Chapter 18 Summary

Essential Concepts and Formulas
Charged Objects and Electric Force

- Charge, like mass, is conserved in isolated system
- Like charges repel, opposites attract
- Unit of charge is the coulomb (C)
- $e$ is the charge on a single proton or electron

$$e = 1.60 \times 10^{-19} \text{ C}$$
Conductors and Insulators

- Conductors are substances that allow electric charges to move relatively easily (like silver)
- Insulators are substances that don't allow charges to move easily (like wood)
Charging by Contact and Induction

Charging by contact is when charged object directly gives another object some charge.

Charging by induction is process by which object can be "induced" to have electric charges, but without touching the charged object.
Coulomb's Law

- Analogous to law of gravitation
- Relates force to the magnitudes of the charges and inversely proportional to square of distance between them
- If more than two charges, net force is vector sum of individual forces

\[ F = k \frac{|q_1||q_2|}{r^2} \]
Electric Field

- Imagine we have a small, positive test charge, $q_0$.
- Put this charge in a field created by other charges.
- Remember, test charge does NOT affect field or force itself.
- Unit: Newton per Coulomb (N/C)

For parallel plate capacitor:

$$E = \frac{F}{q_0}$$

$$E = k \frac{|q|}{r^2}$$

$$E = \frac{q}{\varepsilon_0 A}$$
Electric Field Lines

- Field, like force, is a vector.
- Always directed away from positive charges and towards negative charges.
- Number of lines is proportional to strength of field.
Summary of Important Equations

\[ e = 1.60 \times 10^{-19} \, C \]

\[ F = k \frac{|q_1||q_2|}{r^2} \]

\[ k = \frac{1}{4\pi \varepsilon_0} \]

\[ E = \frac{F}{q_0} \]

\[ E = k \frac{|q|}{r^2} \]