

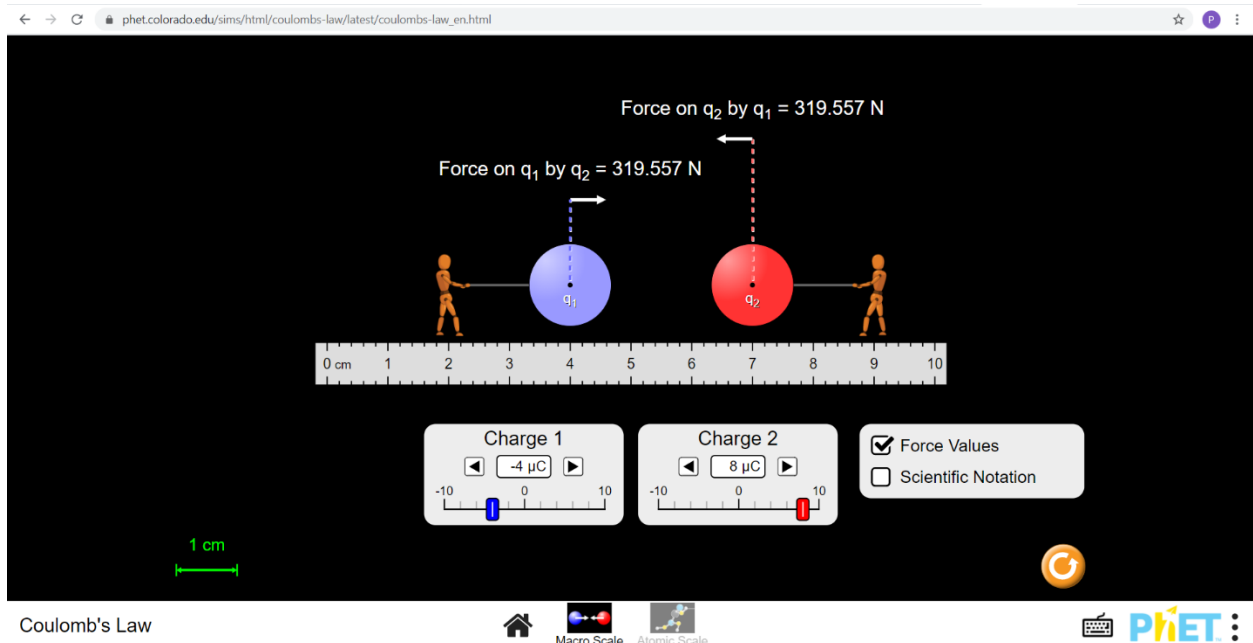
PhET Coulomb's Law

Coulomb's Law is an expression for the force between two charged particles. Here we will work through the characteristics of Coulomb's Law.

Start here:

https://phet.colorado.edu/sims/html/coulombs-law/latest/coulombs-law_en.html

Click twice on the icon that says "Macro Scale". You'll see this:



The arrows above the spheres – which are the charges – show the directions of the forces on the two charges. Open a Word file and answer this question:

How does the direction of the forces depend on the polarities (positive and negative) of the charges?

How does the magnitude of the force depend on the magnitudes of the two charges? To determine this, leave the magnitude of Charge 1 constant and vary Charge 2. Does the magnitude of the force vary linearly with the magnitude of Charge 2? Perhaps quadratically? Inversely?

Now we will examine the dependence of the magnitude of the force on the distance between the two charges. In the simulation, the charges are depicted as having finite size. But we will look at the distance between the centers of the two charges.

Now open an Excel spreadsheet and label the first column "distance" and the second column "force". Move Charge 1 so that its center is located at 0.0 cm. Move Charge 2 to be as close to Charge 1 as the simulation will allow, which is having its center somewhere between 1 and 2

cm. Type that distance (but in meters and not centimeters) and the magnitude of the force into your spreadsheet. Move Charge 2 to a distance of 2.0 cm from Charge 1 and record the distance and magnitude of the force. Repeat at 1.0 cm intervals until you reach 10 cm.

Now select the distance and force columns in your spreadsheet, click on the "Insert" tab, and then click on the button for a scatter plot. Choose the scatter plot option without any lines – just the data points. Click on the Chart Tools Design tab and click on the Add Chart Element button. In the drop-down menu, click on Trendline. On the Trendline drop-down menu, click on "More Trendline Options". That will open up the Format Trendline menu on the right side of the spreadsheet window. Click the "Power" (for Power Law) button near the middle of that menu. Then near the bottom of the Format Trendline menu, click the "Display Equation on chart".

Answer these questions (in your Word document) using the trendline you fit:

- 1) What is the dependence of the electrostatic force on the distance between the charges?
- 2) To calculate the magnitude of the electrostatic force from the distance and the magnitudes of the charges, is a constant (multiplier) necessary? If so, what is that constant?

Take a screen shot of your plot (which includes your equation) and insert it into your Word document. Then convert your document to pdf and submit it via Canvas.