

**PREFLIGHTS****LESSON 29 – POWER RADIATED BY A POINT CHARGE****LEARNING OBJECTIVE:**

**Describe the properties of point charge radiation.**

1) Griffiths does not derive the equation for the magnetic radiation field from a point charge, but from the information that he gives you, it is a fairly easy to derive it. Describe in words how you would derive this field.

2) What is the difference between the angular distribution of power for a non-relativistic point charge, as described by Equation 11.69 and graphed in Figure 11.12, and the angular distribution of power for a relativistic point charge, as described by Equation 11.74 and graphed in Figure 11.14? What factor creates the difference?

3) Study Example 11.3, concentrating on Equation 11.74. Let's assume that we choose a charge  $q$  and an acceleration  $a$  so that  $\frac{\mu_0 q^2 a^2}{16\pi^2 c} = 1$ . The rest of the equation depends on angle. At small angles, we can make the approximation that  $\sin\theta \approx \theta$  and  $\cos\theta \approx 1 - \theta^2/2$ . This will make the angular-dependent part of Equation 11.74  $\frac{\sin^2\theta}{(1-\beta \cos\theta)^5} \approx \frac{\theta^2}{(1-\beta+0.5\beta\theta^2)^5}$ . Using Excel or MATLAB or some other graphing program, determine to the nearest hundredth of a radian where this function peaks when  $\beta = 0.99$ , when  $\beta = 0.95$ , and when  $\beta = 0.90$ . Type in what angles you get below.

4) What is bremsstrahlung radiation? How is it created?

5) **Note: This is a review question from Chapter 8.** Imagine an iron sphere of radius  $R$  that carries a charge  $+Q$  and a uniform magnetization  $\mathbf{M} = M(\mathbf{z}\text{-hat})$ . Suppose the sphere is gradually (and uniformly) demagnetized (perhaps by heating it up past the Curie point). If you're looking at the sphere from above, i.e. from the  $+z$ -side, which way will it rotate?

- a. Clockwise
- b. Counterclockwise
- c. The sphere won't rotate.

6) What did you find difficult or confusing in the pre-class work? If nothing was difficult or confusing, tell me what you found most interesting. Please be as specific as possible.

7) Document whatever help you received on the preclass work.