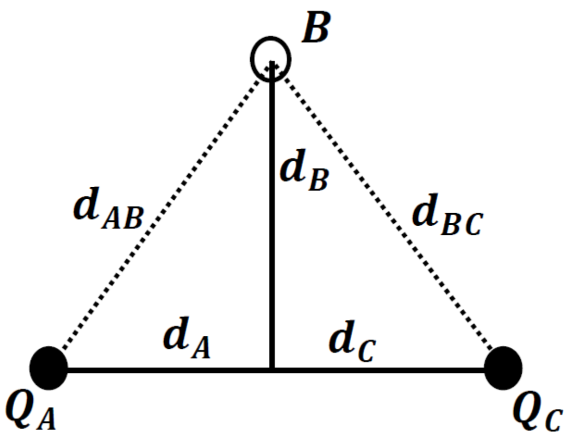
Quiz Average 6.6 **Quiz High Score** 10

PH 202 **Quiz # 03 (10 pts)** **Name** Solution



As shown on the left the three corners of the triangle have charges $Q_A = +26.9\ \mu C$ in the lower left corner, and $Q_C = -50.4\ \mu C$ in the lower right corner. The distances shown in the diagram are: $d_A = 3022.0\ m$, $d_B = 5234.3\ m$, $d_C = 3022.0\ m$, $d_{AB} = 6044.0\ m$, and $d_{BC} = 6044.0\ m$. What is the electric potential at Point B due to the existence of charges A and C?

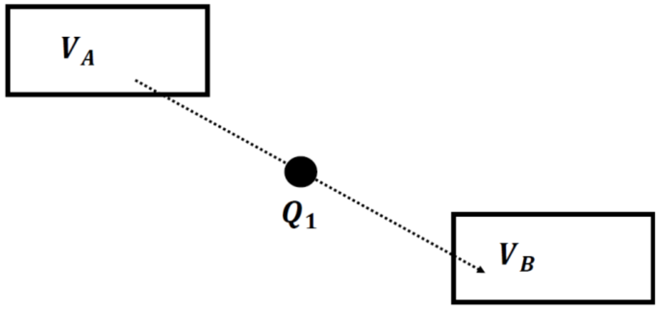
A. $-115.\ V$ **B.** $+115.\ V$ **C.** $+34.9\ V$ **D.** $\mathbf{-34.9\ V}$

$$V_B = V_{AB} + V_{BC} = k\frac{Q_A}{d_{AB}} + k\frac{Q_C}{d_{BC}} = \frac{k}{d}(Q_A + Q_C)$$

$$V_B = \frac{\left(8.99\ x\ 10^9\ {Nm^2}/{C^2}\right)}{(6044.0\ m)}(+26.9\ \mu C - 50.4\ \mu C) = \left(1.487\ x\ 10^6\ {Nm}/{C^2}\right)(-23.5\ x\ 10^{-6} C)$$

$$V_B = -34.9\ {Nm}/{C} = -34.9\ V$$

So, the correct answer is D !



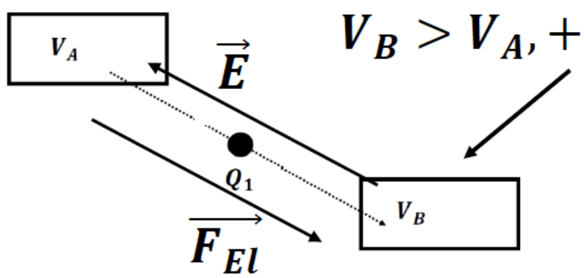
As shown above a charge $Q_1 = -1.23$ mC is moved from voltage $V_A = -137.$ V to a voltage of $V_B = -73.0.$ V . How much work did the electric field do as the charge moves from V_A to V_B ?

A. $\mathbf{+7.87 \text{ x } 10^{-2}\ J}$ **B.** $-7.87 \text{ x } 10^{-2}$ J **C.** $+1.69 \text{ x } 10^{-1}$ J **D.** $-1.69 \text{ x } 10^{-1}$ J

$$\boldsymbol{W_{Field} = -\Delta U_{Field} = -Q\Delta V = -Q_1(V_B - V_A) = -(-1.23\ x\ 10^{-3}\ C)\big(-73.0\ V - (-137.V)\big)}$$

$$\boldsymbol{W_{Field} = +1.23\ x\ 10^{-3}\ C(+64.0\ V) = +7.87\ x\ 10^{-2}\ J}$$

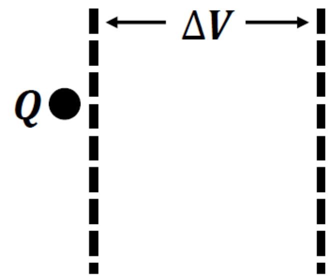
Alternatively consider the orientation of the electric field between these two voltages



Since Electric force is given by $\overrightarrow{F_{El}} = Q\vec{E}$ and Q is negative the force is opposite to the direction of the Electric Field. So, the electric force is in the direction the charge is moving, so force in direction of displacement must be positive work!

So, the correct answer is A !

Pictured to the right is a charge $(Q = -7.30 \text{ x } 10^{-3} C)$ which has a mass of $(m = 8.71 \text{ x } 10^{-6} \text{ kg})$. The charge is initially located at the left side of an unknown potential difference (ΔV). The charge initially has a velocity of $\left(\vec{v} = 1.56 \text{ x } 10^{4} \, {}^{m}/_{s} \, \widehat{Right}\right)$, but after it crosses the potential difference to the right, it is now at rest. What is the magnitude of the potential difference and which side (Right or Left) is the more positive side of the potential difference?



A. $1.45 \text{ x } 10^{5}$ V, Right Side is more Positive

B. **$1.45 \text{ x } 10^{5}$ V, Left Side is more Positive**

C. $9.29 \text{ x } 10^{4}$ V, Right Side is more Positive

D. $9.29 \text{ x } 10^{4}$ V, Left Side is more Positive

The charge has kinetic energy on the left side (its velocity is not zero there) and the kinetic energy is gone on the right side (its velocity is zero there). So, the kinetic energy is transformed into potential energy. So, using conservation of energy we can write:

$$\frac{1}{2}mv_0^2 = Q\Delta V$$

Solving for ΔV

$$\Delta V = \frac{mv_0^2}{2Q} = \frac{(8.71 \text{ x } 10^{-6} \, kg)(1.56 \text{ x } 10^{4} \, {}^{m}/_{s})^2}{2(7.30 \text{ x } 10^{-3} \, C)} = \frac{2.12 \text{ x } 10^{3} \, J}{1.46 \text{ x } 10^{-2} \, C} = 1.45 \text{ x } 10^{5} \, V$$

Now, since the charge is negative and it is slowing down going to the right, the right side of the potential difference must be more negative than the left side. So, the Left side is more positive!

So, the correct answer is B !

A capacitor has a capacitance of 37.8 mF. When measured a charge of 667. mC is found on the plates of the capacitor. What is the voltage difference between the plates?

A. 39.7 V **B.** 0.0252 V **C.** **17.6 V** **D.** 0.568 V

$$Q = CV$$

$$V = \frac{Q}{C} = \frac{667. \text{ x } 10^{-3} \, C}{37.8 \text{ x } 10^{-3} \, F} = 17.6 \, V$$

So, the correct answer is C !

While erasing a whiteboard, the professor becomes charged due to the friction between the dry eraser and the white board. When his hand is $1.25 \text{ x } 10^{-2}$ m from the metal tray used to hold the eraser, he sees a small flash of lightning as charge jumps from his hand to the tray. The electric field between his hand and the tray is $2.00 \text{ x } 10^{6}\ ^{N}/_{C}$. What is the voltage difference between his hand and the tray?

A. $1.60 \text{ x } 10^{8}$ V **B.** $\mathbf{2.50 \text{ x } 10^{4}}$ **V** **C.** $4.00 \text{ x } 10^{-5}$ V **D.** $6.25 \text{ x } 10^{-9}$ V

$$\boldsymbol{E = -\frac{\Delta V}{\Delta d}}$$

We can ignore the minus sign as it is for direction. Solving for ΔV

$$\boldsymbol{\Delta V = E\Delta d = \left(2.00\ x\ 10^{6}\ ^{N}/_{C}\right)\left(1.25\ x\ 10^{-2}\ m\right) = 2.50\ x\ 10^{4}\ V}$$

So, the correct answer is B !

Please send any comments or questions about this page to ddonovan@nmu.edu

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