

# SPH4U

## UNIVERSITY PHYSICS

---

ELECTRIC, GRAVITATIONAL, & ... FIELDS

☛ Using Coulomb's Law  
(P.329-333)

---

---

---

---

---

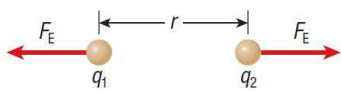
---

---

---

### Electric Force

*All forces, including electrostatic forces, are vector quantities and obey the laws of vector addition. The equation describing Coulomb's law uses only scalar quantities, with the understanding that the direction of the force always lies along the line joining the centre of the two charges.*



November 13, 2012      4U3 - Using Coulomb's Law      1

---

---

---

---

---

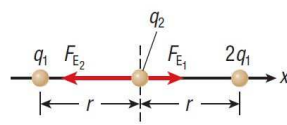
---

---

---

### Electric Force

*However, when one charge experiences a force from more than one other charge, the total force on the charge equals the vector sum of these separate contributions. This combining of forces is an example of the **superposition principle**. So, when all the charges lie in a straight line, the individual forces can be added or subtracted from one another to obtain the resultant, or net, force. But for charges not on a straight line, the solution requires the use of trigonometry or vector components.*



November 13, 2012      4U3 - Using Coulomb's Law      2

---

---

---

---

---

---

---

---

### Coulomb's Law – 1D

**PRACTICE**

1. Three charges ( $q_1 = -2.00 \mu\text{C}$ ,  $q_2 = -1.80 \mu\text{C}$  and  $q_3 = +1.50 \mu\text{C}$ ) are located as shown. Calculate the net force on  $q_3$  due to  $q_1$  and  $q_2$ .

$F_{13} = 1.20 \times 10^{-2} \text{ N[L]}$   
 $F_{23} = 3.88 \times 10^{-3} \text{ N[R]}$   
 $F_{\text{net}} = 8.10 \times 10^{-3} \text{ N[L]}$

November 13, 2012      4U3 - Using Coulomb's Law      3

---

---

---

---

---

---

---

---

---

---

### Coulomb's Law – 1D

**PRACTICE**

2. Using the same charges, calculate the net force on  $q_2$  due to  $q_1$  and  $q_3$ . ( $q_1 = -2.00 \mu\text{C}$ ,  $q_2 = -1.80 \mu\text{C}$ ,  $q_3 = +1.50 \mu\text{C}$ )

$F_{12} = 2.02 \times 10^{-3} \text{ N[R]}$   
 $F_{32} = 3.88 \times 10^{-3} \text{ N[L]}$   
 $F_{\text{net}} = 1.86 \times 10^{-3} \text{ N[L]}$

November 13, 2012      4U3 - Using Coulomb's Law      4

---

---

---

---

---

---

---

---

---

---

### Coulomb's Law – 2D

**PRACTICE**

3. Three charges are arranged at the corners of right triangle as shown. What is the net force on charge C?

$F_{AC} = 54 \text{ N [S]}$   
 $F_{BC} = 135 \text{ N [E]}$   
 $F_{\text{net}} = 150 \text{ N [E}22^\circ\text{S]}$

November 13, 2012      4U3 - Using Coulomb's Law      5

---

---

---

---

---


---

---


---

---

---

 **Check Your Learning**

**TEXTBOOK**  
P.332 Q.3

**WIKI (EGM FIELDS)**  
 4U3 - ASG#1 (Coulomb's Experiment)

November 13, 2012      4U3 - Using Coulomb's Law      6

---

---

---

---

---

---

---

---