Name: _____ DISC: _____ Score: _____ / 20

Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- ***Make sure you show all your work and any equations that you use***.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

| Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|
| | | | |
| 5 | 5 | 10 | 5 |

| R | C |
|---|---|
| $70\ \Omega$ | $7.4 \times 10^{-6}\ F$ |

1. The discharging of a capacitor is described by the following equation: $Q = Q_o e^{-\left(\frac{t}{RC}\right)}$. Using the information in the above table, how long (in seconds) does it take the for the charge to decay to $Q = \frac{1}{8}Q_0$?

Answer: 5 pts

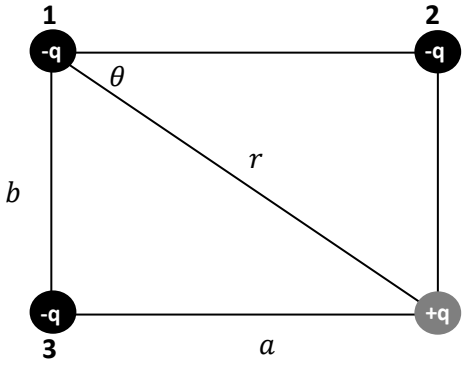
2. The following two questions examine your mastery of two important concepts in electrodynamics.
   a. In your own words, explain the difference between a *conductor* and an *insulator*:

Answer: 2 pts

   b. If a metallic sphere is to be charged by *conduction*, how would you do it:

Answer: 3 pts.

3. Consider the charge distribution in the diagram below:




a. Calculate the magnitude of the force experienced by the charge $+q$ from the charge labeled **1:**

Value for $r$: 1 pt.
Force $F$: 3 pts.

| $q$ | $a$ | $b$ | $k$ | $F$ |
|---|---|---|---|---|
| $2.0 \times 10^{-9}\ C$ | $4.5\ nm$ | $0.6\ nm$ | $9\ \times 10^{9} \frac{Nm^2}{C^2}$ | $k\frac{q_1 q_2}{r^2}$ |

Dipole: 2 pts

b. The charge combination $(+q, q_1)$ forms an *electric dipole.* Why?

$\vec{\boldsymbol{p}}$: 1 pt.
$F_d$: 3 pts.

c. Using the definition of the *electric dipole moment* ( $\vec{\boldsymbol{p}} = q\vec{\boldsymbol{d}}$) find:

i. $\vec{\boldsymbol{p}}$ (be sure to include the direction):

ii. The total force on the dipole $F_d$:

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