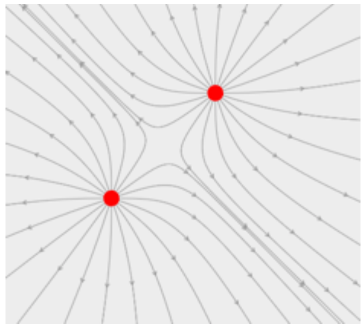
The figure below shows the electric field lines for a matched pair of positive charges. Exactly halfway between then, the field is zero because the fields they produce individually are of equal magnitude but point in opposite directions. What about the electric potential relative to infinity at that same point? Please discuss qualitatively without relying on equations to support your conclusions. Consider what it would take to get a charged particle to that point.



Do not confuse electric field with electric potential!!

I believe it would be 0. The electric field vectors go in opposite directions meaning one would be positive and the other negative. This would cause them to cancel out.

Remember I said not to rely on equations?

The electric potential where the field is zero is some nonzero number. Electric potential does not depend on direction. Therefore, it is the addition of electric potential due to both charges. It is two times kQ/r. It would take work to get the charge to the area where the electric field is zero, just a different amount depending on whether the charge is positive or negative.

Key question: how much energy does it take to move a charge to that position?

Even though the electric field is zero at the point halfway between the matched pair of positive charges, the electric potential relative to infinity at that same point is positive because work needs to be done to bring a positive test charge from infinity to that point against the repulsive forces of the positive charges.

A good narrative explanation

In regards to electric potential the focus shifts to magnitude. If a charge was moved from infinity to the point, as the test charge interacts with positive charges, there is work done by the electric field on said charge. The electric field at that point is zero, but work is required to get the charge to the point so the electric potential at the point in regards to infinity is not zero but has a positive and larger value then those further away from charges. The charge of each potential causes the electric potential to be positive and not zero.

An incandescent light bulb works by moving charges through an electric potential. Those charges gain kinetic energy, which is converted into heat and light. For an ordinary light bulb that operates at 100 Watts (= 100 J/s), estimate the amount of charge that passes through it in one second. (Typical household wiring operates at 110 Volts, which for purposes of estimation is, of course, ~ 100V, right?)

Explanations need words, so please include words in your responses!

> I= 100W/100V --> 1 A ---> 1A*1s= 1C

A good answer despite lack of confidence!

> I don't know how to solve this
> However
>
> A volt is J/C
> C = J/V
> In the one second the light bulb operates at 100 J
> 100 J / 100 V = 1 C
>
> so 1 Coulomb of charge passes in one second?

Good discussion with unconventional notation

> We can use the formula for electric potential and solve for charge:
>
> P = qV
>
> q = P/V
>
> Estimating, we know that it is going to equal about 1 amp. An amp is a watt/volt. Then, we can divide it by the time because we know that it's the charge per time. 1amp/1sec = 1C.

Where is the most convenient place to set electric potential equal to zero when dealing with a single point charge?

a. At that charge's location
b. At the location of test charge you use to probe its influence
c. A standard reference distance 1 meter from the charge
d. Infinitely far away