

CONCEPT: RELATIONSHIPS BETWEEN FORCE, FIELD, ENERGY, POTENTIAL

- So far we have seen FOUR related terms with similar NAMES and EQUATIONS. Now let's put it all together:

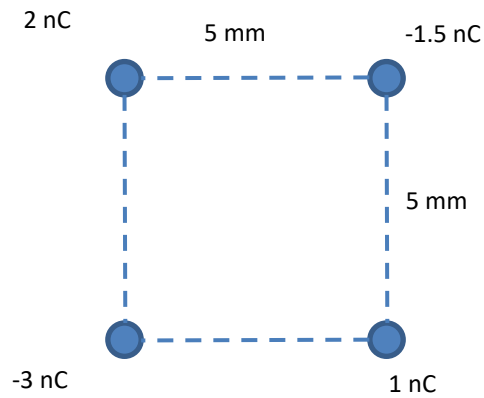
	r^2	r
$q_1 q_2$	ELECTRIC <u>FORCE</u> $F = k \frac{q_1 q_2}{r^2}$	ELECTRIC POTENTIAL <u>ENERGY</u> $U = k \frac{q_1 q_2}{r}$
q	ELECTRIC <u>FIELD</u> (ELECTRIC FORCE FIELD) $E = k \frac{q}{r^2}$	ELECTRIC <u>POTENTIAL</u> (POTENTIAL) (ELECTRIC ENERGY FIELD) $V = k \frac{q}{r}$

→ Remember:

- Electric Potential DIFFERENCE = Potential Difference = VOLTAGE = ΔV
- Electric Potential *ENERGY* difference = $-\Delta U$ = "WORK"

EXAMPLE: POTENTIAL AT CENTER OF CHARGES ARRANGED IN A SQUARE

What is the potential at the center of the arrangement shown in the following figure?



PRACTICE: POTENTIAL DIFFERENCE DUE TO A POINT CHARGE

A -2 C charge lies at rest. a) What is the potential difference between point A, which is 1.5 m from the charge, and point B, which is 4 m from the charge? b) What would the work on a 4 C charge be to move it from A to B?

EXAMPLE: POTENTIAL DIFFERENCE DUE TO TWO CHARGES

A 5 nC charge and a -3 nC charge lie on a line, separated by 6 mm. a) What is the potential halfway between the two charges on the line connecting them? b) What is the potential halfway between the charges, but 4 mm *above* the line connecting them? c) How much work would it take to move a 1 nC charge from the first point to the second?

PRACTICE: STOPPING A POINT CHARGE

A 5 g, 3 μC point charge is moving with an initial speed of 20 m/s away from a $-5 \mu\text{C}$ charge. If they are initially 5 cm apart, how far can the 3 μC travel before stopping?