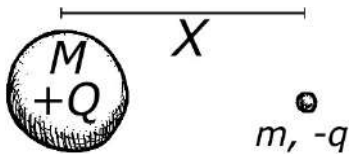
NAME _____ DATE _____

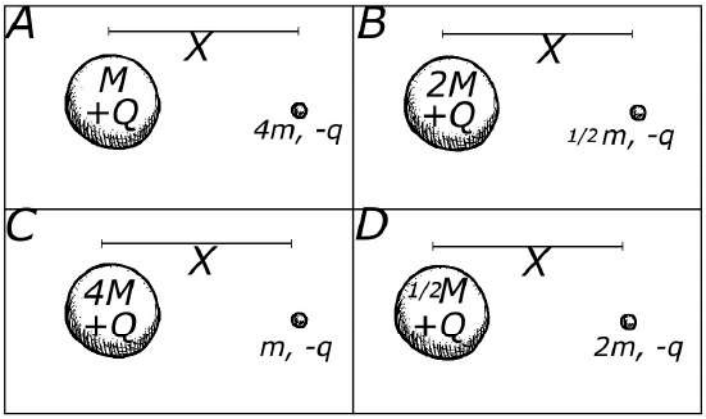
Scenario

The figure at right shows a point charge held a distance x *from a large, charged sphere and then released while the sphere* ***is held still*** *by an external force. Four such scenarios are set up, as shown in the diagram below and right. The massive charged spheres all have the same charge* $(+Q)$ *but have different masses. The initial distance* x *is equal for all four scenarios.*



Argumentation

PART A: Rank the work done by the electric force on the point charge after it is released, from greatest magnitude to least magnitude.



Greatest magnitude of work done by the electric force

_____
Least magnitude electrical potential

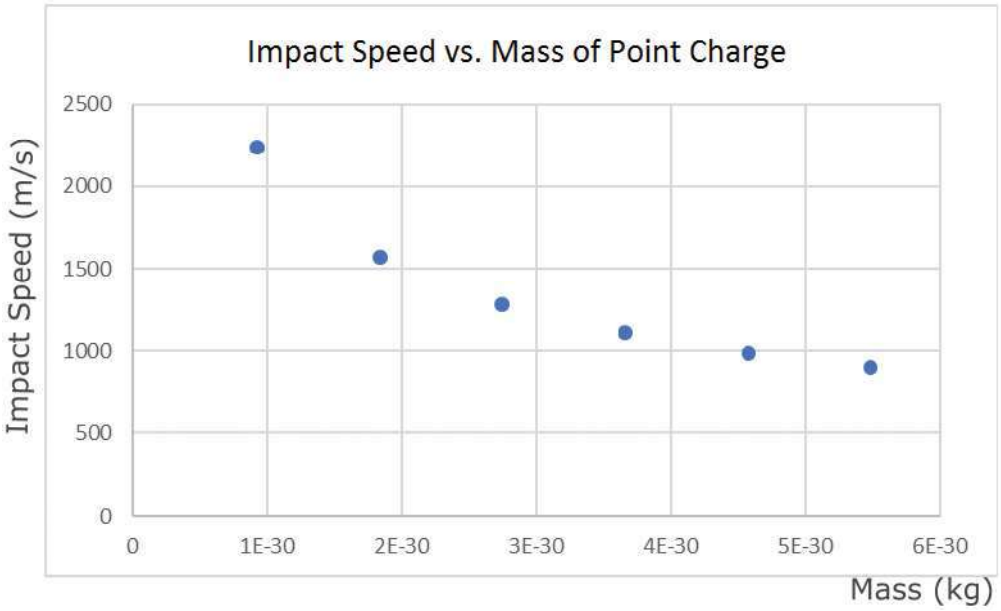
What is different about the four scenarios that would result in them having different velocities before impact? Explain how you arrived at your answer.

PART B: If you graph the impact velocity as a function of the mass of the point charge, will the graph be linear? Explain how you arrived at your answer.

Data Analysis

PART C: Before deriving an equation for a quantity such as v_{impact}, it can be useful to come up with an equation that is intuitively expected to be true. That way, the derivation can be checked later to see if it makes sense physically. Blake comes up with the following equation for the impact speed: $v_{impact} = \sqrt{2Cm}$, where C is a positive constant.

i. To test the equation, he releases the point charges many times and records the impact velocity. Blake varies the mass of the point charge with each trial but keeps everything else the same. The graph shown is a plot of the v_{impact} vs. m.



Are these data consistent with Blake's equation?

_____ Yes _____ No

Briefly explain your reasoning.

ii. Angela suggests that regardless of whether or not the data above are consistent with the equation, the equation could be incorrect for other reasons. Does the equation make physical sense?

_____ Yes _____ No

Briefly explain your reasoning.