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, equipotential lines, electric field, electric field lines, conductors, insulators*
6. *Is electric force conservative?*
7. *A piece of wire has a charge of* -3.2×10^{-5} *C. How many extra electrons does it have?*
8. *At what separation will two charges, each of magnitude 10.0 μC, exert a force of 5 N on each other?*
9. *A -10.0-μC charge is located 0.50 m to the right of a +15.0-μC 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 μC 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 equipotential lines, be able to find area of greatest electric potential energy and electric field strength.*

1. $-1.60 \times 10^{-19}\ C$
2. $8.99 \times 10^{9}\ \frac{Nm^2}{C^2}$
3. *Attract: +,-; +,0; -,0; Repel: +, +; -, -*
4. *See textbook or notes*
7. $\frac{-3.2\times10^{-5}\ C}{-1.60\times10^{-19}\ C} = \mathbf{2.0 \times 10^{14}\ electrons}$
8. $F = k\frac{|q_1 q_2|}{r^2}$

   $5\ N = \left(8.99 \times 10^{9}\frac{Nm^2}{C^2}\right)\frac{|(10 \times 10^{-6}\ C)(10 \times 10^{-6}\ C)|}{r^2}$

   $r^2 = \left(8.99 \times 10^{9}\frac{Nm^2}{C^2}\right)\frac{|(10 \times 10^{-6}\ C)(10 \times 10^{-6}\ C)|}{5\ N}$

   $r^2 = 0.1798\ m^2$

   $\boldsymbol{r = 0.424\ m}$
9. $F = k\frac{|q_1 q_2|}{r^2}$

   $F = \left(8.99 \times 10^{9}\frac{Nm^2}{C^2}\right)\frac{|(-10 \times 10^{-6}\ C)(15 \times 10^{-6}\ C)|}{(0.5\ m)^2}$

   $\boldsymbol{F = 5.39\ N\ to\ the\ right}$
10. *Constant, etc.*
11. *Wider space, less field*
12. *More lines, more charge*
13. *On surface*
14. $E = \frac{F}{q}$

    $-5000\frac{N}{C} = \frac{F}{5 \times 10^{-6}\ C}$

    $F = -0.025\ N$

    0.025 *N* in the -*x* direction
15. $V = \frac{EPE}{q_0}$

    $6\ V = \frac{EPE}{-4\ C}$

    $\boldsymbol{EPE = -24\ J}$
16. $V = \frac{kQ}{r}$

    $\frac{k(2\ C)}{x} + \frac{k(-3\ C)}{2-x} = 0$

    $\frac{(2-x)k(2\ C)}{x(2-x)} + \frac{xk(-3\ C)}{x(2-x)} = 0$

    $(2-x)(2\ C) + x(-3\ C) = 0$

    $4\ C - (2\ C)x - (3\ C)x = 0$

    $4\ C = (5\ C)x$

    $\boldsymbol{x = 0.8\ m}$
17. $V_B - V_A = \frac{EPE_B}{q_0} - \frac{EPE_A}{q_0} = \frac{-W_{AB}}{q_0}$

    $V_B - V_A = \frac{-W_{AB}}{q_0}$

    $V_B - V_A = \frac{-100\ J}{-0.25\ C} = \mathbf{400\ V}$

    $W_{AB} = -W_{BA} = \mathbf{-100\ J}$
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