

# Thursday Reading Assessment: Unit 0 part II, Electric Fields

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## 1 Memory Bank

- $\vec{E} = kQ/r^2\hat{r}$  ... Coulomb field of a charge  $Q$ .

## 2 Electric Fields

1. Consider Fig. 1 below. A ring of charge with radius  $R$  is situated in the  $xy$ -plane. The charge is positive, and it is distributed evenly across the ring. We write  $\Delta q = \lambda R \Delta\theta$ , to mean that there is  $\lambda$  Coulombs per unit length. If  $\Delta\theta$  were to extend to  $2\pi$  (all the way around the circle), then the total charge is  $Q = \lambda(2\pi R)$ . (a) By symmetry, where should the electric field be zero? (b) Where would the electric field be infinite?

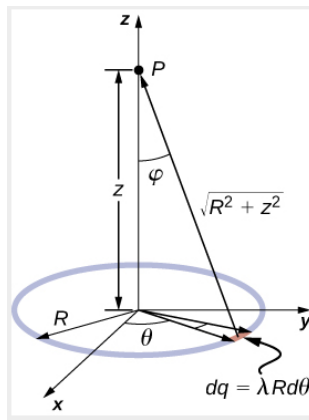


Figure 1: A ring of charge situated in the  $xy$ -plane.

2. Consider again Fig. 1. As  $z \rightarrow \infty$ , what happens to the field?

- A: The field-strength increases.
- B: The field-strength remains constant.
- C: The field-strength decreases.
- D: The field-strength is exactly zero.

3. Suppose the actual function for the E-field  $\vec{E}(z)$  is

$$\vec{E}(z) = \frac{1}{4\pi\epsilon_0} \frac{qz}{(z^2 + R^2)^{3/2}} \hat{z} \quad (1)$$

To see what happens when  $z$  is much larger than  $R$ , try setting  $R = 0$ . What is the result in Eq. 1 if  $R = 0$ ?

4. Do you recognize the expression? What does the ring resemble if  $R \approx 0$ ?