What is the kinetic energy of a proton that is traveling at a speed of 2850 m/s?

K = [ ] J

$$K = \frac{1}{2} m v^2$$

$$= 6.782e-21 \text{ J}$$

If the kinetic energy of an electron is 4.8e-18 J, what is the speed of the electron? (You can use the approximate (nonrelativistic) formula here.)

v = [ ] m/s

$$K = \frac{1}{2} m v^2$$

$$\frac{2K}{m} = v^2$$

$$v = \sqrt{\frac{2K}{m}}$$

$$= 3.246e-6 \text{ m/s}$$

You move from location i at < 4, 3, 8 > m to location f at < 3, 5, 13 > m. All along this path there is a nearly uniform electric field $\vec{E}$ = < 800, 230, -520 > N/C. Calculate $\Delta V = V_f - V_i$, including sign and units.

[ ] V

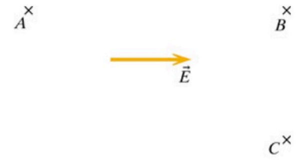
$$\Delta V = -\vec{E} \Delta \vec{x}$$

$$\Delta \vec{x} = f - i$$

$$= \langle -1, 2, 5 \rangle$$

$$\Delta V = -(-800 + 460 - 2600)$$

$$= 2940 \text{ V}$$



Locations A, B, and C are in a region of uniform electric field, as shown in the diagram above. Location A is at < -0.3, 0, 0> m. Location B is at < 0.5, 0, 0> m. In the region the electric field $\vec{E}$ = < 750, 0, 0> N/C.

For a path starting at B and ending at A, calculate:

(a) The displacement vector $\Delta\vec{l}$

$\Delta\vec{l}$ = [ ] m

(b) the change in electric potential:

ΔV = [ ] volts

(c) the potential energy change for the system when a proton moves from B to A:

ΔU = [ ] joules

(d) the potential energy change for the system when an electron moves from B to A:

ΔU = [ ] joules

Part One

$$\Delta\vec{x} = A - B$$

$$= \langle -0.8, 0, 0 \rangle \text{ m}$$

Part Two

$$\Delta V = -\vec{E}\,\Delta\vec{x}$$

$$= 600 \text{ V}$$

Part Three

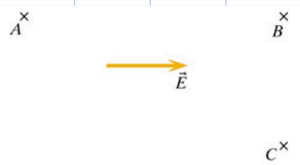
$$\Delta U = q\Delta V$$

$$= 1.6e{-19} \cdot \Delta V$$

$$= 9.6e{-17} \text{ J}$$

Part Four

$\Delta U = -9.6e{-17}\ J$



Locations *A*, *B*, and *C* are in a region of uniform electric field, as shown in the diagram above. Location *B* is at < 0.4, 0, 0 > m. Location *C* is at < 0.4, -0.4, 0 > m. In the region the electric field $\vec{E}$ = < 650, 0, 0> N/C.

For a path starting at *B* and ending at *C*, calculate:
(a) The displacement vector $\Delta\vec{l}$

$\Delta\vec{l}$ = ______ m

(b) the change in electric potential:
ΔV = ______ volts

(c) the potential energy change for the system when a proton moves from *B* to *C*:
ΔU = ______ joules

(d) the potential energy change for the system when an electron moves from *B* to *C*:
ΔU = ______ joules
Which of the following statements are true in this situation? Check all that apply.

- [ ] When a proton moves along this path, the electric force does zero net work on the proton
- [ ] The potential difference cannot be zero because the electric field is not zero along this path
- [ ] $\Delta\vec{l}$ is perpendicular to $\vec{E}$

Part One

$\Delta\vec{l} = C - B$

$= \langle 0, -0.4, 0 \rangle\ m$

Part Two, Three, Four

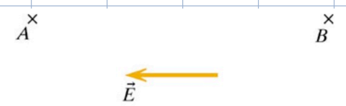
$V = -\vec{E}\vec{r}$

$= -(\langle 650, 0, 0\rangle \cdot \langle 0, -0.4, 0\rangle)$

$= 0$

Part Five

1 and 3 are correct



Locations A and B are in a region of uniform electric field, as shown. Along a path from A to B, the change in potential is 3000 V. The distance from A to B is 0.23 m.

What is the magnitude of the electric field in this region?
$|\vec{E}|$ = ---Select---

$$V = |\vec{E}||\vec{r}|$$

$$|\vec{E}| = \frac{V}{|\vec{r}|}$$

$$= 13043.48 \ \frac{V}{m}$$

An electron starts from rest in a vacuum, in a region of strong electric field. The electron moves through a potential difference of 45 volts. What is the kinetic energy of the electron in electron volts (eV)?

eV

What if the particle were a proton? (Select all that apply.)

- Its kinetic energy would be negative.
- It would move in the opposite direction from the electron.
- Its kinetic energy would be positive.
- It would move in the same direction as the proton.

$$V = \frac{\Delta U}{q}$$

$$\Delta U = Vq$$

$$\Delta K = -\Delta U$$

$$\Delta K = -Vq$$

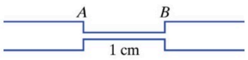
$$= 45 \, eV$$

q is the charge of an electron. It changes the answer to be positive and because the answer is in electron volts the electron's charge is not included in the answer.

2 and 3 are correct for the last question

Potential difference along a wire

The potential difference from one end of a 1 cm long wire to the other in a circuit is $\Delta V = V_B - V_A = 1.7$ volts, as shown in the figure.



(a) Which end of the wire is at the higher potential?

- ○ A
- ○ B
- ○ They are at the same potential

(b) What is the magnitude of the electric field E inside the wire?

E = [ ] V/m

(c) What is the direction of the electric field inside the wire?

- ○ to the right
- ○ to the left
- ○ no direction because $E = 0$

Part One

B must be at higher potential because voltage is positive.

Part Two

$$V_{ab} = -E r_{ab}$$

$$E = \left| -\frac{V_{ab}}{r_{ab}} \right|$$

$$= 170 \text{ V/m}$$

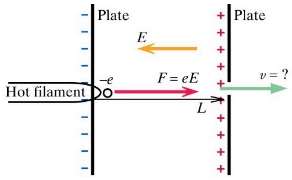
Part Three

To the left because E is negative in the answer above.

Electrons in a television picture tube

In a television picture tube electrons are boiled out of a very hot metal filament placed near a negative metal plate (see the figure). These electrons start out nearly at rest and are accelerated toward a positive metal plate. They pass through a hole in the positive plate on their way toward the picture screen. If the high-voltage supply in the television set maintains a potential difference of 15700 volts between the two plates, what speed do the electrons reach? (You can use the nonrelativistic approximation here.)

v = [ ] m/s



$$V = \frac{\Delta U}{q}$$

$$\Delta U = Vq$$

$$\Delta K = -\Delta U$$

$$\Delta K = -Vq$$

$$\frac{1}{2} m v^2 = -Vq$$

$$v^2 = -\frac{2Vq}{m}$$

$$v = \sqrt{\frac{-2Vq}{m}}$$

$$= 7.43e7 \text{ m/s}$$