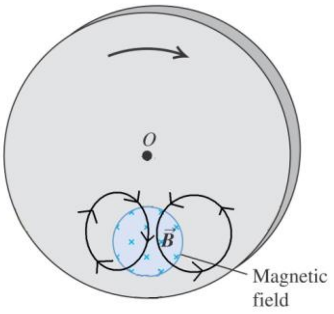
A

Part I Answer Sheet

(1)	$\frac{IlB}{\sqrt{3}k}$
(2)	compressed
(3)	negative
(4)	1/7
(5)	0
(6)	$\frac{\mu_0}{2\pi}\frac{I}{a}$
(7)	$\frac{\mu_0}{4\pi}\frac{I}{a}$
(8)	$\frac{1}{2}\omega BR^2$
(9)	out
(10)	clockwise
(11)	
(12)	3A
(13)	3.3A
(14)	0.005s
(15)	0.3A
(16)	$4\text{x}10^{-6}$C
(17)	1600Hz (15915Hz)
(18)	$3.2\text{x}10^{-3}$J
(19)	12Ω
(20)	2400W
(21)	ABC
(22)	$1.4\text{x}10^{-3}$T
(23)	$5.7\text{x}10^{6}$A/m
(24)	L_{Al} L_{air} L_{copper}
(25)	right

A

Part II Answer Sheet

1.

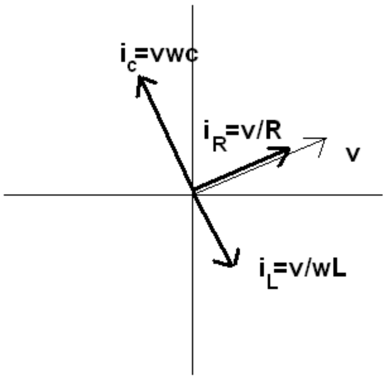
(a) $B\cdot 2\pi r=\mu_0 I\dfrac{r^2}{a^2}$, then $\underline{B=\dfrac{\mu_o Ir}{2\pi a^2}}$

(b) $B\cdot 2\pi r=\mu_0 I$ then $\underline{B=\dfrac{\mu_o I}{2\pi r}}$

(c) For a section with length h, the flux is $\Phi=\int_a^b Bhdr=\int_a^b\dfrac{\mu_0 I}{2\pi r}dr=\dfrac{\mu_0 Ih}{2\pi}\ln(\dfrac{b}{a})$. From $L=\dfrac{\Phi}{I}$, the self-inductance per unit length is $\underline{\dfrac{L}{h}=\dfrac{\mu_0}{2\pi}\ln(\dfrac{b}{a})}$

2.

(a) Phasor diagram



(b) $i=\sqrt{{i_R}^2+(i_C-i_L)^2}=\sqrt{(\dfrac{v}{R})^2+v^2(\omega C-\dfrac{1}{\omega L})^2}$, $\underline{Z=\dfrac{v}{i}=\dfrac{1}{\sqrt{\dfrac{1}{R^2}+(\omega C-\dfrac{1}{\omega L})^2}}}$

3.

(a) In a RC discharging circuit, $I_0=\dfrac{V}{R}=\dfrac{10}{10}=1(A)$, $I(t)=I_0\exp(-\dfrac{t}{\tau})$, where $\tau=RC=10\times 20\times 10^{-6}=2\times 10^{-4}$.

Then, the current at 200μs is $I(200\times 10^{-6})=1\times\exp(-\dfrac{200\times 10^{-6}}{2\times 10^{-4}})=\dfrac{1}{e}=\underline{0.368(A)}$

(b) The flux in small circuit $\Phi=N\int_c^{a+c}\dfrac{\mu_0 Ib}{2\pi r}dr=N\dfrac{\mu_0 Ib}{2\pi}\ln(\dfrac{a+c}{c})$. The induced emf $\varepsilon=-\dfrac{d\Phi}{dt}=-N\dfrac{\mu_0 b}{2\pi}\ln(\dfrac{a+c}{c})\dfrac{dI}{dt}$. And, $\dfrac{dI}{dt}=-\dfrac{I_0}{\tau}\exp(-\dfrac{t}{\tau})$.

The current of the small circuit= $\dfrac{\varepsilon}{\alpha 2N(a+b)}=\dfrac{\mu_0 b}{4\pi(a+b)\alpha}\ln(\dfrac{a+c}{c})\dfrac{I_0}{\tau}\exp(-\dfrac{t}{\tau})=\dfrac{4\pi 10^{-7}(0.2)}{4\pi 0.3}\ln(3)\dfrac{e^{-1}}{200\times 10^{-6}}=\underline{1.34\times 10^{-4}(A)}$

(c) <u>Counterclockwise.</u>

B

(d)

(e) **Part I Answer Sheet**

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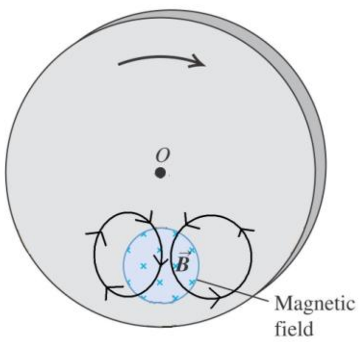
(11)	
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(f)