Ch 16 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Coulomb's Law

Pg. 575-577 #1, 2, 25, 7, 8a, 9, 12, 13

Answers

1. 1.39m

2a. 4.9×10^{-7} kg

b. 7.09×10^{-11}C

25a. 3.2×10^{-19}C

b. 2 electrons

7a. -1×10^{-6}C

b. $+3 \times 10^{-6}$C

8a. $-2(2)^{1/2}$

9a. 0.17N to right

b. 0.047N down

12. A=+16e

13a. 1.6N

b. 2.77N

Ch 21 #2

Hopefully this one was easy for you, but in case you missed the basic idea…

You need to apply Newton's 2nd and 3rd laws here, since the two particles must exert equal and opposite forces on each other (3rd law), you can state that $m_1a_1=m_2a_2$ (2nd law). This should be all you need for part A.

For part B, you'll just need to use F=ma, for either one of the particles.

Ch 21 #7

You need to set up two equations on this one, both with q_1 and q_2 as unknown quantities. Your 1st equation should deal with the attractive force between the spheres before the wire connects them. Then your 2nd equation should deal with the repulsive force after the wire connects them. In this 2nd equation, you'll need to make the force negative to show that it's in the opposite direction as the 1st force. The other thing that makes this 2nd equation a tiny bit trickier is what happened when the wire was there. When the wire is in place, it allows electrons to flow from one sphere to the other until the two spheres have balanced charges.

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Ch 21 #7 (cont.)

So in this 2nd equation, you should substitute in this final balanced amount of charge. So how much charge is on each sphere in that final balanced state? Hopefully it makes sense that each sphere must have half of the total original charge, since charge is a conserved quantity. So your 2nd equation should ultimately look like this…

$$-0.036 = \frac{k\left(\frac{q_1+q_2}{2}\right)\left(\frac{q_1+q_2}{2}\right)}{0.5^2}$$

Now have fun solving them simultaneously. (With the quadratic formula!)

Ch 21 #8

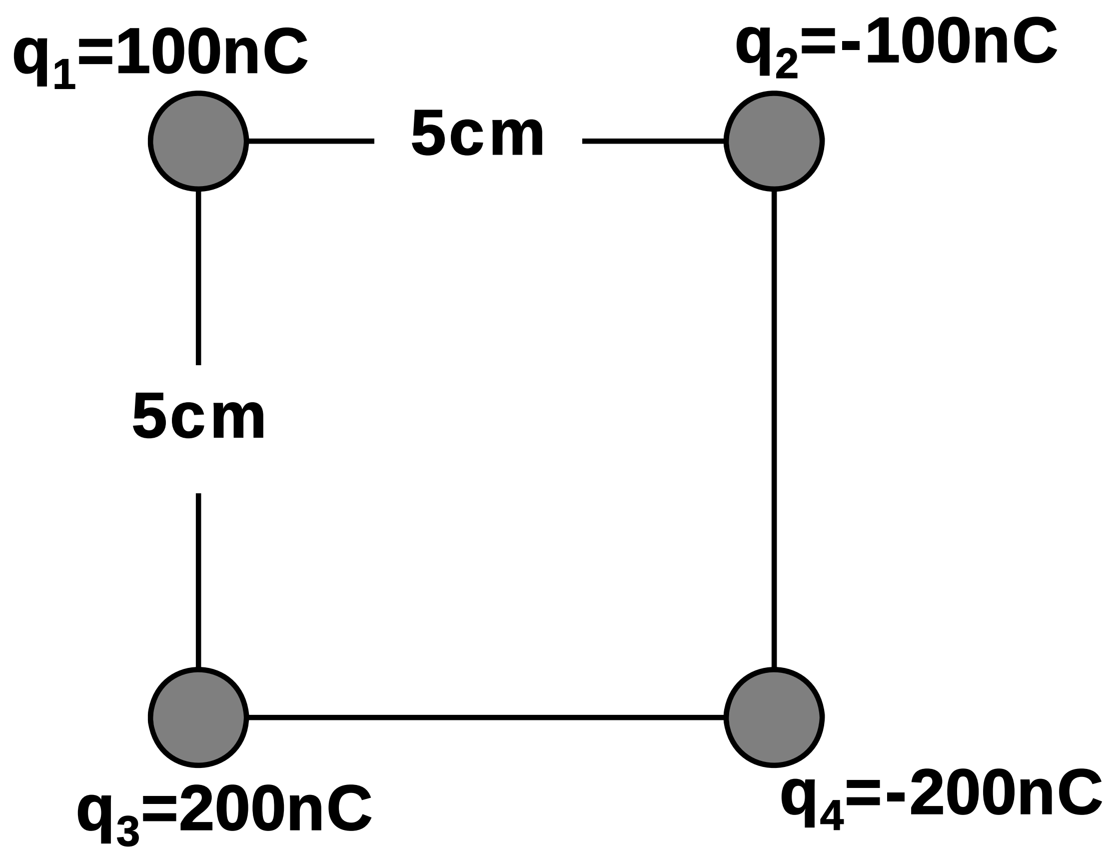
To solve this one, focus on q_1 and the fact that the net force on it must equal zero. A couple things that must be true for zero net force…

1. **Q and q must have opposite signs. So let's arbitrarily decide that q is the negative one.**
2. **Since it's all symmetric, you can just focus on balancing the x-direction forces *or* the y-direction forces. You don't have to do both.**

So if you just think about x-direction, for instance, set up an equation setting $F_{1,2}$ equal to the x-component of $F_{1,4}$. Then solve that equation for Qq, and you're golden!

Ch 21 #9

Just in case you're confused by the wording on this one, here's a drawing to guide you…



Ch 21 #12

Each time the sphere's are touched, they will transfer electrons until they reach a balanced state, where each sphere will have a charge equal to half of the total charge of the two spheres before they touched. So try to work through the problem backwards, at each step using the 'after' information to figure out the 'before' information. (You may not have a lot of work to show, which is okay, but you do need to understand why the answer of +16e is correct.)

Ch 16 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: More Coulomb's Law Problems

Pg. 575-577 #15, 32, 5

Answers

15a. -13.7cm

b. 0cm

32a. 2cm

b. 9.21×10^{-24}N

5. q/Q = 0.5

Ch 21 #32

Just like in class, start by finding an expression for the net force acting on q_3. (A quick drawing could help you to realize both forces will act to the right, so the net force is simply the sum of those two positive forces.) Once you have your expression, find the derivative dF/dx and set it equal to zero to find the location at which the minimum force occurs.

Ch 21 #5

If you're going to maximize the force between the two particles, you need to first have a good expression for that force. You should be able to set up Coulomb's law, realizing that the two charge values are 'q' and 'Q-q'. Once you've got your force expression (and maybe used the distributive property to make life easier), find the value of q that leads to a minimum force by finding the derivative dF/dq and setting it equal to zero.