Electric Fields

Equipment

- VPython, Python and the graphical user interface (GUI) IDLE (or VIDLE)

Objective

Models are only as valid as the physics used to create them.

Physics Concepts

- Electric field
- Static charges

Gain experience writing VPython programs

- Create and use graphics windows to plot variables
- Continue to effectively search for help in tutorials and reference manuals

Clearly express assumptions and limits to model

Conceptual (C-Level)

A charge q_1 = -1.4 nC is located at r_1 = < 3, 0, 0> m. Determine the electric field at a point r_p = < 2, 0, 0 > m.

- Write down a symbolic expression for the electric field.
- Write down the numeric answer. Note: The electric field is a vector quantity.

A charge q_2 = 2.4 nC is located at r_2 = < 0, -2, 1> m. Determine the electric field at a point r_p = < -2, 6, -8 > m.

- Write down a symbolic expression for the electric field.
- Write down the numeric answer. Note: The electric field is a vector quantity.

Both q_1 and q_2 are placed at their respective locations.

- Determine the electric field (symbolically) at an arbitrary point r = < x, y, z>

Basic Lab (B-Level)

Use Vpython to graphically represent the net electric field created by the charges specified above. You must demonstrate (run) working code for full credit.

- Choose a minimum of 5 points and draw the net electric field vector.
- Scale the electric field vector appropriately.

Note: You can verify your conceptual answers using this program…

- You may find it useful to change the location and magnitude of your charges to evaluate the correctness of your program.

Your summary will include; (1) a clear explanation (with schematic if appropriate) of what you did to determine the validity of your program and (2) your copiously commented computer code.

Advanced/Extended Lab Ideas (A-Level)

- Use the momentum principle to have a charged object move through a charge configuration. You could use the charge hockey simulation to check your simulation.
- Determine if it is possible to trap a charged particle using an electrostatic configuration of charges.
- Your text suggests computational problems that could be used as a basis for an inquiry.