

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
70Ω	$6.3 \times 10^{-6} F$

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

Answer: 5 pts

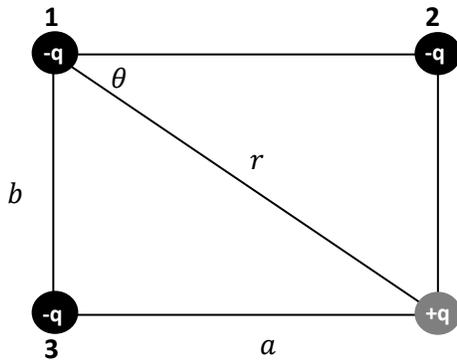
2. The following two questions examine your mastery of two important concepts in electrodynamics.
- In your own words, explain the difference between a *conductor* and an *insulator*:

Answer: 2 pts

- 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
$2.0 \times 10^{-9} \text{ C}$	3.4 nm	0.7 nm	$9 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$	$k \frac{q_1 q_2}{r^2}$

Dipole: 2 pts

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

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

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

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

ii. The total force on the dipole F_d :

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