Last week we discussed electric fields in empty space, now let's worry about electric potential. Can there be a non-zero electric potential at a position in in space where there is no electric charge? Can there be a charge at a position where the potential is zero? Discuss thoroughly, and construct an example if you think it's possible.

Is it necessary to have a medium

I think there can be a non-zero electric potential where there is no electric charge because an electric potential describes the media which a charge could travel through...

First, we get to decide where the potential is zero

For both parts of this question, the answer is yes but it all depends on where we define 0 to be. After we've defined a given area to be 0, we can see the other given area as nonzero for our understanding.

Does a non-zero electric field imply a non-zero electric potential?

Yes, there can be because there are still charges that have an influence (not a big one) at that spot, since there is an electric field, there is an electric potential. Yes, the midpoint between a positive and negative charge will have an electric potential of zero because they will cancel each other out.

Good discussion

There can be non-zero electric potential at a position in space where there is no electric charge as electric potential focuses on the potential energy a positive charge would if it were located at that position in space because of the other charges in the space stems the potential. A positive charge at a stagnant point in space and at the point in space where is a non-zero electric potential due to the presence of the positive charge or any charge in general would replicate this effect. There can be a charge at a position where the potential is zero as if there is a positive charge and negative charge, the midpoint between the two would have a potential of zero but there could be the occurrence of third charge at the point as the other two charges are influencing the potential, but the third charge can still effect the electric potential.

A television set accelerates electrons (m = 9.11 * 10-31 kg, q = -1.6 * 10-19 C) into a beam by sending them through an electric potential difference. They then excite the phosphor on your TV screen and show you strange pictures of strange people. Anyway, you know that the speed each electron has when it hits your screen is about one quarter of the speed of light, right? (The speed of light is 3 * 108 m/s.) Find the potential difference through which they are accelerated.

Conservation of energy does the trick

Similar to last time, we must go back and use some knowledge from physics 1. Our lesson for this week brought back the concepts of kinetic and potential energy. We have also learned delta V(volts) = delta U(potential energy)/q(electric charge). So, we need to start by figuring out how kinetic and potential energy work in this problem. The textbook compares it to a ball rolling down the hill. As it accelerates, kinetic energy increases and it doesn't have potential energy again until once it has hit the bottom. Using the same rationale here, the electron is gaining kinetic energy as it loses potential energy. We also know that it should be equal because of conservation of energy. We have a mass and a velocity, so we can use kinetic energy to figure out potential energy which will then lead us to the potential difference.

Ke=1/2mv^2

It says 1/4 of the speed of light, so we can say 3/4 x 10^8 m/s

Ke=(1/2)(9.11 x 10^-31 kg)(0.75 x 10^8 m/s)^2 = 2.56 x 10^-15 (kg)(m)/s which is the same as 2.56 x 10^-15 J.

We have established that this should be equal to the potential energy but negative. Now, plug into delta V = delta U/q

(-2.56 x 10^-15 J)/(-1.7 x 10^-19 C) = 4.352 x 10^4J/C which equals 1.51 x 10^4 V.

Stop using calculators! Start tracking your units!!!

We can use the fact that W=qV and the fact that work is the change in KE to find V.

KE=(1/2)mv^2=qV. We can do this assuming that the electrons initially have no kinetic energy (almost none basically).

Thus: V=((1/2)mv^2))/q

Now we can plug in values:
(.5(9.11*10^-31kg)(7.5*10^7m/s)^2)/1.6*10^-19C)
=2.5*10^-15/1.6*10^-19C=1.6*10^4 V

(dp – where are your units?!)

If you move in the direction of the electric field, the electric potential must

a. Increase
b. Decrease
c. Stay the same
d. depends on the sign of the charge being moved