Physics 10164 - Spring 2020 Exam 1D

1) (30 pts) Three charges are fixed in place along the x-axis as shown below.

a) Find the magnitude and direction of the electric field at the location marked x. b) If a 1.25-kg mass with a charge of -6.10 μ C were located at x, what would be the magnitude and direction of its acceleration?

 $q_2 = -2.89 \ \mu C$ $q_5 = -5.28 \ \mu C$ $q_5 = -5.28 \ \mu C$

2) (35 pts) A 3.50-kg model rocket's engines provide a constant upward (+y) applied force of 122 N. The rocket is also moving through a uniform electric field of 7850 N/C pointing in the -y direction. Assume only gravity, the applied force and the electric force are relevant in this problem. Starting from rest, the rocket moves upwards a total distance of 338 meters in 4.68 seconds, and the rocket has some charge q.

- a) Find the value of q for the rocket, and be sure to indicate clearly whether it is positive or negative.
- b) How much work is done by the electric force during this motion?

3) (35 pts) Three charges are arranged in a line as shown below. Assume only the electric force does any work in this problem. Charges q_2 and q_4 remain fixed in place throughout this problem. Charge q_5 has a mass of 35.0 grams and is initially at rest, but it accelerates in response to the electric force acting upon it, moving 23.0 cm in the +x direction to a final location marked by x in the diagram below. What is the speed of charge q_5 when it reaches that final location?

