

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

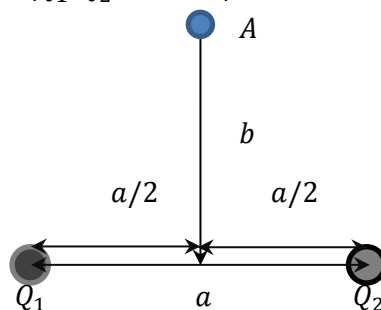
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5

1. Consider the following situation (Q_1, Q_2 are fixed):



a	b	Q_1	Q_2	k	ELECTRIC FIELD	FORCE
4 m	2 m	$+6.0\text{ }\mu\text{C}$	$-3.5\text{ }\mu\text{C}$	$9 \times 10^9\text{ N m}^2/\text{C}^2$	$E(r) = \frac{kq}{r^2}$	$F(r) = \frac{kq_1q_2}{r^2} = qE(r)$

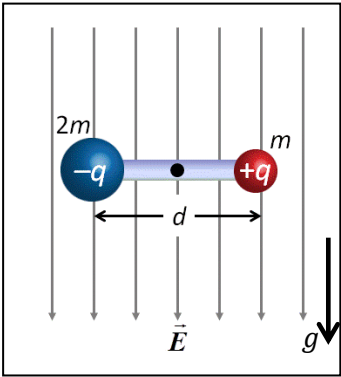
- a. Using the information in the table, find the electric field (magnitude and direction) at point A .

Potential (5 pts):

- b. What force (magnitude and direction) would a charge $q = 1.5\text{ }\mu\text{C}$ experience at point A ?

Work (5 pts):

2. An electric dipole sits perpendicular to an downward-directed electric field, as shown. Gravity also acts downward on the dipole as shown in the diagram. The dipole can rotate about a frictionless axis located a distance $d/2$ from each charge.
- a. What is the electric dipole moment \vec{p} of this dipole? Does it depend on the mass of the charges?



- b. Using the information in the table, find the torque on the dipole due only to the electric field.

Mechanical Torque	$\tau_M = rF \sin \theta$
Electric Dipole Torque due to Field	$\tau_d = pE \sin \theta$
Charge $ q $	$5 \mu\text{C}$
Separation Distance d	0.5 cm
Electric Field E	1100 N/C
Mass m	5 g

- c. Find the mechanical torque on this dipole due to gravity alone.

- d. Does the dipole rotate in this electric field? What field strength would be required to prevent the rotation? (use page 3 to show your work—make sure your answer is clear).

Dipole moment
(1 pts):
Mass dependence
(1pt.):

Dipole Torque (2
pts):

Dipole Torque (2
pts):

Rotate (1 pts):
New Field (3 pts):

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