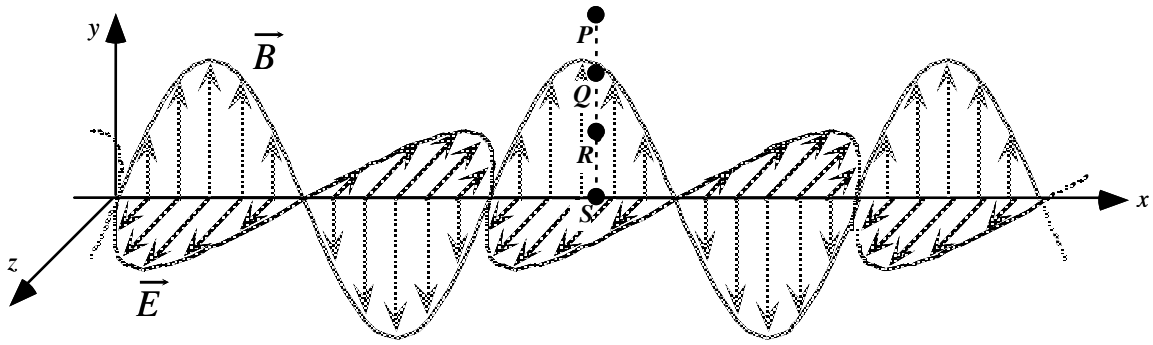
Name**:** _____ Sec. _____ **P212: Quiz 9B Week 12**

Shown below are mathematical and pictorial representations of an electromagnetic plane wave propagating through empty space. The electric field is parallel to the *z*-axis.

$$\vec{B}\,(x, y, z, t) = B_o \sin(kx + \omega t)\,\hat{y}$$



The points *P, Q, R,* and *S* in the diagram above lie in the *x*–*y* plane. Each of the questions relates to the instant shown.

1. Which statement below correctly relates the magnitude of the *electric field* at points *P* and *S?* **[3]**

a) $E_P > E_S > 0$ b) $E_P > E_S = 0$ c) $E_P = E_S > 0$
d) $E_P = E_S = 0$ e) $E_S > E_P > 0$ f) $E_S > E_P = 0$

2. Explain your reasoning. **[2]**

3. Which statement below correctly relates the magnitude of the *electric field* at points *Q* and *R?* **[3]**

a) $E_Q > E_R > 0$ b) $E_Q > E_R = 0$ c) $E_Q = E_R > 0$
d) $E_Q = E_R = 0$ e) $E_R > E_Q > 0$ f) $E_R > E_Q = 0$

4. Explain your reasoning. **[2]**

5. Write an expression for the electric field **E**(x,y,z,t). (Remember to express the amplitude of the electric field in terms of the amplitude of the magnetic field.) **[4]**

6. In which direction is the wave traveling? **[3]**

7. Suppose that the diagram above represents a radio wave. In order to obtain the best reception with a radio, how would you orient the antenna? Remember, the optimal orientation to maximize reception is with the antenna parallel (or antiparallel) to the electric field. **[3]**

a. parallel to the *x*-axis
b. parallel to the *y*-axis
c. parallel to the *z*-axis
d. parallel to the *y*-*z* plane and at an angle of 45° with respect to the *y*-axis
e. any orientation parallel to the *y*-*z* plane.

W12 Quiz 2

Q9B

1) Only the x position matters. P at the same x as S is, so $E_P = E_S$. Neither = 0. (3)
   $E_P = E_S$ (2)
   Neither = 0. (1)
   No explanation required. (That's question 2.)

2) Give the reasoning above (2)

3) Same logic as 1). $E_Q = E_R$. Neither = 0. (3)
   $E_Q = E_R$ (2)
   Neither = 0. (1)
   No explanation required. (That's question 4.)

4) Give the reasoning above (2)

5) $\vec{E}(x,y,z,t) = c\vec{B}_0 \sin(kx+\omega t)\hat{z}$ (4)
   $E_0 = cB_0$ (1)
   Direction of E (1)
   $\sin(kx+\omega t)$ (2)

6) Linear polarization. (3)
   No part credit

7) This is probably a give-away. Antenna should pont along z. (3)
   No part credit.