

## CONCEPT: ELECTRIC POTENTIAL

- ELECTRIC POTENTIAL, also called simply POTENTIAL, is related to, but **different** from Electric Potential ENERGY.

FIELD → FORCE	POTENTIAL → ENERGY
<ul style="list-style-type: none"><li>- A single charge produces an Electric FIELD</li><li>- Field tells charges how much _____ to feel</li> <li>- Once there's a second charge, there is _____ → <math>\mathbf{F} = q \mathbf{E}</math><ul style="list-style-type: none"><li>- E is the strength of the _____ field</li><li>- q is the [ <b>PRODUCING</b>   <b>FEELING</b> ] charge</li></ul></li></ul> <p>→ "Electric FIELD" E = FORCE Field</p>	<ul style="list-style-type: none"><li>- A single charge also produces an Electric POTENTIAL</li><li>- Potential tells charges how much _____ to have</li> <li>- Once there's a second charge, there is _____ → <math>\mathbf{U} = \underline{\hspace{2cm}}</math><ul style="list-style-type: none"><li>- V is the strength of the _____ field</li><li>- q is the [ <b>PRODUCING</b>   <b>FEELING</b> ] charge</li></ul></li></ul> <p>→ "Electric POTENTIAL" V = ENERGY Field</p>

- The UNIT of Electric Potential is the \_\_\_\_\_ ( $\mathbf{V} = \frac{1\text{J}}{1\text{C}}$ )
  - CAREFUL! **V** is the symbol for both Electric Potential AND its unit. Example: \_\_\_\_\_

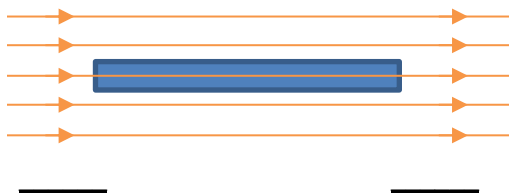
EXAMPLE: A 5C and 3C charge are separated by some distance. If the 5C charge feels 200 V from the 3C charge, what is the potential energy of the 5C charge?

### CONCEPT: MOVEMENT OF CHARGES IN POTENTIAL FIELDS

- [ + | - ] charges ALWAYS move to low potential, and [ + | - ] charges ALWAYS to high potential.
  - Potential is a field that provides “motivation” for charges to move → gives them potential energy

EXAMPLE: An electron is at rest between two points, A at 10 V, and B at 0 V. Which point will the electron move to?

EXAMPLE: A metal rod is placed in a uniform electric field as shown below. Which end of the rod is at a higher potential?



## CONCEPT: POTENTIAL DUE TO A POINT CHARGE

- Remember: Electric POTENTIAL (POTENTIAL) is an ENERGY field  $\rightarrow U = qV \rightarrow V = \underline{\hspace{2cm}}$

$\rightarrow$  So we think of POTENTIAL as Electric Potential Energy per                     .

- A POINT CHARGE produces a Potential:

-  $V = \underline{\hspace{2cm}}$                       - Units are VOLTS (1 V)

- Potential **DIFFERENCE**  $\rightarrow$  difference in potential between 2 points =                      (aka                     )

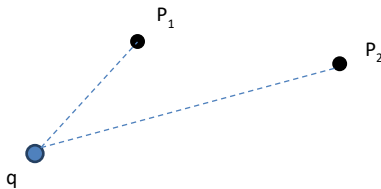
- CAREFUL! Voltage          Volts

- Potential **DIFFERENCE** measured from Point A to Point B  $\rightarrow \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

- This means that a charge  $q$  either gains or loses energy through a potential difference.

$\rightarrow \Delta U = \underline{\hspace{2cm}}$

EXAMPLE: a) What is the potential 0.5 m away from a  $2\mu\text{C}$  charge? b) What about 1 m away? c) What is the potential difference from  $P_1$  to  $P_2$ ? The voltage?



$\rightarrow$  Remember: Voltage is         , not         !

**PRACTICE: ELECTRIC POTENTIAL DUE TO A POINT CHARGE**

How far from a  $5\text{ }\mu\text{C}$  charge will the potential be  $100\text{ V}$ ?

**PRACTICE: POTENTIAL BETWEEN TWO POINT CHARGES**

A  $-1\ \mu\text{C}$  and a  $5\ \mu\text{C}$  charge lie on a line, separated by 5cm. What is the electric potential halfway between the two charges?

### EXAMPLE: POTENTIAL DIFFERENCE BETWEEN TWO CHARGES

Two charges,  $q$  and  $-3q$ , lie on a line as shown below. What is the potential difference between point A and point B?

