Name: _____

Class: _____

Due Date: _____

45 – Electric Potential and Electric Potential Energy

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. C: The following problem refers to *electric potential energy* E_{P}. This is also called *electrostatic potential energy* E_{P}.

   a. Define *electric potential energy* E_{P}. Is it a scalar or a vector?

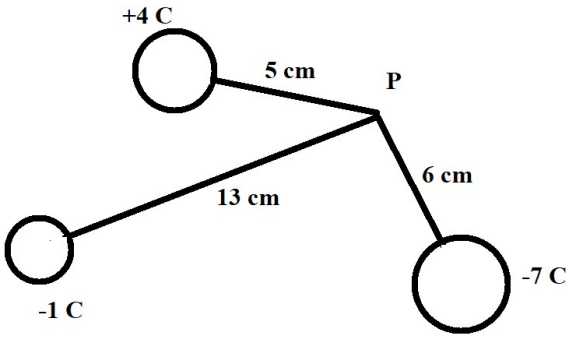
   b. What is the equation for *electric potential energy* E_{P}? Units?

2. C: The following problem refers to *electric potential* V_{e}. This is also called *electrostatic potential*.

   a. Define *electric potential* V_{e}. Is it a scalar or a vector?

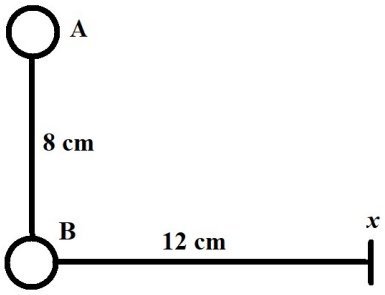
   b. What is the equation for *electric potential*? Units?

3. Determine the electric potential at point P in the figure below:

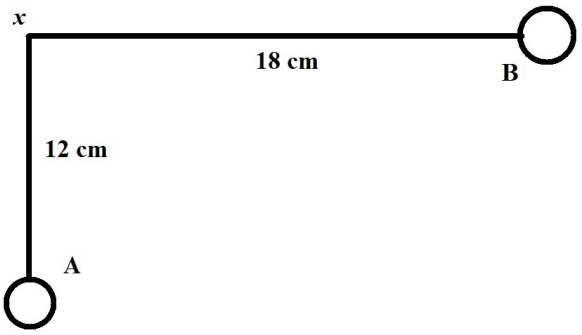


4. E: What will be the electrostatic potential of a point P which is both 12.0 cm from a 25.0 μC charge and 6.00 cm from a 50.0 μC charge?

5. E: Determine the electrostatic potential at point *x*.



6. E: Determine the electrostatic potential at point x.



7. C: Draw a graph of *electric potential vs. distance* of a positively charged solid sphere.

8. C: The following problem refers to *electric field strength E*. This is also called *electrostatic field strength*.

   a. Define *electric field strength E*. Is it a scalar or a vector?

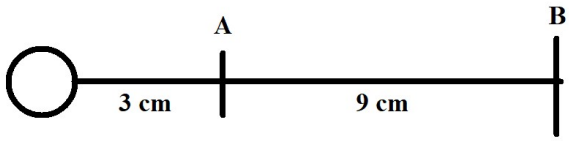
   b. What is the equation and what are the units for *electric field strength*? Define each variable.

c. Where is the *electric field strength* zero? Where is the *electric field strength* maximum?

d. What are the mathematical limits of *electric field strength*? Can *electric field strength* be positive? Negative? Zero?

e. What is the relationship between the *electric field strength* and *electric potential*?

9. E: A small sphere contains a charge of $+5.00 \times 10^{-6}$ C.



a. What will be the direction and magnitude of the electric field at point A?

b. What will be the direction and magnitude of the electrostatic force acting on a proton placed at point A?

c. What will be the electrostatic potential at point A?

d. What will be the direction and magnitude of the electric field at point B?

e. What will be the direction and magnitude of the electrostatic force acting on a proton placed at point B?

f. What will be the electrostatic potential at point B?

g. What will be the potential difference between points A and B?

h. How much work would be required to move a proton from point B to point A?

i. How much work would be required to move a proton from point A to point B?

j. Which point is at the higher potential, A or B?

k. What will be the electrostatic potential at infinity?

l. What would be the potential difference between infinity and point B?

m. How much work would be required to move a proton from infinity to point B?

n. How much work would be required to bring an electron from infinity to point B?

10.E: An atom of C-12 contains six protons in its nucleus.

a. What will be the total charge of the nucleus of a C-12 atom?

b. What will be the strength of the electric field a distance of 0.5 angstroms from this C-12 nucleus?

c. What will be the electrostatic potential a distance of 0.5 angstroms from this C-12 nucleus?

d. What will be the electrostatic potential infinitely far from this C-12 nucleus?

e. What will be the potential difference between a point 0.5 angstroms from the C-12 nucleus and infinity?

f. How much work will be done in moving an electron from infinity to a point 0.5 angstroms from the nucleus of the C-12 nucleus?

g. What will be the potential difference between a point 0.5 angstroms from the nucleus of a C-12 atom and a point 1.5 angstroms from that same nucleus?

h. How much work will be done in moving an electron from a point 0.5 angstroms from the nucleus of a C-12 atom to a point 1.5 angstroms from the same C-12 nucleus?

11. E: Protons in the nucleus of an atom are on average a distance of 3.00 Fermi apart.

    a. What will be the electrostatic potential 3.00 Fermi from a proton?

    b. What will be the electrostatic potential infinitely far away from a proton?

    c. What will be the potential difference between a point infinitely far away from a proton and a point 3.00 Fermi from a proton?

    d. How much work will be required to move a proton from infinity to a point 3.00 Fermi from a second proton?

    Suppose that you hold onto one of these protons and allow the other to accelerate to infinity.

    e. What will be the velocity of this proton when it is very far away?

12. C: The following problem refers to *equipotential surfaces*.

    a. What is an *equipotential surface*?

    b. How much work is done in moving a charge along the same *equipotential surface*?

    c. How much work is done in moving a charge along a different *equipotential surface*? State the equation.

13. C: What is the relationship between an objects *equipotential surfaces* and *electric field lines*?

14. C: Draw a spherical negative charge and a spherical positive charge, both with equal magnitudes of charge and volume, with *electric field lines* and *equipotential surfaces*.

15. C: Draw two spherical negative charges, both with equal magnitudes of charge and volume, with *electric field lines* and *equipotential surfaces*.

16. C: Draw *electric field lines* and *equipotential surfaces* between parallel plates with an equal and opposite charge. For parallel plates remember the equations $W = Fd = q\Delta V$ and $V = Ed$.