ELECTRIC FIELDS AND THEIR EFFECT ON MATTER

Prof. Stephen Sekula
1/27/2011
Supplementary Material for PHY1308 (General Physics - Electricity and Magnetism)
1) What is the sign of the electric charge in this image?

2) A positive charge is placed at location P. In what direction does it move?

3) Each of the charges shown in the image at the right has the same magnitude, \(|q|=1.0\text{C}\). What is the total charge represented by these two particles, including the sign of their total charge?
Homework 1:

- Due next Monday by 8pm
  - Use courses.smu.edu to submit, if possible

TA-led help sessions/office hours

- Farley Ferrante: FS60
  - Thursday: 6-8pm

- Jessica Ginsberg: FS157
  - Wednesday: 6-7pm
  - Saturday: 6-7pm
DIPPOLE ELECTRIC FIELD
(EXERCISE)

Dipole Length = d

\[ \vec{r} \]

\[ x = -a \]

\[ x = a \]

DISTANCE TO O = x

HEIGHT = y

Dipole Length = d
ASSIGNMENTS: 10 MIN.

- Teams Red and Yellow:
  - Calculate the electric field of the POSITIVE charge at point P
- Team Blue and Green
  - Calculate the electric field of the NEGATIVE charge at point P
- Teams Purple and Tan
  - Calculate the electric field of the POSITIVE charge at point O
- Team Orange
  - Calculate the electric field of the NEGATIVE charge at point O
ANSWERS

- Electric field on perpendicular bisector:

\[
\vec{E}_{\text{bisector}} = -\frac{2kqa}{(a^2 + y^2)^{3/2}} \hat{i} \rightarrow -\frac{2kqa}{y^3} \hat{i} \quad \text{(when } y \gg a)\]

- Electric field on axis of dipole:

\[
\vec{E}_{\text{axis}} = -kq \left| \frac{1}{(x+a)^2} - \frac{1}{(x-a)^2} \right| \hat{i} \rightarrow \frac{4kqa}{x^3} \quad \text{(when } x \gg a)\]
**Terminology:**

\[ \vec{p} = (qd) \hat{d} \]

Separation of charges

Cartoon of a water molecule

**Dipole**
DIPOLe IN ELECTRIC FIELD

\[ \vec{F}_+ = q \vec{E} \]
\[ \vec{F}_- = -q \vec{E} \]

\(\pi - \theta\)