Quiz Average 6.1 **Quiz High Score** 10

PH 202 **Quiz # 02 (10 pts)** **Name** Solution

An object with a mass of $789.\,\mathrm{kg}$ has a net charge of -63.8 mC on it. It is placed in an electric field and a force of $7850.\,\mathrm{N}\ \widehat{\mathrm{East}}$ acts on the object. What is the magnitude and direction of the electric field acting on the object?

A. $1.56 \times 10^{2}\ \mathrm{N}/_{\mathrm{C}}\ \widehat{\mathrm{East}}$

B. $1.56 \times 10^{2}\ \mathrm{N}/_{\mathrm{C}}\ \widehat{\mathrm{West}}$

C. $\mathbf{1.23 \times 10^{5}\ N/_{C}\ \widehat{West}}$

D. $1.23 \times 10^{5}\ \mathrm{N}/_{\mathrm{C}}\ \widehat{\mathrm{East}}$

$$\vec{F} = Q\vec{E}$$

Solve for $\vec{E}$

$$\vec{E} = \frac{\vec{F}}{Q} = \frac{7850.\ N\ \widehat{East}}{-63.8\ x\ 10^{-3}\ C} = -1.23\ x\ 10^{5}\ {}^{N}/_{C}\ \widehat{East} = 1..23\ x\ 10^{5}\ {}^{N}/_{C}\ \widehat{West}$$

Alternatively, leave sign out and recognize the minus charge means force will go opposite the field.

So, the correct answer is C !

A performer wants to float on a disc to impress a crowd. The performer stands on a special disc that is $3.00\ \mathrm{m}$ in diameter. The combined mass of the disc and the performer is $1250.\,\mathrm{kg}$. An electric field is set up in the performance area that has a magnitude and direction of $\overrightarrow{E_{ext}} = 8.91 \times 10^{6}\ \mathrm{N}/_{\mathrm{C}}\ \widehat{\mathrm{Down}}$. What is sign and magnitude of the charge that must be uniformly distributed on the bottom of the disc for the performer to "Float"?

A. $\mathbf{-1.37\ mC}$ **B.** $+1.37\ \mathrm{mC}$ **C.** $+4.12\ \mathrm{mC}$ **D.** $-4.12\ \mathrm{mC}$

To create floating the electric force must balance the person's weight.

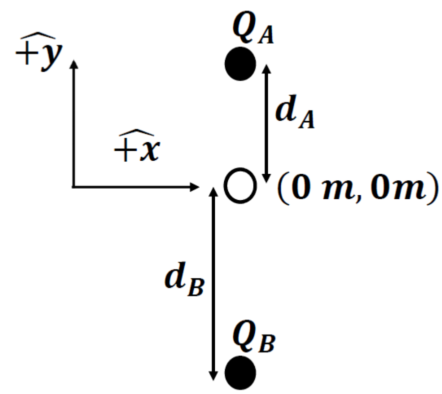
$$F_{El} = QE = mg$$

Since we need the electric force to point up (opposite gravity) and since the electric field is pointing down, Charge must be negative! Solve for charge.

$$Q = \frac{mg}{E} = \frac{(1250.\,kg)\left(9.80\ {}^{m}/_{s^2}\right)}{8.91\ x\ 10^{6}\ {}^{N}/_{C}} = \frac{1.225\ x\ 10^{4}\ N}{8.91\ x\ 10^{6}\ {}^{N}/_{C}} = 1.37\ x\ 10^{-3}\ C = 1.37\ mC$$

So, the correct answer is A !

Two charges are arranged about the origin $(0\text{ m}, 0\text{ m})$ as shown in the figure on the right. Charge A $(Q_A = +16.5\ \mu C)$ is located a distance $(d_A = 8.76 \times 10^{-4}\text{ m})$ and charge B $(Q_B = -6.52\ \mu C)$ is located a distance $(d_B = 13.34 \times 10^{-4}\text{ m})$. What is the magnitude of the electric field found at the origin due to the presence of these two charges?



A. $2.26 \times 10^{11}\ {}^{N}/_{C}\ (\widehat{+y})$

B. $\mathbf{2.26 \times 10^{11}\ {}^{N}/_{C}\ (\widehat{-y})}$

C. $2.13 \times 10^{8}\ {}^{N}/_{C}\ (\widehat{+y})$

D. $2.13 \times 10^{8}\ {}^{N}/_{C}\ (\widehat{-y})$

$$\overrightarrow{E_{Total}} = \overrightarrow{E_A} + \overrightarrow{E_B} = k\frac{Q_A}{d_A^2}\ \widehat{-y} + k\frac{Q_B}{d_B^2}\ \widehat{-y} = k\left(\frac{Q_A}{d_A^2} + \frac{Q_B}{d_B^2}\right)\widehat{-y}$$

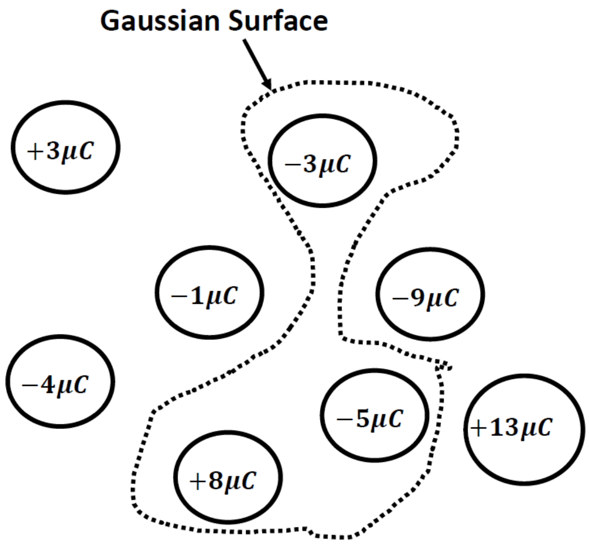
The positive charge Q_A creates a repulsive electric field which would point in the $\widehat{-y}$ direction. The negative charge Q_B creates an attractive electric field which would also point in the $\widehat{-y}$ direction.

$$\overrightarrow{E_{Total}} = k\left(\frac{Q_A}{d_A^2} + \frac{Q_B}{d_B^2}\right)\widehat{-y} = \left(8.99 \times 10^9\ {}^{Nm^2}/_{C^2}\right)\left(\frac{16.5 \times 10^{-6}\ C}{(8.76 \times 10^{-4}\ m)^2} + \frac{6.52 \times 10^{-6}\ C}{(13.34 \times 10^{-4}\ m)^2}\right)(\widehat{-y})$$

$$\overrightarrow{E_{Total}} = \left(8.99 \times 10^9\ {}^{Nm^2}/_{C^2}\right)\left(21.5\ {}^{C}/_{m^2} + 3.66\ {}^{C}/_{m^2}\right)(\widehat{-y})$$

$$\overrightarrow{E_{Total}} = \left(8.99 \times 10^9\ {}^{Nm^2}/_{C^2}\right)\left(25.2\ {}^{C}/_{m^2}\right)(\widehat{-y}) = 2.26 \times 10^{11}\ {}^{N}/_{C}\ (\widehat{-y})$$

So, the correct answer is B !



The surface in the picture above marked by the dotted line is a Gaussian surface. What is the net electric flux Φ_E passing out of this surface?

A. $\frac{-10\ \mu C}{\varepsilon_0}$ **B.** $\frac{+46\ \mu C}{\varepsilon_0}$ **C.** $\frac{+2\ \mu C}{\varepsilon_0}$ **D.** $\mathbf{\frac{0\ \mu C}{\varepsilon_0}}$

Gauss's Law tells us that

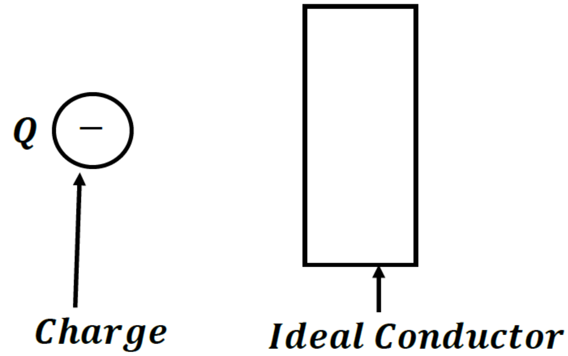
$$\Phi_E = \frac{Q_{enclosed}}{\varepsilon_0}$$

Add up the charges enclosed in the surface

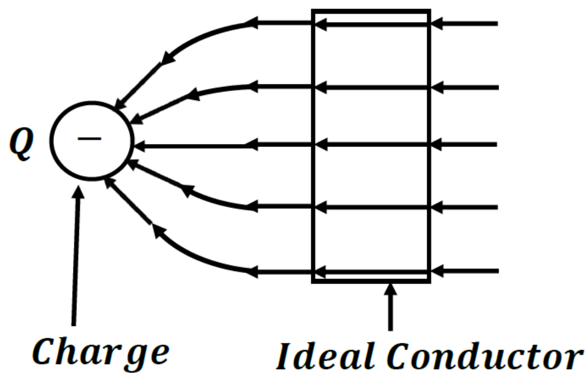
$$Q_{enclosed} = -3\ \mu C - 5\ \mu C + 8\ \mu C = 0\ \mu C$$

So, the correct answer is D !

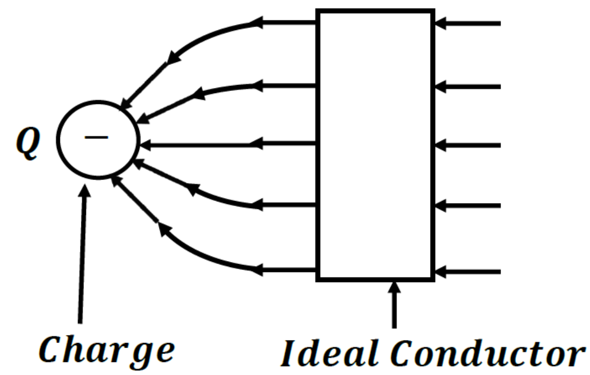
A negative charge Q, is located to the left of an ideal conductor as shown in the figure to the right. Which of the following is the correct visualization for the electric field lines in this situation?



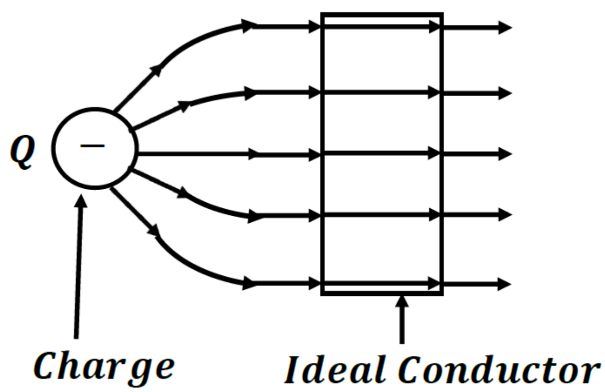
A.



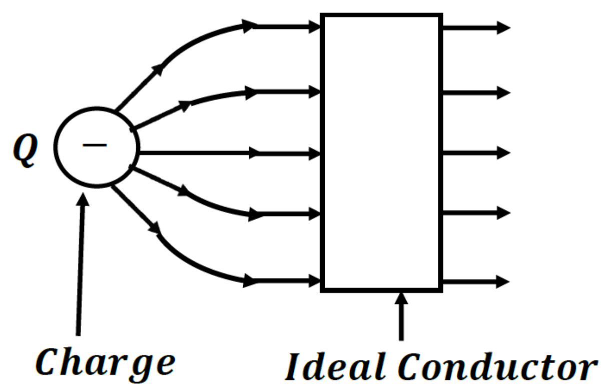
C.



B.



D.



Electric fields cannot exist inside of the ideal conductor. The field lines end on negative charges. So, answer C is the best representation of the Electric Fields lines.

So, the correct answer is C !

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