

## Chapter 21: Electric Potential

### Questions & Problems

$$W = \Delta U_E = q\Delta V \quad K_1 + U_1 = K_2 + U_2 \quad V = KQ/r \quad \Delta V = Ed$$

#### Example 20.1

At one point in space, the electric potential energy of a 15 nC charge is 45  $\mu$ J.

- What is the electric potential at this point?
- If a 25 nC charge were placed at this point, what would its electric potential be?

#### Example 20.2

It takes 3.0  $\mu$ J of work to move a 15 nC charge from point A to B. It takes  $-5.0 \mu$ J of work to move the charge from C to B. What is the potential difference  $V_C - V_A$ ?

**Example 20.3**

An electron with an initial speed of 500,000 m/s is brought to rest by an electric field.

- a. Sketch the situation. Did the electron move into a region of higher potential or lower potential?
- b. What was the potential difference that stopped the electron?
- c. What was the initial kinetic energy of the electron, in electron volts?

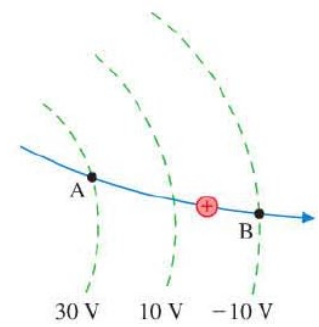
**Example 20.4**

A 2.0 cm by 2.0 cm parallel-plate capacitor has a 2.0 mm spacing. The electric field strength inside the capacitor is  $1.0 \times 10^5$  V/m.

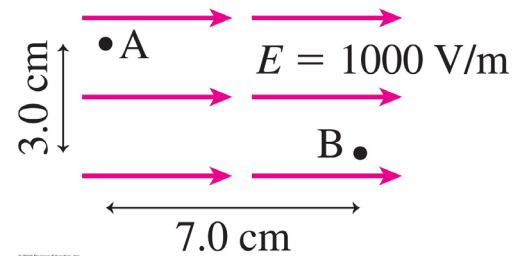
- a. What is the potential difference across the capacitor?
- b. How much charge is on each plate?

**Example 20.5**

A proton's speed as it passes point A is  $50,000 \text{ m/s}$ . It follows the trajectory shown in to the right. What is the proton's speed at point B?

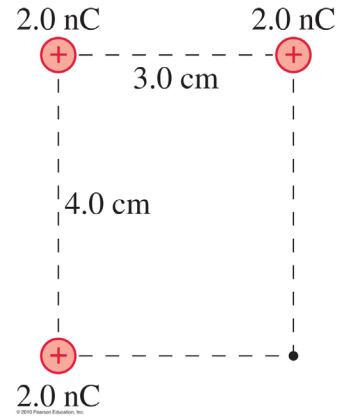
**Example 20.6**

- In the figure to the right, which point, A or B, has the higher electric potential?
- What is the potential difference between A and B?



**Example 20.7**

What is the electric potential at the point indicated with the dot in the figure to the right?

**Example 20.8**

- What is the potential difference between the terminals of an ordinary AA or AAA battery? (If you're not sure, find one and look at the label.)
- An AA battery is connected to a parallel-plate capacitor having a  $4.0\text{-cm}$ -diameter plates spaced  $2 \text{ mm}$  apart. How much charge does the battery move from one plate to the other?
- Electric outlets have a voltage of approximately  $120 \text{ V}$  between the two parallel slots. Estimate the electric field strength between these two slots.

**Example 21.9**

Three electrodes, 1 – 3, are attached to a patient as shown. During ventricular depolarization, across which pair of electrodes is the magnitude of the potential difference likely to be the smallest? Explain.

