

Physics 10164 - Spring 2020 Exam 1E

1) (30 pts) An experimenter is attempting to hold a 3.15 kg ball in place. The ball has a $-424 \mu\text{C}$ charge on it, and the ball is immersed in an electric field of magnitude 87500 N/C, pointing in a direction 36.0° above the $-x$ direction. What is the magnitude and direction of the applied force needed to hold the ball in place? Assume gravity, electric and applied forces are all relevant.

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) Charge q_3 ($3.00 \mu\text{C}$) is fixed in place at the origin. Nearby, at a coordinate $x = 7.50 \text{ cm}$, a charge q_4 ($-4.80 \mu\text{C}$) with a mass of 382 grams is initially at rest. An unknown applied force also acts in this problem in addition to the electric force while charge q_4 moves from its initial location at $x = 7.50 \text{ cm}$ to its final location at $x = 4.10 \text{ cm}$. When it arrives at its final location, q_4 has a speed of 1.33 m/s in the $-x$ direction.

How much work is done by the applied force during this motion?