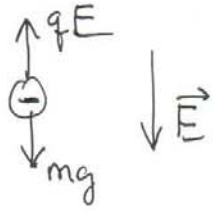
KING FAHD UNIVERSITY OF PERTOLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #6- CHAPTER 22

NAME: Key ID# SECTION#

A charged particle has a mass of 2.0×10^{-4} kg. It is held stationary by a downward 300 N/C electric field.

(a) Calculate the charge of the particle.



$$qE = mg$$

$$\Rightarrow q = \frac{mg}{E}$$

$$= \frac{2 \times 10^{-4} \times 9.8}{300}$$

$$= \boxed{6.5 \times 10^{-6}\ C}$$

(b) Is the charge positive or negative? Explain why?

Negative charge so that the electric force (qE) is opposite to the weight (mg).

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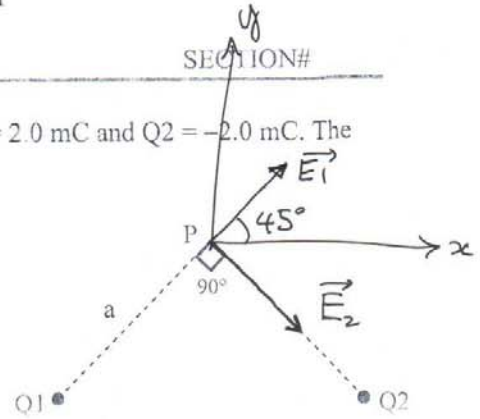
Consider the charges configuration shown in the figure. Q1 = 2.0 mC and Q2 = –2.0 mC. The distance a = 5 cm. Calculate the net electric field at point P.



$$|\vec{E_1}| = |\vec{E_2}| = \frac{kQ}{r^2}$$

$$= \frac{9\times10^{9} \times 2\times10^{-3}}{(0.05)^2}$$

$$= 7.2\times10^{13}\ \frac{N}{C}$$

$$E_y = E_1 \sin 45^\circ - E_2 \sin 45^\circ = 0$$

$$E_x = E_1 \cos 45^\circ + E_2 \cos 45^\circ =$$

$$= 2E_1 \cos 45^\circ$$

$$= 2 \times 7.2\times10^{13} \times \frac{\sqrt{2}}{2} = 1.02\times10^{14}\ \frac{N}{C}$$

$$\vec{E} = 1.02\times10^{14}\ \hat{i} + 0\ \hat{j}\ \ \frac{N}{C}$$

direction : positive x- axis.

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An electric dipole consists of charges +2e and –2e separated by 0.78×10^{-9} m. It is in an electric field of strength 3.0×10^{6} N/C.

(a) How much work is needed to rotate the dipole from perpendicular to the electric field to antiparallel to the electric field direction?

$$W_{app} = \Delta U = U_f - U_i$$

$$U_f = -pE\cos 180^\circ = pE$$

$$U_i = -pE\cos 90^\circ = 0$$

$$W_{app} = pE = qdE$$

$$= (2 \times 1.6 \times 10^{-19})(0.78 \times 10^{-9})(3 \times 10^{6})$$

$$= \boxed{7.5 \times 10^{-22}\ \text{J}}$$

(b) Who does the work, the electric field or external agent? Why?

External agent does the work

because $W_{app} > 0$.