

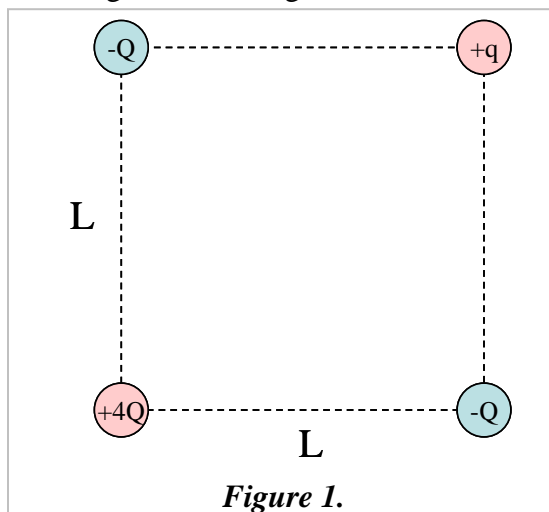
**General for Biological Sciences Majors II (171.104)**  
**Midterm Exam #1, Feb 17, 2009, 8:00am-8:50am**

- Exams are closed book but each student will be allowed to use a single sheet (8.5 x 11 inches, double-sided) of notes. The page (with your name) must be turned in with your blue book.
- Calculators are allowed. Do not bring laptops, PDAs, cell phones, etc.
- Please write all exams in ink. Exams written in pencil cannot be re-graded.
- All work must be done in the blue book except for problem 1, which may be done on the piece of graph paper supplied with the exam.
- Please show all your work.
- All students must bring their J-card IDs to the exam.

**Problem 1.** (25 pts) A 1.0cm tall object is 75cm in front of a converging lens that has a 30cm focal length. Use ray tracing to find the position and height of the image. To do this accurately, use the graph paper supplied with your exam. Determine the image distance and height by making approximate measurements on your diagram

- Calculate the image position and height. Compare those with the answers from ray tracing in part (a).
- How would the image position and height change, if the object is moved to a distance of 60cm from the lens?

**Problem 2.** (25 pts) Figure 1 shows four charges at the corners of a square of side  $L$ . Assume  $q$  and  $Q$  are positive. What is the magnitude and direction of the net force on  $q$ ?



**Problem 3.** (50 pts) An electron is launched at a  $45^\circ$  angle and a speed of  $v=5.0 \times 10^6$  m/s from the positive plate of the parallel-plate capacitor shown on Figure 2. The electron lands 4.0cm away.

- What is the electric field strength inside the capacitor?
- What is the smallest possible spacing between the plates so that the electron does not collide with the top plate?

