NAME _____ DATE _____

Scenario

A scientist studying pollen collects many identical pollen grains of mass m. The scientist subjects the grains to a process that strips one or more electrons from each grain and then injects the grains into a vertical evacuated tube. At the bottom of the tube is a sphere carrying a charge $Q = 1\,\mu C$. The grains in the tube, subject only to the forces of Earth's gravitational field and the charge Q, group together when they come to equilibrium as shown in the diagram to the right. The numbers on the diagram represent millimeters of distance.

Data Analysis

PART A: Briefly explain why the grains group together rather than being distributed at all points in the tube.
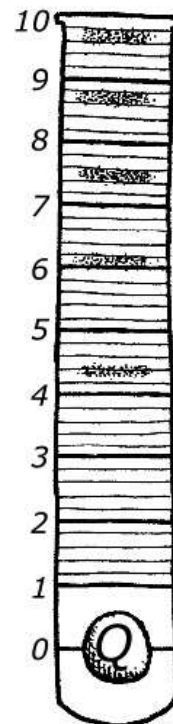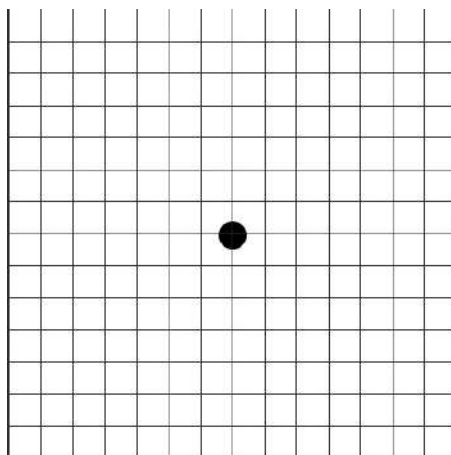
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PART B: Draw a diagram of the forces exerted on a single grain and use the diagram to write an equation that expresses the exerted forces in terms of m, Q, y (the vertical height of the pollen grain), and q (the charge on that grain), plus any other physical constants needed.

PART C: Using the diagram given in the scenario, fill in the table below with the charge q on a single grain and height y of a single grain. Note that you are asked to calculate the quantity y^2.

Charge q (C)	Height y (m)	y² (m²)

PART D: Graph q vs. y^2 from your data table on the grid below. Draw a best-fit line. Use the slope of the best-fit line (not an average or a single data point) to calculate the mass m of a pollen grain.
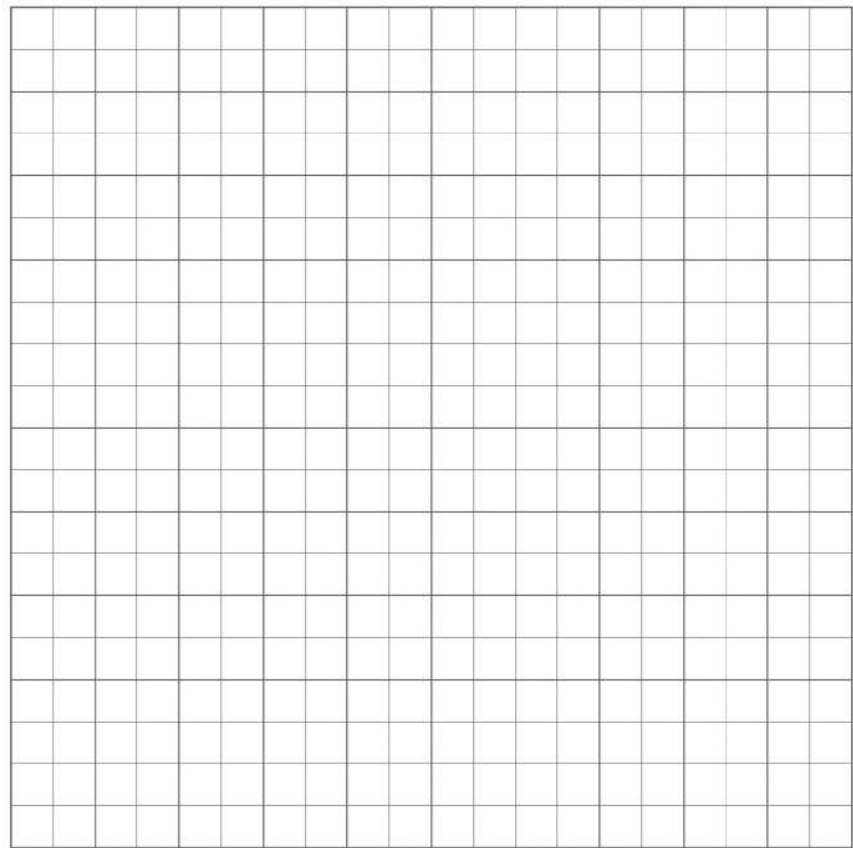
PART E: Explain how you used the equation from Part B to determine the meaning of the slope of the graph by giving the relationship between the mass of a pollen grain and the slope of the line above.