

GENERAL CHEMISTRY LABORATORY

CH101

Post-lab assignment on exp. #5

Coulomb's law and ionic compounds

Name: _____

ID#: _____

TF: _____

Lab section:

Exp.#5: Coulomb's law and ionic compounds

Part A – Using Coulombs Law to Predict Trends

Apply Coulomb's Law you should be able to:

- Predict and explain Periodic Trends such as atomic radius, ionic radius, and ionization energy.
- Predict trends in lattice energy.
- Use trends in lattice energy to predict solubility of ionic compounds in water.

So, let's start with some simple questions which we will later use Coulomb's Law to answer. Get out a Periodic Table. Nothing else – no text, no tables, no calculator. Answer each question briefly.

1. Which atom is larger, Na or K? Explain why.

2. Which atom is larger, Na or Al? Explain why.

3. Which is larger, Na or Na⁺ ? Explain why.

4. Which is larger, Br or Br⁻ ? Explain why.

5. Which has a higher first ionization energy, Li or Na? Explain why.

6. Which has a higher first ionization energy, Na or Al? Explain why.

If you can answer these, using only a Periodic Table, as quickly as you read them then you already know and use Coulomb's Law.

Part B – Phet Coulomb's Law for Chemistry

- A. Go to Phet: Physics>Coulomb's Law or enter or click on this link: <http://bit.ly/2I6VMDY>.
- B. Click on the play arrow and then select the atomic model.
- C. Some general notes:
 - a. Pay attention to the direction of the arrows at the top of the dashed lines and the values of the q force. Q represents the charged particle. If there is no arrow the two particles are not being affected by each other.
 - b. Change the value of the charge by scrolling across the bottom or clicking on the arrows. A proton would have a charge of +1 e. An electron would have a charge of -1e. $e = -1.602 \times 10^{-19}$ coulomb, hence the connection to the law's name.
 - c. Change the distance by moving the people along the ruler.
 - d. The body stance of the people will change based on whether they push or pull.

Charge q_1 (e)	Location q_1 (pm)	Charge q_2 (e)	Location q_2 (pm)	Force (on q_1 by q_2) (N)	Force (on q_2 by q_1) (N)	Attracts (person pulls) or repels (person pushes)
1	15	1	85			
1	15	-1	85			
1	15	3	85			
1	15	-3	85			
1	30	1	85			
1	30	-3	70			

1. The two factors that affect the magnitude of the force are

2. Circle one of the underlined terms.

- a. The size/magnitude of the charge is **directly or inversely** proportional to the force.
- b. The distance between the charges is **directly or inversely** proportional to the force.

3. Summarize how the sign of the charge affects the direction of the force (attraction or repulsion) in two sentences or more.

4. Summarize Coulomb's Law in a sentence

Click on the play arrow and then select the macro scale model.

1. Identify two ways(factors) you can change in order to the charge the objects experience.

2. How could you increase electric force using each factor?

3. How could you decrease electric force using each factor?

Complete the table below:

Charge 1 (μC)	Location 1 (cm)	Charge 2 (μC)	Location 2 (cm)	Force (of 1 on 2) (N)	Force (of 2 on 1) (N)
10	3	10	7		
10	1	10	9		
10	1	5	9		
5	1	-5	9		

Summarize:

1. Determine whether each statement is true or false.

The electric force increases as objects move closer together.

The electric force increases as an object's charge increases.

If two objects have different charges, the object with the greater charge, pulls with a greater force.

Apply:

1. The first charged object is exerting a force on the second charged object. Is the second charged object necessarily exerting a force on the first? Explain your reasoning.

2. Electric force is a force of attraction or repulsion between objects based on their charges and their distance apart.

A. When is the electric force attractive?

B. When is the electric force repulsive?