Physics 153 Section T0H - Week 3
Point Charges

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1 Review

Tutorial assignment marks are online at `http://www.physics.ubc.ca/~blok/phys153/`.

I'll keep the lecture short and the problem easy this time, since you just finished your Optics midterm.

Reminder: you can get help with your homework from the Resource Center in Hebb 12 (here) at the following times:

Thurs	9:30 - 10:30
	12:30 - 2:30
	4:30 - 5:30
Fri	11:30 - 12:30
	2:30 - 5:30

2 Constants

Coulomb's constant: $k = 8.99 \times 10^9 \, \mathrm{N \cdot m^2/C^2}$. (Try not to get it confused with all the other k's you see in this course.)
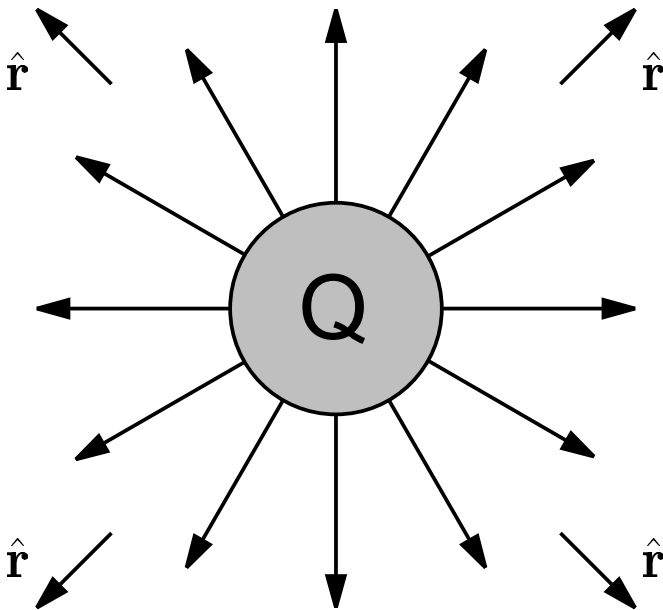
Fundamental charge: $e = 1.60 \times 10^{-19} \, \mathrm{C}$

3 Discrete Charges

A particle with charge Q sets up an electric field $\mathbf{E}$ in space according to Coulomb's law:

$$\mathbf{E} = \frac{kQ}{r^2}\hat{\mathbf{r}} \tag{1}$$

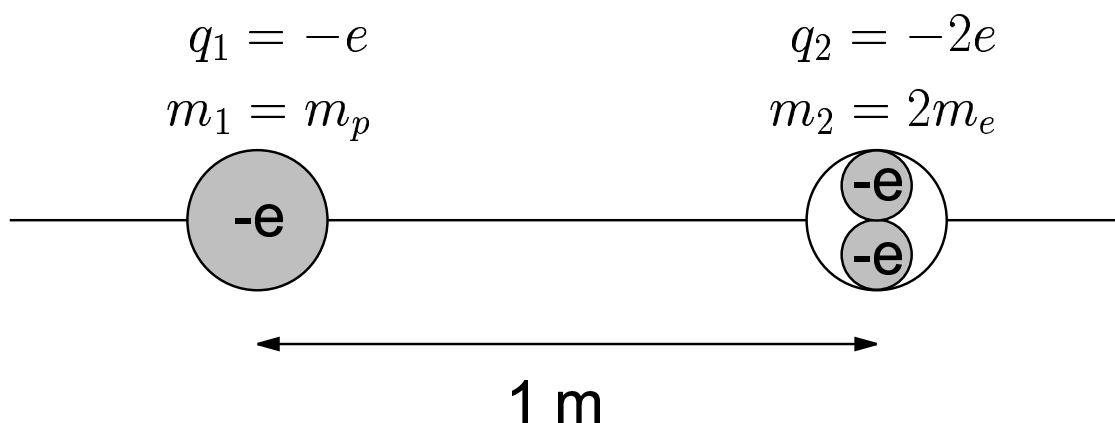The electric field is a vector; it has a direction $\hat{\mathbf{r}}$ which points directly away from the charge.

The electric field applies a force to any other charge q in the region

$$\mathbf{F} = q\mathbf{E} \tag{2}$$

Notice that, by definition, the force is repulsive if both charges are of the same sign, else attractive.

4 Assigned Problem

$$q_1 = -e \qquad\qquad\qquad q_2 = -2e$$
$$m_1 = m_p \qquad\qquad\qquad m_2 = 2m_e$$

Two point charges, one an *anti-proton* with charge $-e$ and the other a closely-bound pair of electrons with charge $-2e$ are held fixed at a separation of $1\,\mathrm{m}$, as shown above. (*a*) At what position may a proton (charge $= +e$) be placed so that it is in electrostatic equilibrium? This configuration is actually unstable. (*b*) Describe what would actually happen to the proton and why. (*Hint:* What other force should be considered?) (*c*) Calculate the proton's initial acceleration.