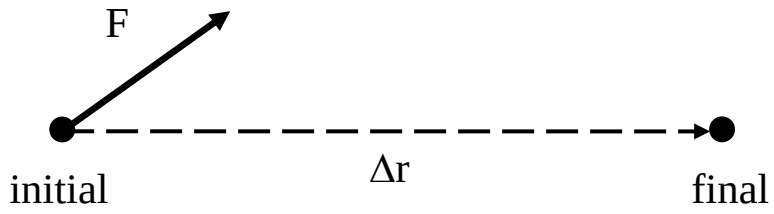
CTVoltage-1.
Two charges, +Q and +2Q are released from rest a distance R apart.

Each particle feels only the coulomb force due to the other charge. As the particles continue to move apart after their release, the speed of each particle

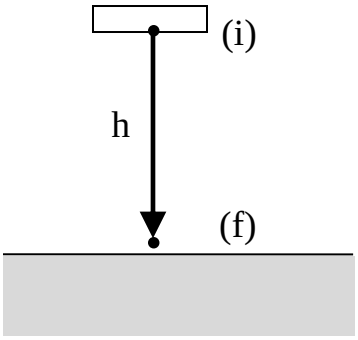
A) decreases B) increases C) stays the same

Answer: the speed increases. The acceleration decreases as they move apart, but the acceleration is never zero, so the particles never stop going faster and faster.

CTVoltage-2. The work done by a constant force $\vec{F}$ in moving an object through a displacement $\Delta\vec{r}$ is defined as $W_F = \vec{F}\cdot\Delta\vec{r}$



A person carefully lowers a book at constant speed a distance h.

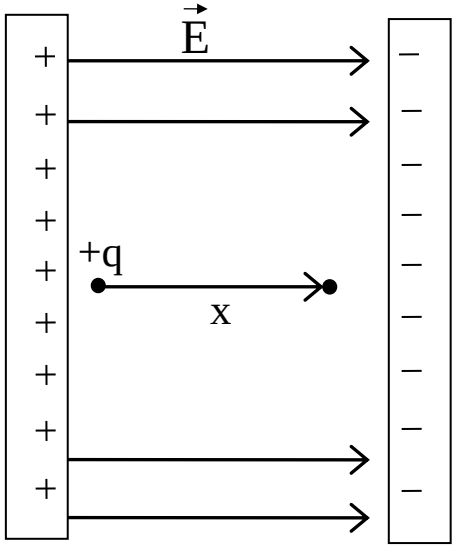


The work done by the person, done by gravity, and done by the *net force* on the book are:

	person	gravity	net force
A)	+	–	+
B)	–	+	–
C)	–	+	0
D)	+	–	0
E)	None of these.		

Answer: The work done by the person is negative; the work done by gravity is positive; the work done by the net force is zero.

CTVoltage-3. A positive test charge +q is carefully moved by some external agent (tweezers) at constant speed a distance x between two capacitor plates in the direction along the electric field.



The work done by the agent, done by the electric field, and done by the **net force** on the test charge are:

	agent	field	net force
A)	+	–	+
B)	–	+	–
C)	–	+	**0**
D)	+	–	**0**
E)	None of these.		

The change in electrostatic potential energy PE $\Delta U = +W_{ext} = -W_{field}$ of positive test charge was

A) positive (the PE increased)
B) negative (PE decreased)
C) zero (the PE remained constant)

The change in voltage of the test charge was
A) negative(V decreased) B) positive (V increased)
C) zero, no change in voltage

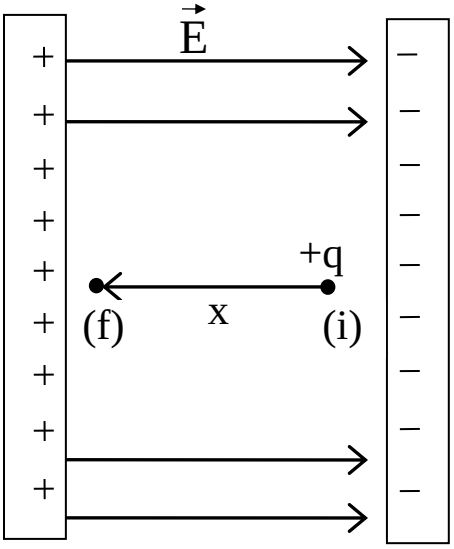
Answers: The work done by the agent is negative (the agent has to restrain the particle as it is moved). The work done by the field is positive; the work done by the net force is zero.

The change in the PE was negative (PE became more negative), since the work done by the external agent is negative.

The change in the voltage is negative (V became more negative as we moved from near positive charges to near negative charges.)

CTVoltage-4.

A positive charge +q is moved from position i to position f between the plates of a charged capacitor as shown. As the test charge +q was moved from i to f, the potential energy (U) increased or decreased and the voltage (V) at the position of the test charge increased or decreased.



A) PE increased and V decreased.
B) PE decreased and V increased.
C) PE increased and V increased.
D) PE decreased and V decreased.
E) None of these.

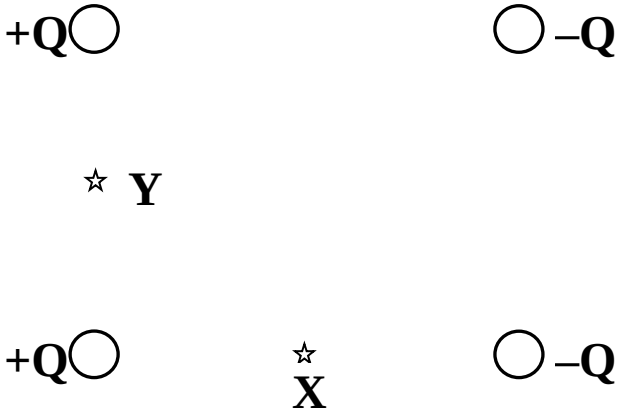
What if the test charge was negative –q (same choices) ?

Answers: For the positive charge (+q) moving to the left, the PE increases and the voltage V also increases. For a negative charge (–q) moving to the left, the PE decreases, but the voltage still increases.

The voltage at the location of a test charge does not depend on the test charge. The PE of a test charge does depend on the test charge.

CTVoltage-5.

Consider 4 charges +Q, +Q, –Q, and –Q arranged in a square, with points X and Y located midway between a pair of charges, as shown.



At point X, the voltage is.. A) positive B) negative C) zero

At point Y, the voltage is.. A) positive B) negative C) zero

At point Y, the electric field ...
A) is zero B) points right C) points left
D) points up E) points down

Answers: At point X, the voltage is zero. At point Y, the voltage is positive. At Point Y, the E-field points right.
