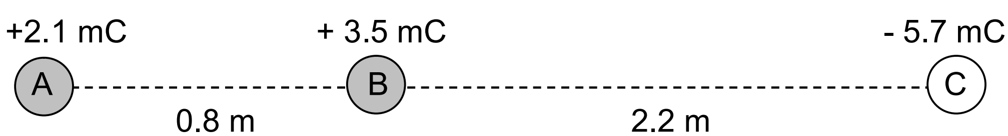
Module 13 Physics

Assignment #1 Read pages 423 - 438.

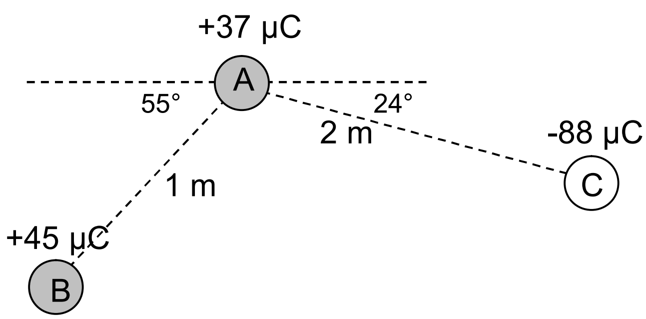
1. Object A is attracted to Object B. If object B is known to be positively charged, what can you conclude about the charge of A?
2. What is the difference between charging something by conduction and charging it by induction?
3. You have a negatively-charged object and you want to give another object a positive charge. Should you charge it by conduction or induction?
4. What units are used to measure electric charge?
5. The charge of an electron is the smallest amount that has ever been detected as a free charge. What is the charge of an electron?
6. Convert units.
   a. 12 mC to C
   b. 5 mC to C
   c. 54 μC to C
7. Particle A has a charge of +2 mC and Particle B has a charge of -3 mC. Calculate the force between the particles when they are 1.2 m apart.
8. Why is the force you calculated in the previous problem called an *instantaneous* force?
9. Two objects exert a mutual attractive force of 3.8×10^4 Newtons on each other. Both charges have a magnitude of 0.4 mC.
   a. What do you know about the signs on the charges?
   b. How far apart are the objects?
10. Three charged particles are placed in a straight line, as shown below.



   a. Find the force Particle A exerts on B.
   b. Would this force move Particle B to the right or the left?
   c. Find the force Particle C exerts on B.
   d. Would this force move Particle B to the right or left?
   e. What is the net force on Particle B?
11. Honors: From an atomic viewpoint, explain why charge is usually transferred by electrons and not protons.
12. Honors: Do an internet search and find out how Robert Millikan measured the charge on an electron. Describe the process he used.

13. Honors: Two protons in a molecule are separated by a distance of 3.80×10^{-10} m. The mass of a proton is 9.1×10^{-31} kg.
    a. Find the electric force exerted by one proton on the other.
    b. Use Newton's Law of Gravitation to calculate the gravitational force between the protons.
    c. Compare the two forces. Which is larger? By how much?

14. Honors: Three point charges are arranged as shown below:

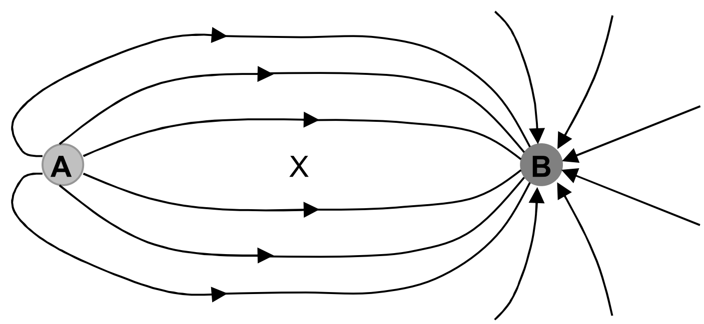


What is the instantaneous electrostatic force on Particle A?

15. Draw the electric field lines for a +4.0 mC charge that is 0.1m from a -4.0 mC charge.

16. Draw the electric field lines for a +3.0 mC charge that is 0.5 m from a +6.0 mC charge.

17. Use the diagram below to answer the following questions:

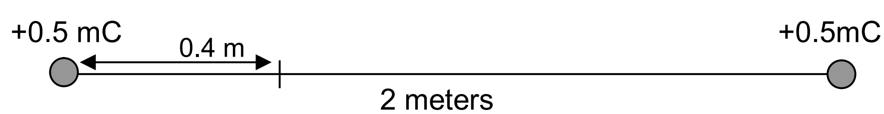


    a. Is particle A positively or negatively charged? Explain how you can tell.
    b. Is particle B positively or negatively charged? Explain how you can tell.
    c. Which particle has the higher value of charge (more Coulombs)? How can you tell?
    d. If a positive test charge were placed at the X, which way would it accelerate?
    e. Where would a negative test particle have the largest amount of acceleration?

18. A particle has a charge of -0.4 mC.
    a. How strong is the electric field 0.5 meters from the particle?
    b. When you move farther away from the particle does the field get stronger, weaker, or stay the same?

19. A test +0.3 mC test charge is placed at a point in an electric field where the field strength is 4×10^6 N/C. If the test charge is replaced with a -0.3 mC test charge, what happens to the electric field at that point?

20. Two +0.5 mC charges are placed 2 meters apart. (See diagram below.)



    a. What is the strength of the electric field 0.4 m from the left particle?

    b. If a +0.3 mC test charge was placed at that point, what would be the force on the test charge?

    c. What is the strength of the electric field halfway between the two +0.5 mC charges?

21. Honors: An electron (mass = 9.1×10^{-31} kg, q = -1.6×10^{-19} C) orbits a proton (q = $+1.6 \times 10^{-19}$ C) with a radius of 7.32×10^{-11} m. At what speed does the electron travel?