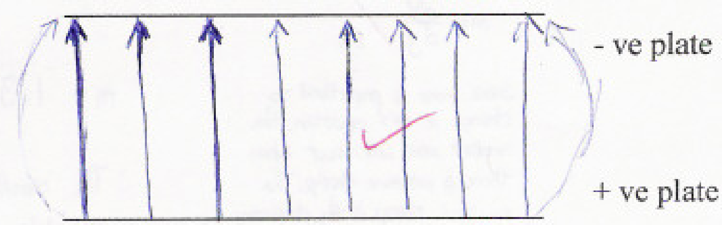
Lab Test - FIELDS

Name: Kevin Siu December 2005
SKILLS: 14 /15 14/14

Part A: Data Analysis
The following questions can be answered directly on this sheet.

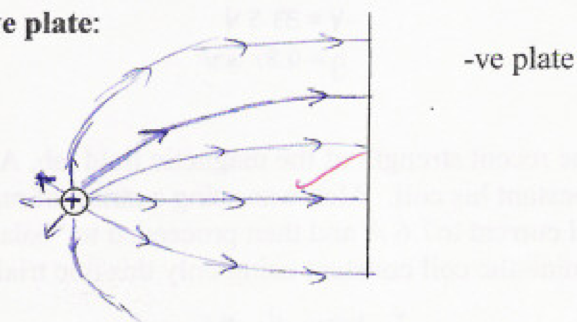
1. State the **type of field lines** most likely present in each situation and **sketch them.** (2 marks each for a total of 6 marks)

a) A parallel plate apparatus:



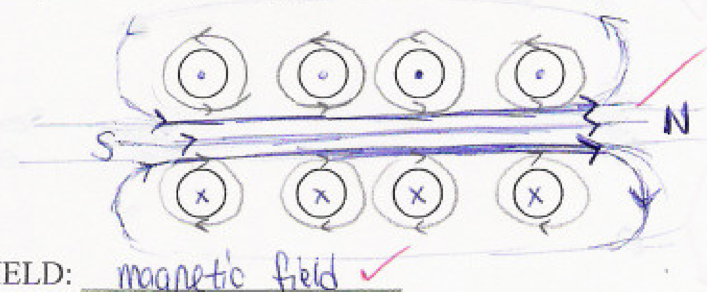
FIELD: electric field

b) A **positive point charge** and a **negative plate**:



FIELD: electric field

c) A solenoid, with **positive current** flowing as indicated:



FIELD: magnetic field

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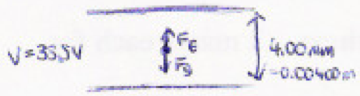
2. While peering into his Millikan apparatus, Dustin DeHouse noticed a piece of dust floating inside his apparatus before any plastic spheres were injected. He found that he could balance this piece of dust against gravity by applying a voltage of 33.5 V across the parallel plates of the apparatus, which were separated by a distance of 4.00mm, like the one that you used in class. What is the ***smallest*** mass that this dust particle could have? (~~5~~ 4 marks)



$F_E = F_g$ ✓

$q\mathcal{E} = mg$

$q\frac{V}{d} = mg$

$m = \frac{qV}{dg}$ ✓

Since mass is proportional to charge in this equation, the smallest mass will occur when there is minimum charge. The smallest charge is the elementary charge - that of an electron.

$\therefore q = e = 1.60 \times 10^{-19}$ C ✓

$d = 0.00400$ m

$V = 33.5$ V

$g = 9.81$ m/s^2

$$m = \frac{(1.60 \times 10^{-19}\ C)(33.5\ V)}{(0.00400\ m)(9.81\ m/s^2)}$$

$m = 1.37 \times 10^{-16}$ kg ✓

$\therefore$ The smallest mass of the dust particle possible is 1.37×10^{-16} kg.

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3. During the recent strength of the magnetic field lab, Alek Trick was having troubles determining the coil constant his coil. Alek was using a string of mass 5.7 g and a loop of width 2.5 cm. Alek set the coil current to7.6 A and then proceeded to "balance" the apparatus with a loop current of 5.8 A. Determine the coil constant using only this one trial... the only one that he did. (4 marks)

$m = 5.7$ g
$= 0.0057$ kg

$L = 2.5$ cm
$= 0.025$ m

$I_{coil} = 7.6$ A

$I_{loop} = 5.8$ A

To balance the string,

$F_{loop} = F_g$

$F_{loop} = (0.0057\ kg)(9.8\ m/s^2)$

$F_{loop} = 0.0559$ N ✓

$B = \frac{F_{loop}}{I_{loop} L}$ ✓

$B = \frac{0.0559\ N}{(5.8 A)(0.025 m)}$

$B = 0.386$ N/Am

$B = kI_{coil}$ ✓

0.386 N/Am $= k(7.6 A)$

$k = 0.051$ N/A^{2}m ✓

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