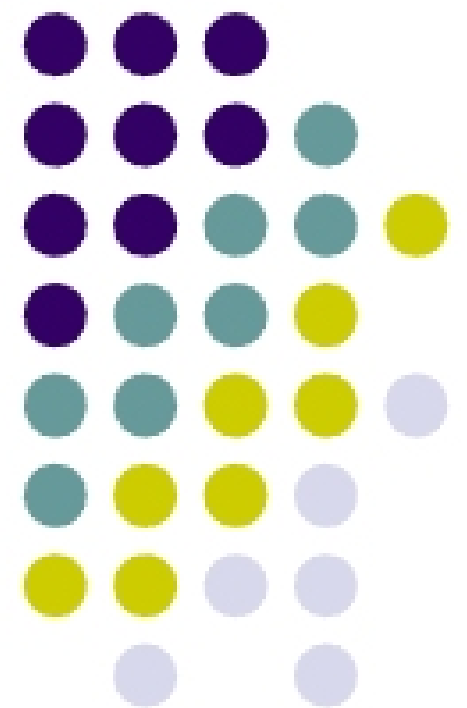


# Chapter 23

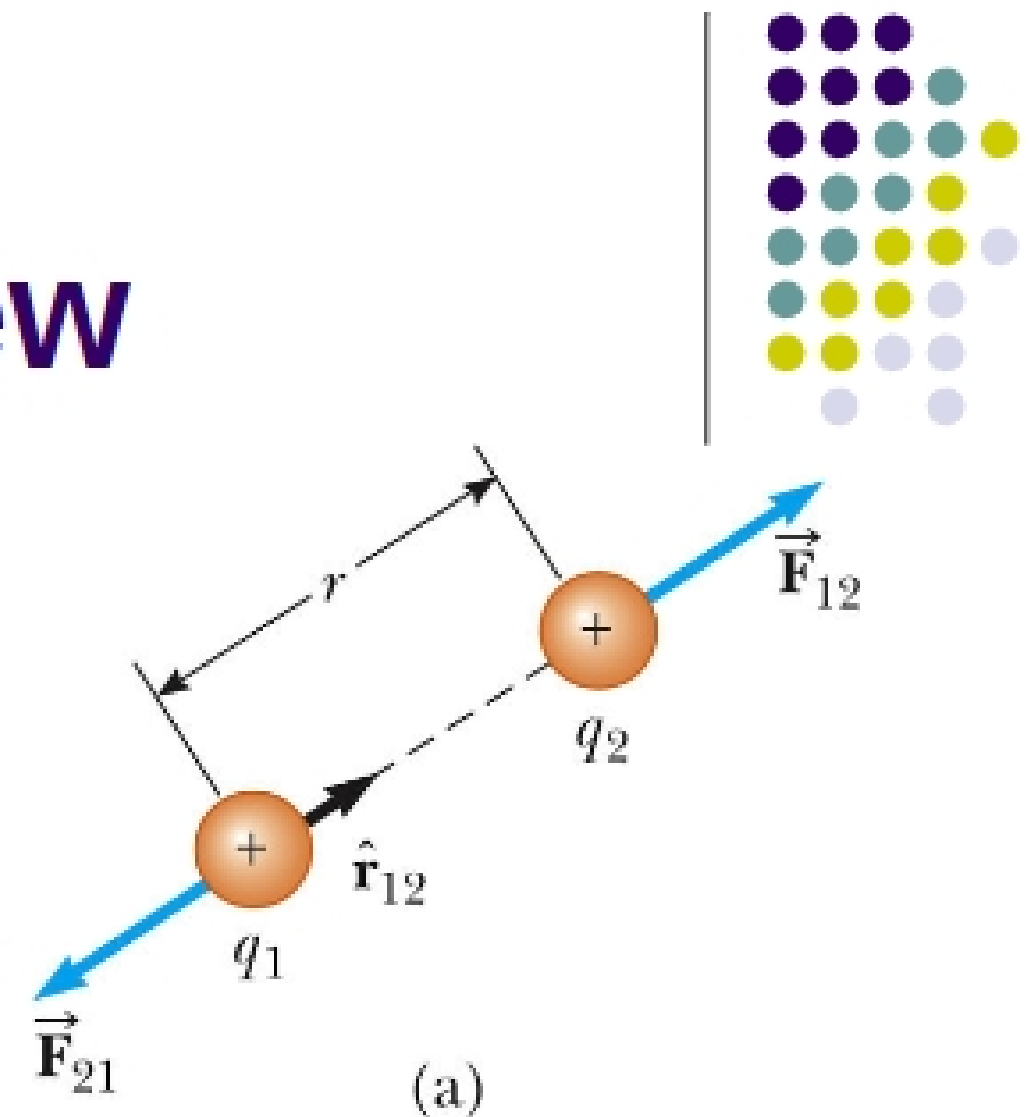
1. A review on Coulomb's Law
2. Define Electric Field
3. Define Electric Field Line
4. Examples on How to Calculate for the Electric Field
5. Charge Particles Experience Force in an Electric Field
6. Quiz 1/22



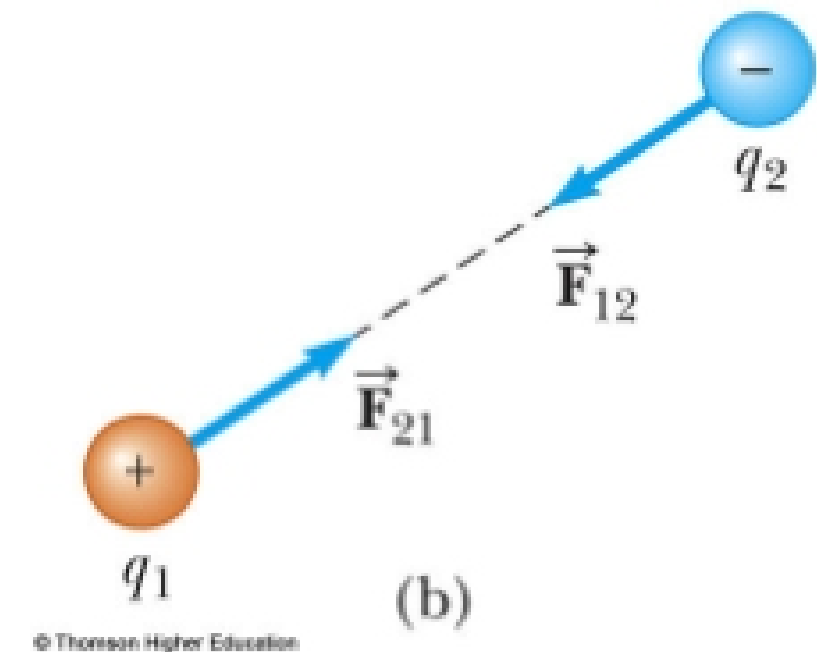
# Coulomb's Law, Review

- The formula:

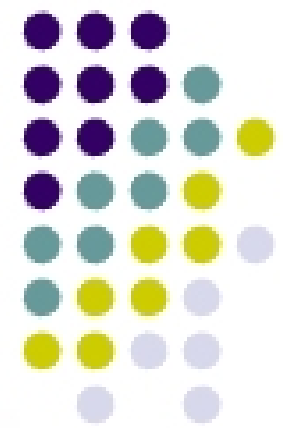
$$F_e = k_e \frac{|q_1| |q_2|}{r^2} \quad \text{or} \quad \vec{F}_{12} = k_e \frac{q_1 q_2}{r^2} \hat{r}_{12}$$



- The units (SI):
  - Charge: **coulomb** (C)
  - Distance: meter
  - Force: Newton
- The constants:
  - $k_e$  the **Coulomb constant**:  
 $k_e = 8.9876 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2 = 1/(4\pi \epsilon_0)$
  - $\epsilon_0$  the **permittivity of free space**:  
 $\epsilon_0 = 8.8542 \times 10^{-12} \text{ C}^2 / \text{N}\cdot\text{m}^2$



# Electric Field: the definition of this concept



- The electric force acts through space, i.e., the effect is produced even with no physical contact between objects.
- One way to offer an explanation (we met this situation before, what is that?), as Faraday initiated, is the concept of a field in terms of electric fields.
- An **electric field** is postulated to exist in the region of space around a charge (of called the **source charge**).
- The strength and direction of that electric field at a point in space is then measured by the force of the electric field exerts on another charge (often called the **test charge**) at that point.
- Mathematically:

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

- The electric field,  $\vec{E}$ , is a vector. The test charge,  $q_0$ , is usually a very small charge compared with the source charge, so that its existence does not distort the electrical field generated by the source charge.
- Unit: Newton/Coulomb or N/C.

