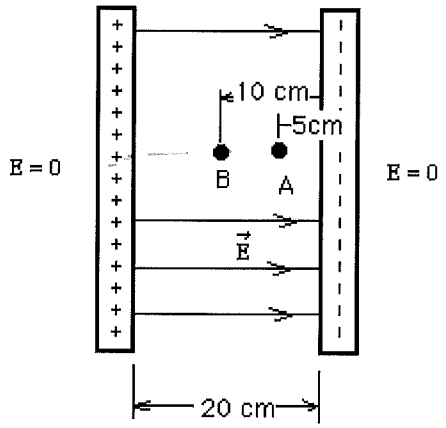
Physics 12
Section 17-1
Electric Potential and Potential Difference.

1. Charges in an electric field have a certain amount of <u>electric potential energy</u> due to their position in an electric field.



$F_c = \frac{k Q_1 Q_2}{r^2}$

2. If a positive charge were at position B it would have more <u>electric potential energy</u> than at A.

3. If a negative charge were at position A it would have more <u>electric potential energy</u> than at B.

4. The <u>electric potential</u> V_A, at location A, can be defined to be the <u>electric potential energy</u> per unit charge.

$$V_A = Ep_A/q$$

The unit of measure for <u>electric potential</u> is the Volt V

$$1V = 1J/C$$

5. Differences in electric potentials can be calculated using:

$$\Delta V = \Delta Ep/Q$$

$$\Delta Ep = Ep_2 - Ep_1$$

This is equal to the negative of the work done by the field moving the charge from location 1 to 2.

$$\Delta V = -W/Q$$

Example 17-1 page 505: Suppose an electron in the picture tube of a television set is accelerated from rest through a potential difference of 5000V. What is the change in potential energy of the electron?

$$\Delta V = \Delta Ep/Q$$

$$\Delta Ep = \Delta V \times Q$$

$$\Delta Ep = (+5000V) \times (-1.6 \times 10^{-19}C)$$

Note the ΔV is positive since the final potential is higher than the initial potential

$$\Delta Ep = -8.0 \times 10^{-16}J$$

What is the speed of the electron as a result of the acceleration?

$$\Delta KE = -\Delta PE$$

$$\tfrac{1}{2}mv^2 = -q\,\Delta V$$

$$v = \sqrt{\frac{-2q\,\Delta V}{m}}$$

$$v = \sqrt{\frac{-2(-1.6 \times 10^{-19}C)(5000V)}{9.1 \times 10^{-31}kg}}$$

Repeat for a proton accelerating through a potential difference of –5000V

$$\Delta Ep = \Delta V \times Q$$

$$\Delta Ep = (1.6 \times 10^{-19})(-5000V)$$

$$\Delta Ep = 4.2 \times 10^{7} m/s$$

$$\Delta KE = -\Delta PE$$

$$\tfrac{1}{2}mv^2 = -q\,\Delta V$$

$$v = \frac{-2q\,\Delta V}{m}$$

$$v = \frac{-2(1.6 \times 10^{-19} C)(-5000V)}{1.67 \times 10^{-27} Kg}$$

Do # 1-4 page 522