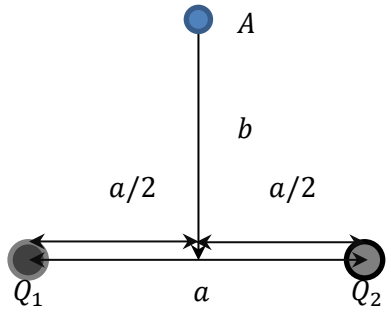
Name: _____ DISC: _____ Score: _____ / 20

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
10	10	5	5

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



a	b	Q_1	Q_2	k	ELECTRIC FIELD	FORCE
$5\ m$	$3\ m$	$+5.0\ \mu C$	$-2.5\ \mu C$	$9 \times 10^9 N\ m^2/C^2$	$E(r) = \frac{kq}{r^2}$	$F(r) = \frac{kq_1q_2}{r^2} = qE(r)$

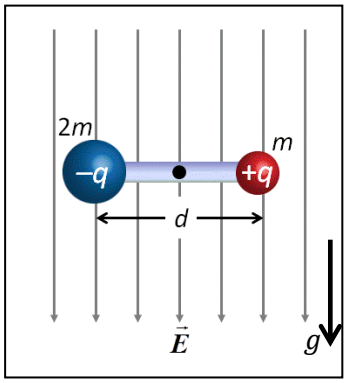
a. Using the information in the table, find the electric field (magnitude and direction) at point A.

Potential (5 pts):

b. What force (magnitude and direction) would a charge $q = 1.5\ \mu C$ 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?

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

   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 $\|q\|$	$3\ \mu C$
Separation Distance d	$0.5\ cm$
Electric Field E	$1300\ N/C$
Mass m	$5\ g$

Dipole Torque (2 pts):

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

Dipole Torque (2 pts):

   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).

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

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