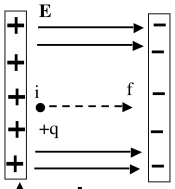
A *positive* charge q is released from position i to position f between the plates of a charged capacitor.

Did the pot. energy (PE) increase or decrease?

Did the voltage (V) at the position of the test charge increase or decrease?



A: PE ↑, V ↑ B: PE ↑, V ↓

C: PE ↓, V ↑ D: PE ↓, V ↓

E: None of these.

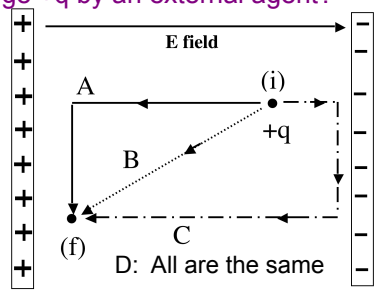
$$\Delta V = \Delta PE / q$$

$V = kQ/r$ near a point charge Q, assuming V=0 at ∞

$\Delta V = -\vec{\mathbf{E}} \bullet \Delta\vec{\mathbf{d}}$

if E is constant, e.g. in a capacitor

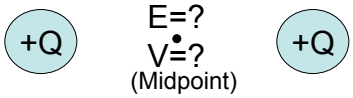
Which path requires the most work on charge +q by an external agent?



D: All are the same

Two identical charges, +Q and +Q, are fixed in space. What is the magnitude of the E field, and the value of the voltage, at the midpoint between them?

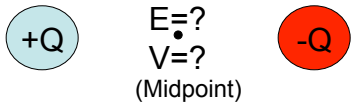
(Assume the potential is zero at infinity.)



A) **E**=0 , V nonzero
B) **E** nonzero , V=0
C) Both are 0
D) Both are nonzero
E) ???

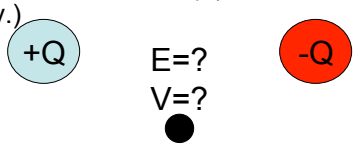
Two charges, +Q and -Q, are fixed in space. What is the magnitude of the E field, and the value of the voltage, at the midpoint between them?

(Assume the potential is zero at infinity.)



A) **E**=0 , V nonzero
B) **E** nonzero , V=0
C) Both are 0
D) Both are nonzero
E) ???

+Q and -Q, are fixed in space. What is the magnitude of the E field, and the value of the voltage, at the point shown? (equidistant from both!) (Assume V=0 at infinity.)

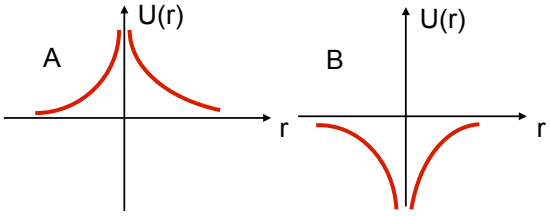


A) **E**=0 , V nonzero
B) **E** nonzero , V=0
C) Both are 0
D) Both are nonzero

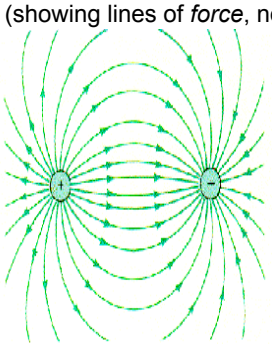
Two point chargesare separated by distance r.

$$U(r) = \frac{kQ_1Q_2}{r}$$

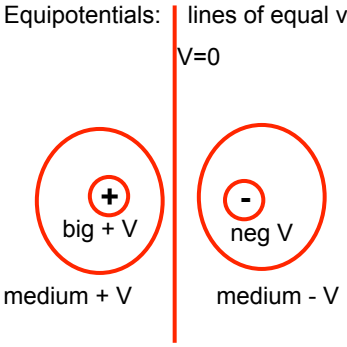
Which graph is correct for two - charges?



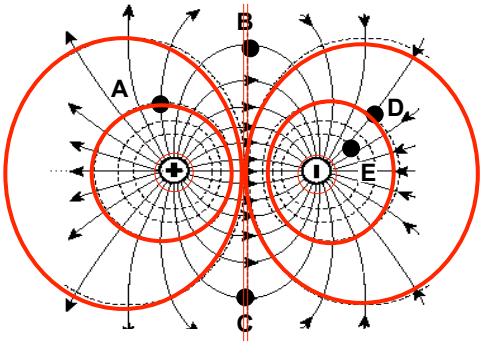
E-field lines (showing lines of *force*, not energy!)



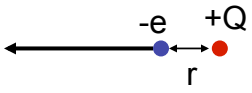
Equipotentials: lines of equal voltage



At which labeled point is voltage highest?



An electron is fired away (left) from a large + charged point starting at a distance r.



The electron will escape (go out to -∞) if:

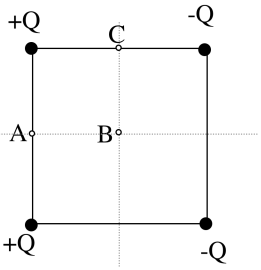
A: $|v| \geq \sqrt{\frac{2kQe}{mr}}$ B: $|v| \geq \frac{kQ}{r}$

C: $|v| \geq \sqrt{\frac{kQe}{mr}}$ D: It will never escape

4 point-charges (same magnitude, sig shown) are arranged square.

(Assume the potentia V=0 at infinity)

At which one of the "r points" (A, B, C) is th potential V=0?



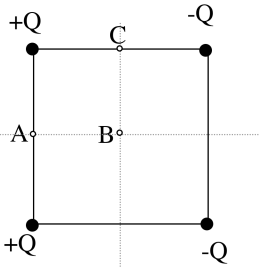
A, B, C (only), or… D: Both B and C

E: (Some other combination)

4 point-charges (same magnitude, signs shown) are arranged in a square.

(Assume the potential V=0 at infinity)

At which one of the "mid-points" (A, B, C) is the Electric Field 0?



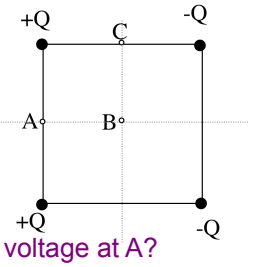
A, B, C (only), or… D: Both B and C

E: None of these

4 point-charges (same magnitude, signs shown) are arranged in a square.

(Assume the potential V=0 at infinity)

To think about:



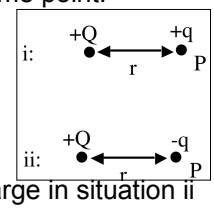
What is the sign of the voltage at A?

Two test charges are brought separately into the vicinity of a fixed charge +Q.

i: +q is brought to point A, "r" away.

ii: -q is brought to the same point.

(U=0 and V=0 at ∞)



The potential, V, at point P is ...

A: Greater for the +q charge in situation i

B: Greater for the -q charge in situation ii

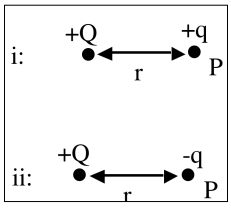
C: The same for both.

The potential energy, U of the test charge in situation i is ...

A: Greater than in situation ii

B: Smaller than in situation ii

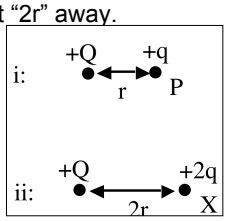
C: The same for both.



Two test charges are brought separately into the vicinity of a fixed charge +Q.

i: +q is brought to point A, "r" away.

Ii: +2q is brought to a point “2r” away.



(U=0 and V=0 at ∞)

The potential (V) at point P (in situation. i) is

A: greater than…

B: Less than…

C: The same as…

…the potential at point X in situation ii.

The potential energy, U of the test charge in situation i is ...

A: Greater than in situation ii

B: Smaller than in situation ii

C: The same for both.