Physics

Unit 8: Electric Forces and Electric Fields

1. What is the charge of an electron?
2. What is the value of k?
3. What are some combinations of charges that attract? Repel?
4. Know the steps to charge by contact and by induction.
5. Definitions: electric potential difference, electric potential energy, capacitor, dielectric, equipotential lines, electric field, electric field lines, conductors, insulators
6. Is electric force conservative?
7. A piece of wire has a charge of $-3.2 \times 10^{-5}$ C. How many extra electrons does it have?
8. At what separation will two charges, each of magnitude $10.0 \mu C$, exert a force of 5 N on each other?
9. A -10.0-$\mu$C charge is located 0.50 m to the right of a +15.0-$\mu$C charge. What is the magnitude and direction of the electrostatic force on the positive charge?
10. Know about the electric field in a parallel plate capacitor.
11. How is the spacing of the electric field lines related to the strength?
12. How is the number of electric field line related to the size of the charge?
13. Where are the excess charges on a conductor located?
14. What is the magnitude and direction of the electric force on a +5 $\mu$C charge at a point where the electric field is 5000 N/C and is directed on the $-x$ axis?
15. The electric potential at a certain point in space is 6 V. What is the electric potential energy of a -4 C charge placed at that point in space?
16. If a 2-C charge is located at the origin and a -3-C charge is located at $x = 2$ m, where is the electric potential zero?
17. If the work required to move a -0.25 C charge from point A to point B is +100 J, what is the potential difference between the two points? What is the difference in potential energies of A and B?
18. Given a picture of a equipotential lines, be able to find area of greatest electric potential energy and electric field strength.
19. A capacitor has a very large capacitance of 100 F. The capacitor is charged by placing a potential difference of 3 V between its plates. How much energy is stored in the capacitor?
1. \(-1.60 \times 10^{-19} \text{ C}\)
2. \(8.99 \times 10^9 \frac{N m^2}{C^2}\)
3. Attract: 
   \(+, +; +, 0; -0, -;\)  
   Repel: 
   \(+, +; -0, -;\)
4. See textbook or notes
7. \(-3.2 \times 10^{-7} \text{ C}\)  
   \(-1.60 \times 10^{-19} \text{ C}\)  
   \(= 2.0 \times 10^{14} \text{ electrons}\)
8. \(F = k \frac{|q_1 q_2|}{r^2}\)
   \[5N = \left(8.99 \times 10^9 \frac{N m^2}{C^2}\right) \frac{|(10 \times 10^{-6} \text{ C})(10 \times 10^{-6} \text{ C})|}{r^2}\]
   \[r^2 = \left(8.99 \times 10^9 \frac{N m^2}{C^2}\right) \frac{|(10 \times 10^{-6} \text{ C})(10 \times 10^{-6} \text{ C})|}{5N}\]
   \[r^2 = 0.1798 \text{ m}^2\]
   \[r = 0.424 \text{ m}\]
9. \(F = k \frac{|q_1 q_2|}{r^2}\)
   \[F = \left(8.99 \times 10^9 \frac{N m^2}{C^2}\right) \frac{|(-10 \times 10^{-6} \text{ C})(15 \times 10^{-6} \text{ C})|}{(0.5 \text{ m})^2}\]
   \(F = 5.39 \text{ N to the right}\)
10. Constant, etc.
11. Wider space, less field
12. More lines, more charge
13. On surface
14. \(E = \frac{F}{q}\)
15. \(V = \frac{\text{EPE}}{q_0}\)
16. \(V = \frac{kQ}{r}\)
17. \(V_B - V_A = \frac{E_{PE_B}}{q_0} - \frac{E_{PE_A}}{q_0} = \frac{-W_{AB}}{q_0}\)
18. EPE: electron has highest EPE at lowest V and proton has highest EPE at highest V
   \(E\)-field: highest at place where equipotential lines are closest together
19. \(E_{cap} = \frac{CV^2}{2}\)
   \[E_{cap} = \frac{(100 \text{ F})(3 \text{ V})^2}{2} = 450 \text{ J}\]