

# Tuesday Reading Assessment: Unit 0, Electric Fields

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January 30, 2024

## 1 Memory Bank

- $\vec{F} = q\vec{E}$  ... Force on a charge  $q$  in the presence of an  $\vec{E}$ -field.
- $\vec{F} = m\vec{a}$  ... Newton's 2nd Law.
- $m = \rho V = \frac{4}{3}\pi r^3 \rho$  ... Mass of a sphere with volume  $V$ , density  $\rho$ , and radius  $r$ .

## 2 Electric Fields

1. Consider Fig. 1 below. An ink nozzle in an inkjet printer shoots microscopic ink droplets through a charging electrode, giving each droplet a charge  $q$ . In the region of the deflection plates, there is an electric field  $\vec{E}$  pointed upwards. The force on the charged droplets is used to deflect them and draw a shape on the page. Droplets without sufficient charge simply fall to the reservoir.

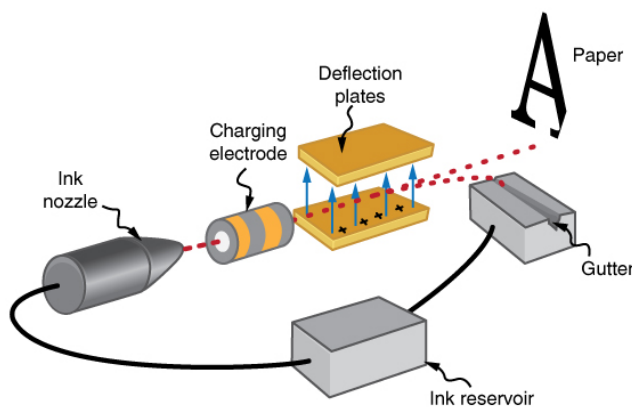


Figure 1: A ring of charge situated in the xy-plane.

2. If the  $\vec{E}$  is pointed upwards, and the  $q$  on each droplet is positive, the droplets will
  - A: Accelerate downward, if  $qE$  exceeds  $mg$
  - B: Accelerate upwards, if  $qE$  exceeds  $mg$
  - C: Travel in a straight line, if  $qE$  exceeds  $mg$
  - D: Fall to the reservoir
3. Suppose the the radius of the droplets is 0.1 mm, and the density of the ink is comparable to water ( $1 \text{ gm/cm}^3$ ), and  $q = 1 \text{ nC}$ . If  $g = 9.81 \text{ m/s}^2$ , what must the value of  $E$  be if the drops are to travel in a straight line?