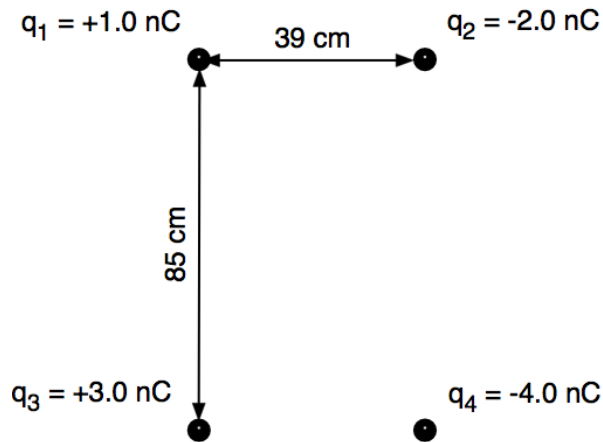


## **Physics 10164 - Summer 2018 - Exam #1**

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer. Clearly indicate your answer with a circle or a box and remember to include correct units and significant figures.

1. (35 pts) Four charges are arranged in a rectangle as shown and fixed in place.
  - a) Determine the magnitude and direction of the electric field at the location of the  $-4.0$  nC particle due to the other charges.
  - b) Determine the magnitude and direction of the electric force acting on the  $-4.0$  nC particle.



2. (35 pts) A 1.46-kg hovercraft on a smooth, horizontal, frictionless surface carries a charge of  $-355\ \mu\text{C}$ . The device is initially moving in the  $+y$  direction with a speed of  $4.40\ \text{m/s}$ . The device is moving through a uniform electric field of  $8520\ \text{N/C}$  pointing in the  $+y$  direction. There is also a constant applied force from the engine of the device of  $5.50\ \text{N}$  pointing in the  $+y$  direction. The applied force and the electric force are the only relevant forces in this problem.

- a) After the device has moved  $5.00$  meters, what is its new speed?
- b) How much work has been done by the electric force during this motion?
- c) If the voltage at the initial position of the device is  $24,500$  Volts, what is the voltage at the final position?

#3. (30 pts) Three point charges are arranged in a line as shown below. The charges  $q_5$  and  $q_3$  are fixed, and  $q_2$  (starting from rest) is free to move. After  $q_2$  (which has a mass of 1.30 kg) has moved a distance of 55.0 cm, what is its final velocity?

