Homework #6 Solutions

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2:59 PM

11.9 $\vec{p}$ is along $\vec{y}$ (symmetry)

$$dp_y = 2b^2 \cdot \lambda_0 \sin^2\varphi \cdot d\varphi$$

$$p_y = 2b^2\lambda_0 \cdot \int_0^{\pi} \sin^2\varphi \cdot d\varphi =$$

$$= 2b^2\lambda_0 \cdot \frac{\pi}{2} = \pi b^2 \lambda_0$$

$$\vec{p}(t) = \pi b^2 \lambda_0 (\sin\omega t \cdot \hat{x} + \cos\omega t \cdot \hat{y})$$

$$\ddot{\vec{p}}(t) = -\omega^2 \pi b^2 \lambda_0 (\sin\omega t\, \hat{x} + \cos\omega t\, \hat{y})$$

$$\langle |\ddot{p}(t)|^2 \rangle = \omega^4 \pi^2 b^4 \lambda_0^2$$

$$\text{Power} = \frac{\mu_0}{6\pi c} \cdot (\omega^2 \pi b^2 \lambda_0)^2 = \frac{\mu_0 \pi \omega^4 b^4 \lambda_0^2}{6c}$$

11.10 $U = m \cdot g \cdot h \qquad t = \sqrt{\frac{2h}{g}}$

$$\text{Power} = \frac{\mu_0 q^2 a^2}{6\pi c}$$

Energy dissipated = Power $\cdot\, t$ =

$$= \frac{\mu_0 q^2 \cdot g^2}{6\pi c} \cdot \sqrt{\frac{2h}{g}}$$

$$\frac{\text{Energy dissip.}}{U} = \frac{\mu_0 q^2}{6\pi c \cdot mgh} \cdot \sqrt{\frac{2h}{g}} =$$

$$= \frac{\mu_0 q^2}{6\pi c \cdot m} \cdot \sqrt{\frac{2g}{h}} \approx 10^{-24}$$

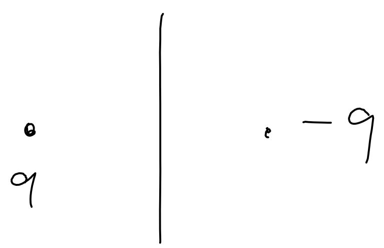
11.13 $$\text{Power} = \frac{\mu_0 q^2 a^2}{6\pi c}$$

$$t = \frac{v_0}{a} \Rightarrow E = \text{Power} \cdot t = \frac{\mu_0 q^2 \cdot a \cdot v_0}{6\pi c}$$

$$\frac{E}{\frac{mv^2}{2}} = \frac{\mu_0 q^2 \cdot a}{3\pi m v_0 c}$$

b) $$\frac{E}{\frac{mv^2}{2}} = 1.3 \cdot 10^{-10} \quad \text{(small)}$$

11.25



$$p = q \cdot 2z$$

$$\ddot{p} = q \cdot 2\ddot{z}$$

$$P = \frac{\mu_0 (\ddot{p})^2}{6\pi c} \qquad m\ddot{z} = \frac{q^2}{4\pi\varepsilon_0 (2z)^2}$$

$$P = \frac{\mu_0}{6\pi c} \cdot \left(\frac{q^3}{8\pi \varepsilon_0 m z^2} \right)^2 =$$

$$= \left(\frac{\mu_0 c q^2}{4\pi} \right)^2 \cdot \frac{1}{6 m^2 z^4}$$