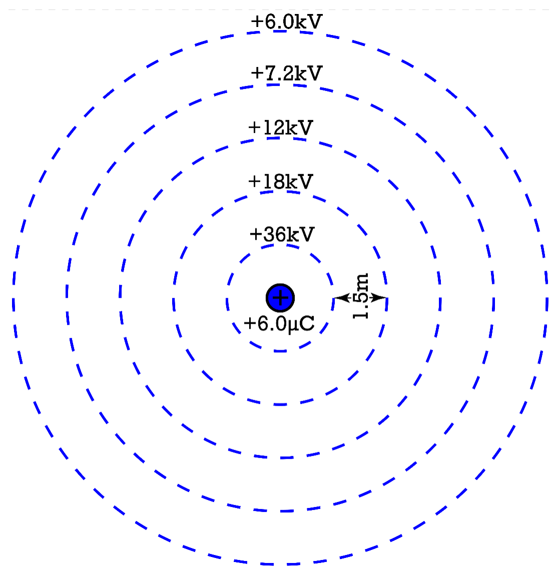
We have already learned that the electric potential which surrounds a point charge is $V = \frac{kq}{r}$

And we can see the electric potential around a +6.0 μC charge is 36 kV a distance of 1.5 m from the center of the charge.



Knowns: $q = +6.0\mu C\left(\frac{1C}{1\times 10^{6}\mu C}\right) = +6\times 10^{-6}C;$

$r = 1.5m;\ V = ?$

$$V = \frac{kq}{r} = \frac{\left(9\times 10^{9}\right)\left(6\times 10^{-6}\right)}{1.5}$$

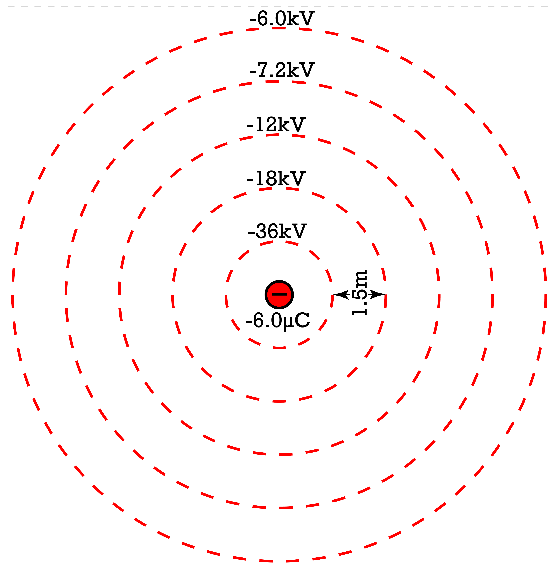
$$\Rightarrow V = 36,000V\left(\frac{1kV}{1000V}\right) = 36kV$$

This forms a concentric sphere with the charge that has a uniform electric potential of 36 kV. From the equation you can see the electric potential decreases as you get farther from the charge (as r increases.)

Each one of these dotted circles represents a spherical surface where the electric potential has the same value throughout. These are often called equipotential surfaces.

- They are sometimes called equipotential lines.

- They are sometimes called isolines of electric potential. Isoline is a more general term for a line of constant value on a map.
- Because it refers to a surface where the electric potential is constant, I prefer the term equipotential surface.

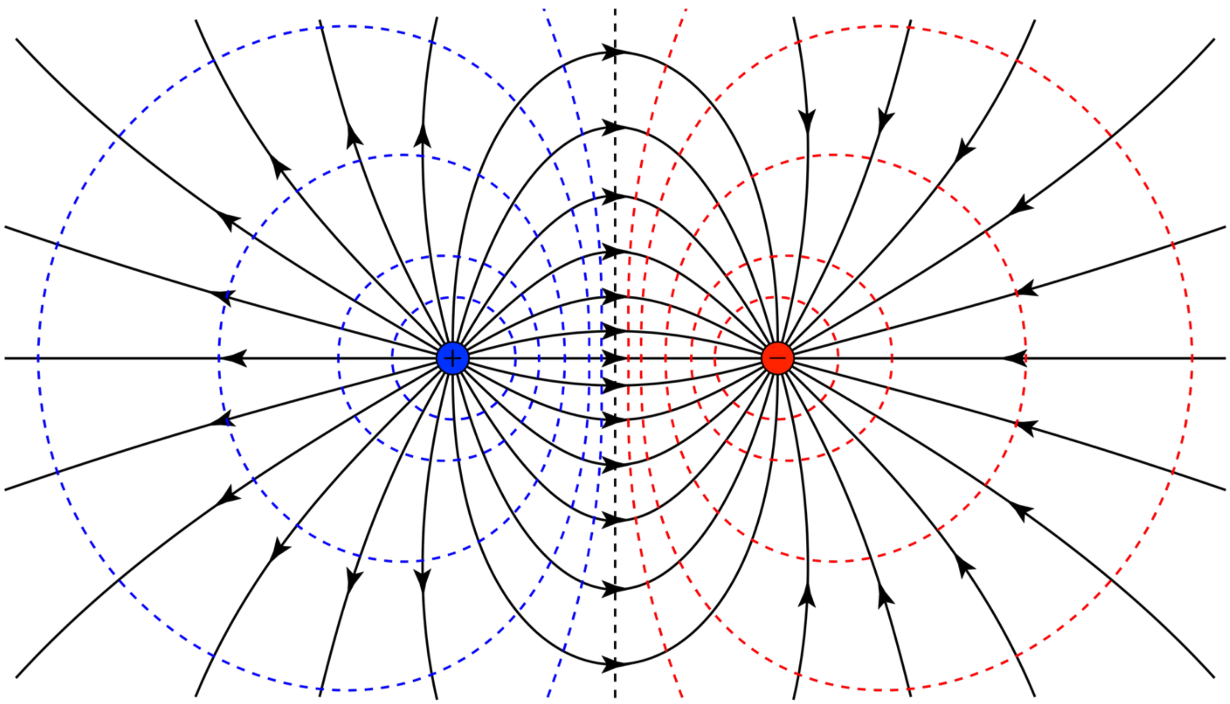


And, if we replace the +6.0 μC charge with a -6.0 μC charge, there are also concentric spheres of uniform electric potential around the negative charge. Notice the electric potential is now negative.

Because electric potential equals electric potential energy divided by charge, and both electric potential energy and charge are scalars, electric potential is also a scalar. That means that, when both of these charges are close to one another, the electric potential from both charges add together. This is the principle of scalar superposition.

$$V_{\text{total}} = \sum_i \frac{kq_i}{r_i} \Rightarrow V_{\text{total}} = V_1 + V_2 = \frac{kq_1}{r_1} + \frac{kq_2}{r_2}$$

For example, there is a vertical plane right between the two charges where the equipotential adds up to zero. This is identified with a black, vertical dotted line.



- Electric field lines and equipotential surfaces are always 90° to one another.
- Electric field lines always point in the direction of decreasing electric potential.