

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
$70\ \Omega$	$6.3 \times 10^{-6}\ F$

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 the for the charge to decay to  $Q = \frac{1}{8} Q_0$ ?

Answer: 5 pts

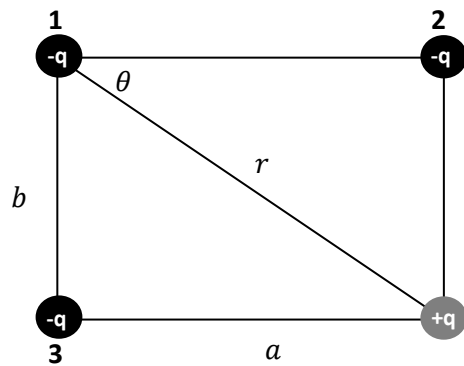
2. The following two questions examine your mastery of two important concepts in electrodynamics.
- a. In your own words, explain the difference between a *conductor* and an *insulator*:

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.

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

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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