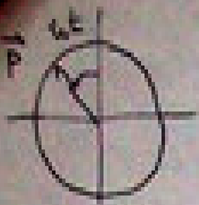
a) $\vec{p}(0) = \int \vec{r}\, dq = \int \vec{r}\, \lambda\, dl = \int_0^{2\pi} b(s\phi, c\phi, 0)(\lambda_0 \operatorname{sen}\phi)(b\, d\phi) = \pi b^2 \lambda_0\, \hat{y}$



$\vec{p}(t) = p_0(-s\omega t, c\omega t, 0)$ , $p_0 = \pi b^2 \lambda_0$

b) $\boxed{P = \frac{c^2 Z_0 k^4}{6\pi} |\vec{p}|^2 = \frac{\pi b^4 \lambda_0^2 \mu_0 \omega^4}{6c}}$ (11.60 Griffiths)

También: 2 dipolos $\perp$, como en el práctico

Deducción P: $\vec{p}(t) = p_0 e^{-i\omega t}(-i\hat{x} + \hat{y}) = \tilde{p}\, e^{-i\omega t}$ $\tilde{p} = p_0(-i\hat{x} + \hat{y})$

$\vec{H}_c = \frac{ck^2}{4\pi}(\hat{r}\times\vec{p})\frac{e^{i(kr)}}{r} = H_0(\hat{r}\times\tilde{p})$ , $H_0 = \frac{ck^2}{4\pi} p_0 \frac{e^{i(kr-\omega t)}}{r}$ ,

$\vec{E}_c = \frac{\mu_0 c^2 k^2}{4\pi r} e^{ikr}(\hat{r}\times\vec{p})\times\hat{r} = E_0(\hat{r}\times\tilde{p})\times\hat{r}$ , $E_0 = \mu_0 \frac{c^2 k^2}{4\pi}\frac{e^{i(kr-\omega t)}}{r} p_0$

$\hat{r} = \left(\frac{x}{r}, \frac{y}{r}, \frac{z}{r}\right)$ $\tilde{p}\cdot\tilde{p} = 0$ $\tilde{p}\cdot\hat{r} = \frac{-ix+y}{r}$ $(\tilde{p}\cdot r)^2 = \frac{y^2 - x^2 - 2ixy}{r^2}$ $\tilde{p}\cdot\hat{r}\,\tilde{p}^*\cdot\hat{r} = 1 - z^2/r^2$

$\tilde{p}\cdot\tilde{p}^* = 2$

$\vec{S} = \vec{E}\times\vec{H} = \frac{(E_c + E_c^*)\times(H_c + H_c^*)}{4} = \frac{E_c\times H_c + E_c\times H_c^*}{4} + cc$

$E_c\times H_c = E_0 H_0 (\tilde{p} - \hat{r}(\tilde{p}\cdot\hat{r}))\times(\hat{r}\times\tilde{p}) = E_0 H_0\, \hat{r}\,(\tilde{p}^2 - (\tilde{p}\cdot\hat{r})^2) = -E_0 H_0 (\tilde{p}\cdot\hat{r})^2\, \hat{r}$

$E_c\times H_c^* = E_0 H_0^* (\tilde{p} - \hat{r}(\tilde{p}\cdot\hat{r}))\times(\hat{r}\times\tilde{p}^*) = E_0 H_0^*\, \hat{r}\,(\tilde{p}\cdot\tilde{p}^* - \tilde{p}\cdot\hat{r}\;\tilde{p}^*\cdot\hat{r})$

$\Rightarrow \vec{S} = \frac{1}{4}\hat{r}\left(E_0 H_0 \frac{x^2 - y^2 - 2ixy}{r^2} + E_0 H_0^*(1 + z^2/r^2) + cc\right)$

$P = \int d\Omega\, r^2\, \hat{r}\cdot\vec{S} = \frac{1}{4}\frac{\mu_0 c^3 k^4}{16\pi^2}\int d\Omega\left[\frac{x^2 - y^2 - 2ixy}{r^2} e^{2iu} + (1 + z^2/r^2) + cc\right] p_0^2$ , $u = kr - \omega t$

$\int d\Omega\, xy = 0$ $\int d\Omega\, x^2 = \int d\Omega\, y^2 = \int d\Omega\, z^2 = 4\pi/3 \Rightarrow$ único que contribuye

$P = \frac{1}{4}\frac{\mu_0 c^3 k^4}{16\pi^2} 2\cdot 4\pi\left(1 + \frac{1}{3}\right) p_0^2 = \boxed{\frac{\mu_0 \omega^4}{6c}\pi b^4 \lambda_0^2 = P}$