Thursday Reading Assessment: Unit 0, Electric Fields

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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 ρ, 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.

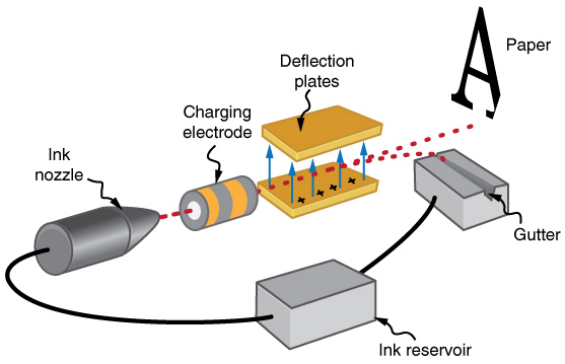

Figure 1: A ring of charge situated in the xy-plane.

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 gm/cm^3), and $q = 1$ nC. If $g = 9.81$ m/s^2, what must the value of E be if the drops are to travel in a straight line?