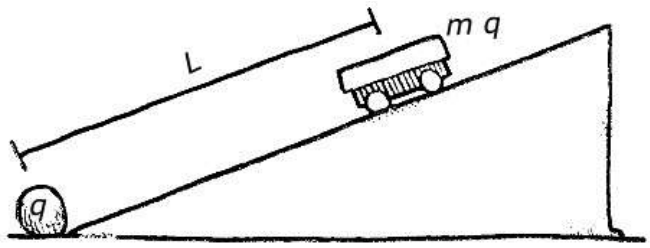
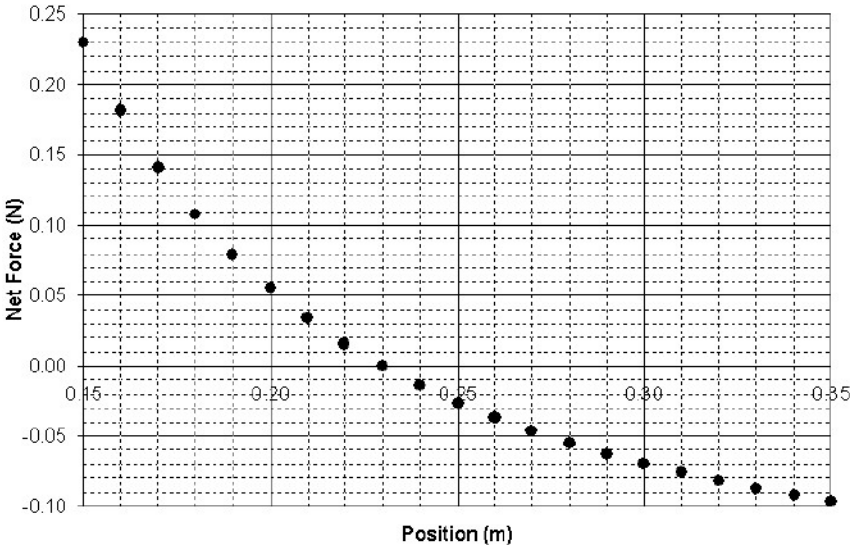
NAME _____ DATE _____

Scenario

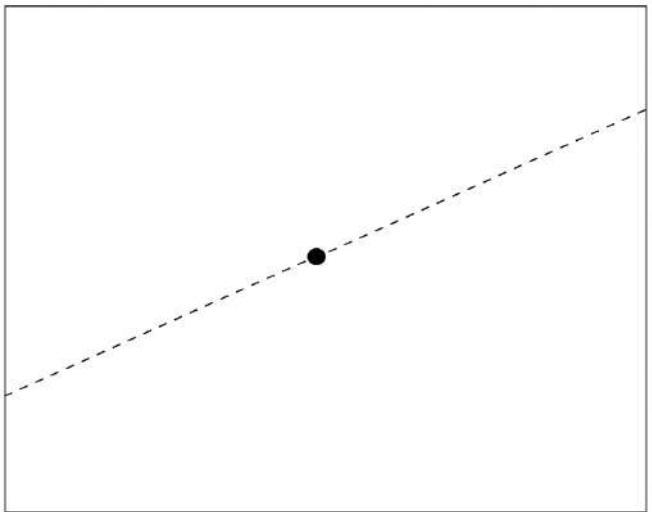
A charged sphere q is fixed at the bottom of a non-conducting incline having angle $\theta = 10°$ with the horizontal. A cart of mass $m = 0.1$ kg with a charge q and frictionless bearings is set on the incline. Angela and Blake measure the net force exerted on the cart at various distances L between the center of the cart and the center of the sphere. Their data are represented on the graph shown below. (Forces directed up the ramp are considered positive.)





Using Representations

PART A: The dot below represents the cart on the incline. Draw a free-body diagram showing and labeling the forces (not components) exerted on the cart. Draw the relative lengths of all vectors to reflect the relative magnitudes of all the forces. Each force must be represented by a distinct arrow starting on and pointing away from the dot.



Quantitative Analysis

PART B: Derive an expression for the charge q. Explain how you use the graph and other information and what physical principles you are applying in your calculations.

Argumentation

PART C: If the cart is set at its equilibrium position on the incline and released, the cart will remain at rest. However, if the cart is set a small distance away from the equilibrium position and released, the cart will oscillate about the equilibrium position.

Explain why this occurs.