Physics 222
Winter 1997
January 24, 1997
George A. Williams

Average = 17.9
222 students

FIRST MIDTERM

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Name: _____

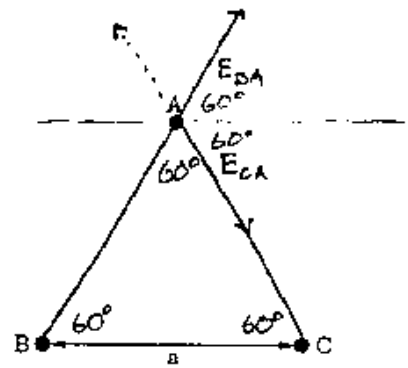
Discussion Instructor (circle): Frolov McKain Osan Strang Zhukov

Discussion Section # _____

SHOW ALL WORK!!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

Points A, B and C are at the corners of an equilateral triangle of side a. A charge of $+6.50 \times 10^{-6}$ C is placed at B. A charge of -9.00×10^{-6} C is placed at C. a = 1.25 cm

(a) Calculate the electric field, magnitude and direction, at point A. Angles are measured counter-clockwise from the positive x-axis.
(b) Calculate the magnitude of the force on a charge of 1.70×10^{-6} C placed at A.



a) $\vec{E}_{BA} = \frac{k(6.5\times10^{-6}C)}{(.0125m)^2}\left[\cos 60^\circ\,\hat{i} + \sin 60^\circ\,\hat{j}\right]$ -2pts for each sign error

$= 1.87\times10^{8}\frac{N}{C}\,\hat{i} + 3.74\times10^{8}\frac{N}{C}\,\hat{j}$ (5pts) -4pts for using the wrong angle

$\vec{E}_{CA} = \frac{k(-9.8\times10^{-6}C)}{(.0125m)^2}\left[\cos 120^\circ\,\hat{i} + \sin 120^\circ\,\hat{j}\right]$ -2pts for using 1.25 instead of .0125 for r.

OR $\frac{k(9.8\times10^{-6}C)}{(.0125m)^2}\left[\cos(-60^\circ)\,\hat{i} + \sin(-60^\circ)\,\hat{j}\right]$

$= 2.59\times10^{8}\frac{N}{C}\,\hat{i} - 4.49\times10^{8}\frac{N}{C}\,\hat{j}$ (5pts)

$\vec{E}_{TOTAL} = (4.46\times10^{8}\,\hat{i} - 1.25\times10^{8}\,\hat{j})\ N/C$ (4pts)

$|\vec{E}| = \sqrt{E_x^2 + E_y^2} = \boxed{4.63\times10^{8}\ N/C}$ (3pts), $\theta = \tan^{-1}\left(\frac{-1.25}{4.46}\right) = \boxed{-15.6^\circ \text{ or } 344^\circ}$ (3pts)

b) $F = (1.7\times10^{-6}C)(4.63\times10^{8}N/C) = \boxed{787\,N}$ (5pts)

No partial credit is given for long calculations in b
5pts is simply given if your answer in b was 1.7×10^{-6} times your answer to part a.