Quiz Average 6.0 **Quiz High Score** 8.0

PH 221 **Quiz # 03 (10 pts)** **Name** Solution

A charge ($Q_A = -56.9\ \mu C$) is located a distance ($d = 3.45 \times 10^{-4}\ m$) away from a second charge ($Q_B = +23.9\ \mu C$). What is the electrical potential energy between these two charges?

A. $+3.54 \times 10^4\ J$ **B.** $-1.07 \times 10^8\ J$ **C.** $+1.07 \times 10^8\ J$ **D.** $\mathbf{-3.54 \times 10^4\ J}$

$$U_{el} = \frac{Q_A Q_B}{4\pi\varepsilon_0 d} = \frac{(-56.9 \times 10^{-6}\ C)(+23.9 \times 10^{-6}\ C)}{4\pi\left(8.85 \times 10^{-12}\ C^2/Nm^2\right)(3.45 \times 10^{-4}\ m)} = \frac{-1.360 \times 10^{-9}\ C^2}{3.837 \times 10^{-14}\ C^2/J}$$

$$U_{el} = -3.54 \times 10^4\ J$$

So, the correct answer is D !

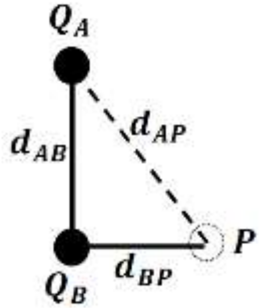
At a point in space the electric potential is found to be ($V_1 = -97.5\ V$) . While at another point in space the electric potential is ($V_2 = +43.1\ V$). What is the work done by the electric field if an object with a charge ($Q_A = +7.23\ C$) is moved from V_1 to V_2?

A. $+393.3\ J$ **B.** $+1017.\ J$ **C.** $\mathbf{-1017.\ J}$ **D.** $-393.3\ J$

$$W_{field} = -\Delta U = -Q_A \Delta V = -Q_A(V_2 - V_1) = -(+7.23\ C)\big(+43.1\ V - (-97.5\ V)\big)$$

$$W_{field} = -(+7.23\ C)(+140.6\ V) = -1016.5\ J = -1017.\ J$$

So, the correct answer is C !



As shown on the left, two charges are on a line ($d_{AB} = 4.00 \text{ x } 10^{-3}$ m). Charge ($Q_A = +5.00$ μC) is at the top and Charge ($Q_B = -3.00 \text{ x } 10^{-3}$ m). A point P is located a distance ($d_{BP} = 3.00 \text{ x } 10^{-3}$ m) to the right of Charge Q_B. What is the total electric potential (V_P) found at point P?

A. $+2.25 \text{ x } 10^{6}$ V **B.** $\mathbf{0.00\ V}$ **C.** $+1.80 \text{ x } 10^{7}$ V **D.** $-1.20 \text{ x } 10^{9}$ V

$$V_P = V_{PA} + V_{PB} = \frac{Q_A}{4\pi\varepsilon_0 d_{AP}} + \frac{Q_B}{4\pi\varepsilon_0 d_{BP}} = \frac{Q_A}{4\pi\varepsilon_0\sqrt{d_{AB}^2 + d_{BP}^2}} + \frac{Q_B}{4\pi\varepsilon_0 d_{BP}}$$

$$V_P = \frac{+5.00 \; x \; 10^{-6} \; C}{4\pi\left(8.85 \; x \; 10^{-12} \; C^2/_{Nm^2}\right)\left(\sqrt{(4.00 \; x \; 10^{-3} \; m)^2 + (3.00 \; x \; 10^{-3} \; m)^2}\right)} + \frac{-3.00 \; x \; 10^{-6} \; C}{4\pi\left(8.85 \; x \; 10^{-12} \; C^2/_{Nm^2}\right)(3.00 \; x \; 10^{-3} \; m)}$$

$$V_P = +8.99 \; x \; 10^{6} \; V + (-8.99 \; x \; 10^{6} \; V) = 0.00 \; V$$

So, the correct answer is B !

An external force does work ($W_{ext} = +6.26 \text{ x } 10^{-4}$ J) on a charge ($Q = +5.87$ μC) which is initially at rest ($K_A = 0.00$ J)at point A. The work brings the charge to point B where the charge now has a kinetic energy ($K_B = +1.43 \text{ x } 10^{-3}$ J). What is the change in potential going from point A to point B?

A. $\mathbf{-137.V}$ **C.** $-350.\text{V}$

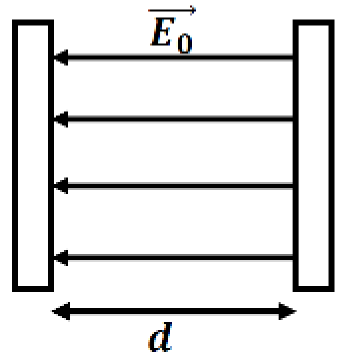
B. $+137.\text{V}$ **D.** $+350.\text{V}$

$$W_{ext} = \Delta E = \Delta U + \Delta K = Q\Delta V + \Delta K$$

$$\Delta V = \frac{W_{ext} - \Delta K}{Q} = \frac{+6.26 \; x \; 10^{-4} \; J - (+1.43 \; x \; 10^{-3} \; J)}{+5.87 \; x \; 10^{-6} \; C} = \frac{-8.04 \; x \; 10^{-4} \; J}{+5.87 \; x \; 10^{-6} \; C} = -137. V$$

So, the correct answer is A !

Two conducting plates are shown on the right. The distance between the two plates is given as $\mathrm{d} = 7.16 \times 10^{-3}\ \mathrm{m}$. The electric field is found to be $\overrightarrow{E_0} = 5.61 \times 10^{4}\ {}^{N}/_{C}\ \widehat{(-\imath)}$. What is the change in voltage going from the left plate to the right plate?



A. $-7.84 \times 10^{6}\ \mathrm{V}$

B. $-4.02 \times 10^{2}\ \mathrm{V}$

C. $+7.84 \times 10^{6}\ \mathrm{V}$

D. $\mathbf{+4.02 \times 10^{2}\ V}$

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

Solve for the change in voltage

$$\Delta V = -E_0 d = -\left(5.61\ x\ 10^{4}\ {}^{N}/_{C}\right)\left(7.16\ x\ 10^{-3}\ m\right) = -401.7\ V$$

This implies that going in the direction of the Electric field (i.e. from right to left as indicated in picture, the change in voltage is $-402.V$, but question is going from left to right, so actual answer is

$$V = +402.V$$

So, the correct answer is D !

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