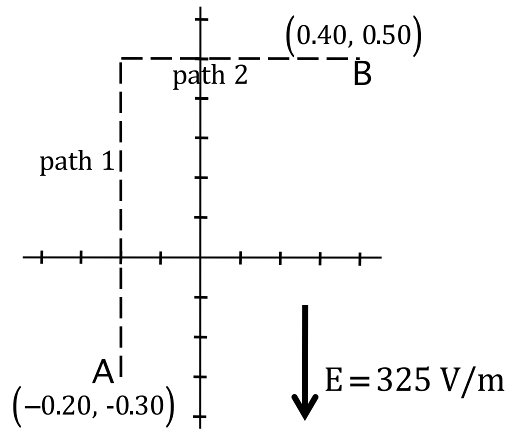
25-Series Problem (Electrical Potentials)

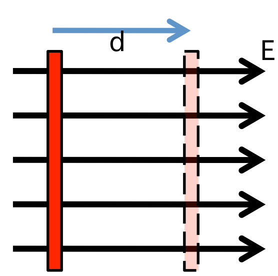
25.1) A proton is accelerated through a potential difference of 120 volts.
- a.) Determine its final speed.
- b.) Determine the speed of an electron accelerated through the same electric potential.

25.3) Given the electric field as shown, use the paths defined to determine the voltage difference between *Point A* and *Point B* in the sketch to the right.

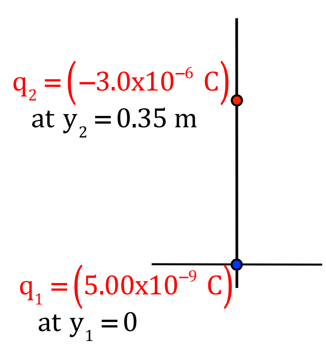


25.5) As an electron passes through the origin moving along the *x-axis,* it has a speed of $3.70\text{x}10^6$ m/s. By the time it gets to *x = 2.00 cm*, it's speed is $1.40\text{x}10^5$ m/s.
- a.) Derive an expression for (then determine) the electric potential difference between the origin and *x = 2.00 cm*.
- b.) Which point has the higher potential?

25.9) An insulating rod sits at rest in a uniform electric field (see sketch) whose magnitude is *E = 100 V/m*. The rod's linear mass density is $\mu = 0.100$ kg/m and it has a linear charge density on it of $\lambda = 40.0\ \mu\text{C/m}$.
- a.) Derive an expression, then determine the rod's speed after it has traveled a distance of 2.00 meters.
- b.) How would the answer to *Part a* have changed if the electric field had not been perpendicular to the rod?



25.14) Two charges are shown to the right.
- a.) How much electrical potential energy is wrapped up in the two-particle system? What is the significance of the sign of that value?
- b.) What is the electric potential at a point halfway between the two?

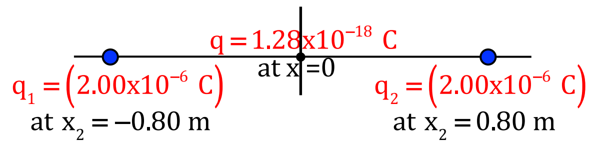


25.15) Consider the charge configuration shown to the right.

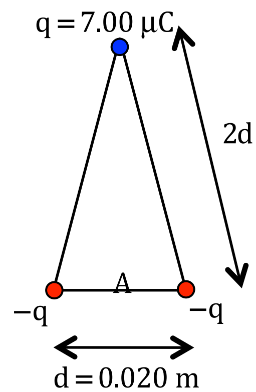
a.) What is the net electric force acting on the charge at the origin?

b.) What is the net electric field at the origin generated by the charges q_1 and q_2?

c.) What is the net electric potential at the origin generated by the charges q_1 and q_2?



25.20) Consider the isosceles triangle shown to the right. All of the charges are $7.00\ \mu C$ in magnitude. Determine the *electric potential* midway between the two bottom charges at *Point A*.



25.33) Between $x = 0$ and $x = 6.00$ *meters*, there exists an electric potential equal to $V = a + bx$, where $A = 10.0\ V$ and $B = -7.00\ V/m$.

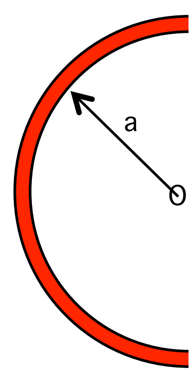
a.) What is the potential at $x = 0$, $x = 3.00$ *meters* and $x = 6.00$ *meters.*

b.) What is the direction and magnitude of the *E-fld* at $x = 0$, $x = 3.00$ *meters* and $x = 6.00$ *meters.*

25.35) The electric potential function for a region in space is $V = 5x - 3x^2y + 2yz^2$.

a.) Derive the associated electric field function for this electric potential.

b.) Determine the electric field at (1.00, 0, -2.00) meters.

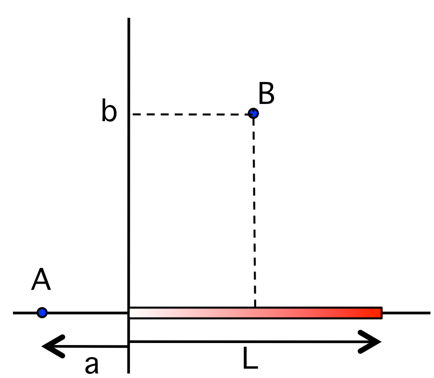


25.40) The semicircular insulating rod shown to the right has a uniformly distributed charge of $-7.50\ \mu C$ on it. If the length of the rod is 14 cm, derive an expression for the electric potential at the center of the semicircle.

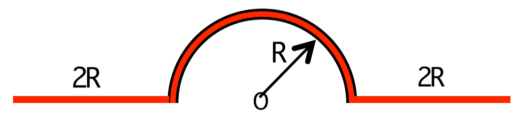
25.42) A rod of length L (see sketch) has a varying linear charge density defined as $\lambda = \alpha x$, where α is defined as a positive constant.

a.) Determine the units for α.

b.) Derive an expression for, then determine the electric potential at *Point A*.



25.44) Consider the uniformly charged wire (linear charge density λ) shown to the right. Derive the electric potential for the charge configuration at *Point O*.



25.45) We would like to generate a 7.50 kV potential on the surface of a 0.300 meter radius, uncharged spherical conductor. How many electrons would have to be removed to do this?

25.48) A 14.0 cm spherical conductor has $26.0\ \mu C$'s worth of charge on its surface. Derive expressions for the electric field and electric potential at:

a.) r = 10.0 cm;
b.) r = 20.0 cm;
c.) r = 14.0 cm.