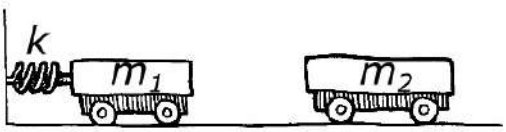
NAME _____ DATE _____

Scenario

Angela, Blake, Carlos, and Dominique are performing an experiment involving Cart 1 and Cart 2, which are both light and the friction in the bearings can be neglected. The students push Cart 1 against a spring (force constant k), compressing the spring a distance x from its equilibrium length. Cart 1 is released, collides with Cart 2, and sticks. The two carts continue with constant speed v_f after the collision. The students are tasked with making v_f as fast as possible but with the following constraints:



- *The spring compression distance x cannot be varied.*
- *Masses can be added or removed from either Cart 1 or 2 or both as long as the total mass of the system ($M = m_1 + m_2$) **remains constant**.*

Argumentation

PART A: Answer the following question. Explain your reasoning. You may cite equations but do not manipulate or combine equations as part of your explanation.

i. After Cart 1 is launched, how will the total mechanical energy of the system (spring and m_1), change if m_1 is large?

Claim: _____

Evidence/Reasoning: _____

ii. After Cart 1 is launched, how will the total momentum of the system change if m_1 is large?

Claim: _____

Evidence/Reasoning: _____

PART B: Based on one or both of your answers to Part A, explain whether m_1 should be large or small to make the final speed v_f the fastest.

Quantitative Analysis

PART C: Derive an expression for v_f, the combined cart speed, in terms of m_1, M, x, and k. Then explain how this expression supports your assertions in Part B.

(1)	
(2)	
(3)	
(4)	
(5)	

(6)	
(7)	
(8)	

Line number _____ supports my claim by: _____

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