilon^2}{R}(1 - e^{-Rt/L})$

when $t \to \infty$

$P_{\varepsilon(max)} = \frac{\varepsilon^2}{R} \cdot 1$

$= \frac{\varepsilon^2}{R}$

50.

a)

$i_1 = \frac{\varepsilon}{R_1} = 8$

$i_2 = \frac{\varepsilon}{R_1} = 8$

$i_3 = 0$

b)

$i_1 = \frac{\varepsilon}{\frac{1}{R_1} + \frac{1}{R_2}} = \varepsilon \cdot \frac{R_1 R_2}{R_1 + R_2} = 96 \times \frac{28}{12+16} = 14$

$i_2 : i_3 = R_3 : R_1 = 8 : 6$

$\Rightarrow i_2 = 8,\ i_3 = 6$

c)

$I = I_0(1 - e^{-tR/L})$

$\frac{I}{I_0} = \frac{1}{2} = 1 - e^{-tR/L}$

$e^{-tR/L} = \frac{1}{2}$

$t = \frac{L}{R_2}\ln 2$

$= 1.3 \times 10^{-2}$

d)

$i_2 = \frac{\varepsilon}{R_1} = 8$

$i_1 = i_2 + i_3 = 11$

51.

a)

$i_0 = 0$

$V_{ac} = 0$

$V_{cb} = 36$

b)

$i_0 = \frac{36}{50+150} = 0.18$

$V_{ac} = i_0 \times R_2 = 9$

$V_{cb} = i_0 \times R = 27$

c)

$i = I(1 - e^{-tR/L})$

$I = 0.18$

$\frac{R}{L} = \frac{200}{4} = 50$

$\Rightarrow i_0 = (0.18)(1 - e^{-50t})$

$V_{ac} = (0.18)(1 - e^{-50t})(50)$

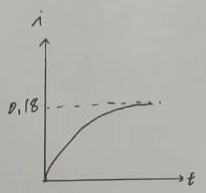
$V_{cb} = \varepsilon - V_{ac}$

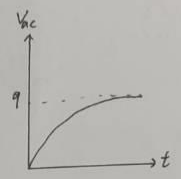
when $t = 0$

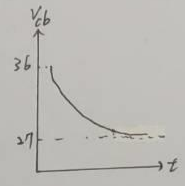
$\Rightarrow i_0 = 0,\ V_{ac} = 0,\ V_{cb} = 36$

when $t \to \infty$

$\Rightarrow i_0 = 0.18,\ V_{ac} = 9,\ V_{cb} = 27$







52.

a)

$V_{ab} = \varepsilon = 60$

b)

a is connected to the positive terminal

$\therefore$ a is at higher potential

c)

$\varepsilon - i_2 R_2 - V_L = 0$

$i_2 = 0 \Rightarrow \varepsilon = V_L$

$\therefore V_{cd} = 60$

d)

c is connected to the positive terminal

$\therefore$ c is at higher potential

e)

$\frac{60}{25} \times 40 = 96$

$V_{ab} = -96$

f)

$\because$ the current flows from b to a

$\therefore$ b is at higher potential

g)

$i = \frac{60}{\frac{1}{25} + \frac{1}{40}} \times \frac{8}{13} = 2.4$

$V_{cd} = 2.4 \times (40 + 25) = 156$

h)

$\because$ the current flows from d to c

$\therefore$ d is at higher potential