Physics 3B Week 6: Electric Forces and Electric Fields

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Date: February 13, 2008   Day: Wednesday   Hour: 8:00 – 12:50
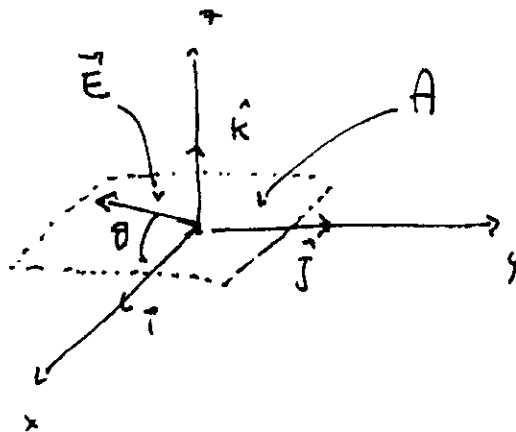
1. A rectangle with area 3 m² lies in the xy plane. There is a uniform electric field $\vec{E} = E_o(\hat{i} + \hat{k})$ where $E_o = 10$ N/C. What is the electric flux Φ through the rectangle?

$$\Phi_e = \oint \vec{E} \cdot d\vec{A}$$
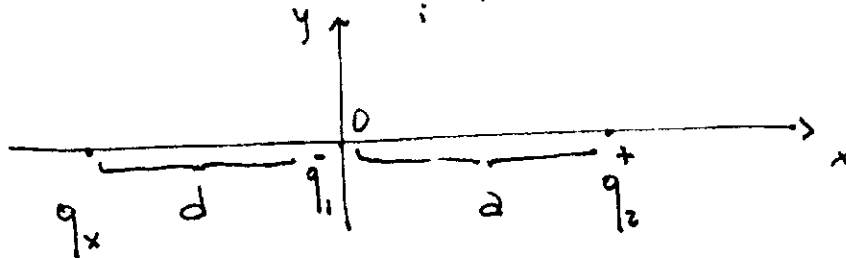
$$\theta = 45° \quad \text{since} \quad E_x = E_z$$

$$\Phi_e = |\vec{E}| \cdot |\vec{A}| \cos 45° = \vec{E} \cdot \vec{A} =$$

$$= \sqrt{2} \, 10 \frac{N}{C} \cdot 3m^2 \cdot \frac{1}{\sqrt{2}} = \boxed{30 \, \frac{Nm^2}{C}}$$

2. Two know charges, $q_1 = -12.0$ μC and $q_2 = 45.0$ μC, and an unknown charge q_u are located on the x axis. q_1 is at the origin, and q_2 is at $x = 15.0$ cm. The unknown charge is to be placed so that each charge is in equilibrium under the action of the electric forces exerted by the other two charges. Is this situation possible? Is it possible in more than one way? Find the required location, magnitude, and sign of the unknown charge q_u. (You can write on the back of the paper.)

the total force must be zero: $\sum \vec{F}_i = 0$ let's call $X = a$

Solve for d; q_x: ?