

PH-214 Homework 2

Jacob Sigman

Problem 1

Radiation occurs.

Problem 2

$$P = \frac{q^2 a^2}{6\pi\epsilon_0 c^3} \quad a = \frac{1.6 * 10^6 \text{ m/s}}{2 \text{ s}} = 8 * 10^5 \text{ m/s}^2 \quad q = 1.6 * 10^{-19} \text{ C}$$
$$P = \frac{(1.6 * 10^{-19})^2 * (8 * 10^5)^2}{6\pi * (8.85 * 10^{-12}) * (3 * 10^8)^3} = \boxed{3.63 * 10^{-42} \text{ W}}$$

Problem 3

$$\epsilon_0 = \frac{\text{C}^2}{\text{N} \cdot \text{m}^2} \quad q = \text{C} \quad a = \frac{\text{m}}{\text{s}^2} \quad c = \frac{\text{m}}{\text{s}}$$
$$P = \frac{q^2 a^2}{6\pi\epsilon_0 c^3} = \frac{\text{C}^2 * \frac{\text{m}^2}{\text{s}^4}}{\frac{\text{C}^2}{\text{N} \cdot \text{m}^2} * \frac{\text{m}^3}{\text{s}^3}} = \text{C}^2 * \frac{\text{m}^2}{\text{s}^4} * \frac{\text{N} \cdot \text{m}^2}{\text{C}^2} * \frac{\text{s}^3}{\text{m}^3} = \boxed{\frac{\text{N} \cdot \text{m}}{\text{s}} = \text{W}}$$

Problem 4

$$v = 7.5 * 10^{14} \text{ Hz} \quad \theta = 30^\circ \quad E_0 = 10^3 \text{ V/m}$$
$$\omega = v * 2\pi = 4.71 * 10^{15} \text{ rad/s} \quad \omega = ck \quad k = 1.57 * 10^7 \hat{x}$$
$$\vec{E} = E_0 e^{i(k \cdot r - \omega t)}$$
$$\vec{E}_0 = 10^3 * \langle 0, \sin 30^\circ, \cos 30^\circ \rangle = \langle 0, 866, 500 \rangle$$
$$\vec{E} = \boxed{(866\hat{y} + 500\hat{z}) e^{i(1.57*10^7 \hat{x} \cdot r - 4.71*10^{15} t)}}$$
$$\vec{B} = B_0 e^{i(k \cdot r - \omega t)}$$
$$\vec{B}_0 = \frac{1}{c} * 10^3 * \langle 0, \sin 120^\circ, \cos 120^\circ \rangle = \langle 0, -1.66 * 10^{-6}, 2.88 * 10^{-6} \rangle$$
$$\vec{B} = \boxed{(-1.66 * 10^{-6} \hat{y} + 2.88 * 10^{-6} \hat{z}) e^{i(1.57*10^7 \hat{x} \cdot r - 4.71*10^{15} t)}}$$