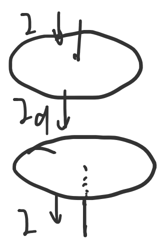
课后题

2022年6月16日 星期四　　上午11:33

1. 

$2\times10^{-6}F.$

(1) $j_d=\frac{\partial D}{\partial t}=\varepsilon\frac{\partial E}{\partial t}=\frac{\varepsilon}{d}\frac{\partial V}{\partial t}$

$I_d=jS=\frac{\varepsilon S}{d}\frac{\partial U}{\partial t}=C\frac{dU}{dt}=$.

(2) $I=\frac{V}{R}=I_d=C\frac{dU}{dt}.$

$\frac{\Delta t}{R}=C\frac{dU}{dt}$, $\Delta t=$,

(3) $\oint_l \vec{H}\cdot d\vec{l}=\iint \vec{j}+\vec{j}_d\,dS$

$B=\frac{\mu_0}{2\pi r}I_d=\frac{\mu_0}{2\pi r}j_d S.$

$2\pi rB=\mu_0(I_d+I)\frac{\pi r^2}{\pi a^2}=\mu_0\frac{r^2}{a^2}(C\frac{dU}{dt}+\frac{dU}{dt}\times\frac{\Delta t}{R})$

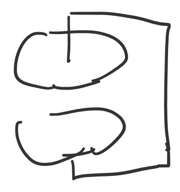
2. (1) $I=I_0\sin\omega t$, $j=j_0\sin\omega t$

$j_D=\varepsilon\frac{\partial E}{\partial t}=\varepsilon\frac{\partial j_0\sin\omega t}{\sigma\,\partial t}=\frac{\varepsilon j_0\omega\cos\omega t}{\sigma}.$

$\frac{j}{j_D}=\frac{\sigma j_0\sin\omega t}{\varepsilon j_0\omega\cos\omega t}=\frac{\sigma}{\varepsilon\omega}=\frac{I}{I_D}.$

(2) $\eta_1=\frac{\sigma}{\varepsilon_0\times2\pi\times50}$　　$T=\frac{1}{f}$　$\omega=2\pi f$

$\eta_2=\frac{\sigma}{\varepsilon_0\times2\pi\times3\times10^{11}}.$

3. 

$B\times2\pi r=\mu_0\iint(\vec{j}+\vec{j}_d)d\vec{S}$

$=\mu_0\frac{\pi r^2}{\pi a^2}(\frac{\partial Q}{\partial t}+\frac{\partial D}{\partial t})$

$=\mu_0\frac{r^2}{a^2}(\omega Q_0\cos\omega t+\varepsilon_0\frac{\partial E}{\partial t})$

$=\mu_0\frac{r^2}{a^2}\omega Q_0\cos\omega t(1+\frac{\varepsilon}{Cd})$

$\frac{\partial E}{\partial t}=\frac{1}{d}\frac{\partial U}{\partial t}=\frac{1}{Cd}\frac{\partial Q}{\partial t})$

注意题目：求H. $H=\frac{\frac{r^2}{a^2}\omega Q_0\cos\omega t}{2\pi r}(1+\frac{\varepsilon}{Cd})$

4. $E_{\parallel1}=E_{\parallel2}$. $H_{\parallel1}=H_{\parallel2}$.

$\varepsilon_1E_{\perp1}=\varepsilon_2E_{\perp2}$　$\mu_1H_{\perp1}=\mu_2H_{\perp2}$.

$\Rightarrow E_1\sin\theta_1=E_2\sin\theta_2$　$H_1\sin\varphi_1=H_2\sin\varphi_2$

$\varepsilon_1E_1\cos\theta_1=\varepsilon_2E_2\cos\theta_2$　$\mu_1H_1\cos\varphi_1=\mu_2H_2\cos\varphi_2$.

$\therefore \varepsilon_1\cot\theta_1=\varepsilon_2\cot\theta_2$　$\mu_1\cot\varphi_1=\mu_2\cot\varphi_2$

5. (1) $V=\frac{c}{\sqrt{\varepsilon_r\mu_r}}=\frac{3\times10^8 m/s}{\sqrt{2.53}}=\frac{3\times10^8}{1.6}m/s.$

(2) $T=\frac{1}{f}$, $\lambda=VT=\frac{V}{f}=$

(3) $H=\frac{E}{V}=$　$H=\sqrt{\frac{\varepsilon}{\mu}}E$.

6. (1) $H=\sqrt{\frac{\varepsilon}{\mu}}E=$.

(2) $f=7.94\times10^7Hz.$

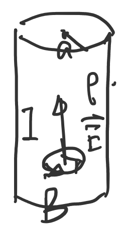
$\omega=2\pi f$, $c=\frac{\lambda}{T}=\frac{\omega}{k}$.

$k=\frac{\omega}{c}=\frac{2\pi\times7.94\times10^7}{3\times10^8}=$.

(3) $\lambda=\frac{2\pi}{k}=\frac{3\times10^8}{7.94\times10^7}=$.

(4) $\vec{S}=\frac{1}{\varepsilon_0}\vec{E}\times\vec{B}=\frac{1}{2}\vec{E}\times\vec{H}.$

$P=\vec{S}\cdot4\pi r^2$

7. 

$\vec{E}=\frac{\vec{j}}{\sigma}=\vec{j}\rho=\frac{I\rho}{\pi r^2}$, $r<a$.

$\vec{H}=\iint_S\vec{j}\cdot d\vec{S}=\frac{I}{\pi a^2}\times\pi r^2=\frac{Ir^2}{a^2}$. $r<a$

$\vec{S}=\frac{1}{2}\vec{E}\times\vec{H}=\frac{1}{2}\times\frac{I^2\rho}{\pi^2a^4}.$　朝外

$P=IU=I\times\frac{I\rho}{\pi r^2}l=\frac{I^2\rho l}{\pi r^2}$ ✗　$(\frac{I}{\pi a^2})^2\pi r^2l\rho$

从已导进入内部的功率

8. (1) $\bar{S}=1353W\cdot m^{-2}$,

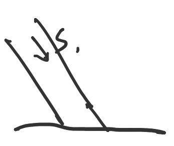
$P=\bar{S}\cdot\vec{A}=S\times4\pi d^2=1353\times4\times\pi\times(1.5\times10^{11})^2$

$\bar{S}_0=\frac{P}{A_0}=\frac{1353\times4\pi\times(1.5\times10^{11})^2}{4\pi\times(7\times10^8)^2}=\frac{1353\times2.25}{49}\times10^6$

(2) $\bar{S}=\frac{1}{2}\vec{E}\times\vec{H}=\frac{1}{2}\sqrt{\frac{\varepsilon}{\mu}}E^2=\frac{1}{2}c\varepsilon_0E^2$

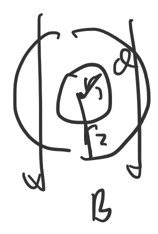
$E=\sqrt{\frac{2S}{c\varepsilon_0}}=\sqrt{\frac{1353\times\frac{2.25}{49}\times10^6}{3\times10^8\times\varepsilon_0}}=$

(3) $H=\sqrt{\frac{\varepsilon_0}{\mu_0}}E=$.

9. 

$S\Delta A\cos\theta=P\cdot(W)$　动量 $p=\frac{SA\cos\theta}{c}$

$mv=F\Delta t=p\Delta A\Delta t$　压力 $p=\frac{2SA\cos^2\theta}{cA}$

10. 

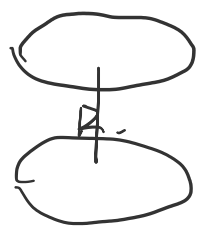
$\vec{D}=\frac{Q}{4\pi r^2}\vec{e}_r$

$\vec{g}=\vec{D}\times\vec{B}=\frac{Q}{4\pi r^2}\vec{e}_r\times\vec{B}$

$\vec{l}=\vec{r}\times\vec{g}=\frac{Q}{4\pi r^2}r\vec{e}_r\times(\vec{e}_r\times\vec{B})=\frac{Q}{4\pi r}(B\cos\theta\vec{e}_r-\vec{B})$

$L_z=\iiint l_z dV=-\frac{QB}{4\pi}\int_0^{2\pi}d\varphi\int_0^{\pi}\sin^3\theta\,d\theta\int_{r_1}^{r_2}dr=-\frac{QB}{3}(r_2^2-r_1^2)$

$\omega=-\frac{QB}{3I}(r_2^2-r_1^2)$

1. 

$C=2\times10^{-6}F.$

$j_d=\frac{\partial D}{\partial t}$　$\varepsilon S\frac{\partial E}{\partial t}=\frac{\varepsilon S}{d}\frac{\partial U}{\partial t}=C\frac{\partial U}{\partial t}$

$I_d=\iint\frac{\partial\vec{D}}{\partial t}\cdot d\vec{S}=\varepsilon_0\iint\frac{\partial\vec{E}}{\partial t}\cdot d\vec{S}$

$CU=Q.$

$C=\frac{4\pi\varepsilon_0S}{d}$　$=\varepsilon_0\frac{4\pi\varepsilon_0S}{C}S\frac{dU}{dt}$

$d=\frac{C}{4\pi\varepsilon_0\pi r^2}$

$E=\frac{U}{d}=\frac{4\pi\varepsilon_0SU}{C}$

$j=\sigma E$, $I=\frac{U}{R}=C\frac{dU}{dt}$

$\frac{dt}{CR}=\frac{1}{U}dU$

$2\pi rB=\mu_0 j_d\pi r^2$ (I_d+I) $\frac{\pi r^2}{\pi a^2}$

5. $V=\frac{1}{\sqrt{\varepsilon\varepsilon_0\mu\mu_0}}=\frac{c}{\sqrt{\varepsilon\mu}}$

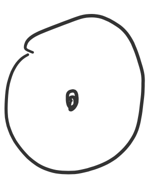
$\lambda=VT=\frac{V}{f}.$

$H=\sqrt{\frac{\varepsilon}{\mu}}E$

6. $H=\sqrt{\frac{\varepsilon}{\mu}}E$

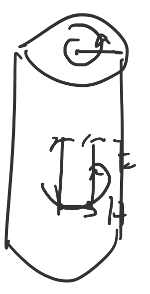
$\lambda=\frac{V}{f}=\frac{\omega}{k}$, $k=\frac{V}{\lambda}$　$k=\frac{\omega}{c}$

$\lambda=\frac{2\pi}{k}$



$P\times4\pi R^2=E\times H$

$P=\frac{E^2\sqrt{\frac{\varepsilon}{\mu}}}{4\pi R^2}$　$P=\bar{S}\times4\pi r^2=\frac{1}{2}EH\,4\pi r^2$

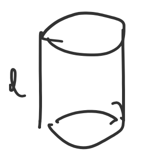
7. 

$E=\vec{j}\rho=\frac{I}{\pi a^2}\rho$

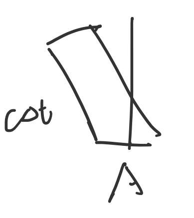
$\oint\vec{H}\cdot d\vec{l}=\frac{I}{\pi a^2}\pi r^2=I\frac{r^2}{a^2}$

$H\times2\pi r=I\frac{r^2}{a^2}$, $H=\frac{rI}{2\pi a^2}.$

$S=\vec{E}\times\vec{H}=-\frac{rI^2\rho}{2\pi^2a^4}$ 向内



$P=\frac{j^2V}{\sigma}$　$P=IU=jSEl=\frac{j^2}{\sigma}\pi r^2l$

设为S  $\cot\theta S=2$