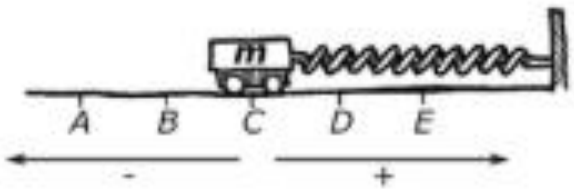
NAME _____ DATE _____

Scenario

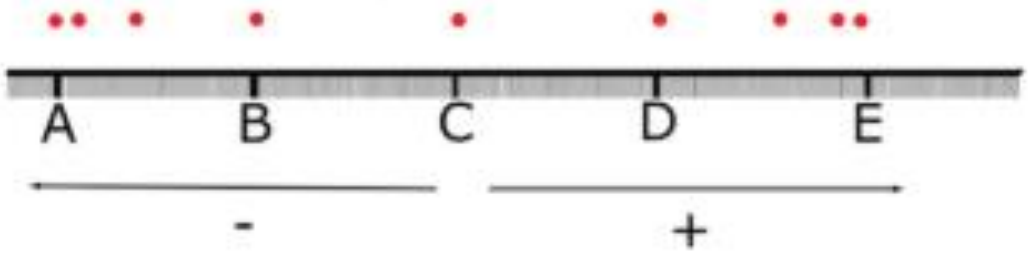
A cart of mass m is attached to an ideal spring that can stretch and compress equally well. The cart and spring rest on a smooth horizontal track. The cart is pulled to position A and released. The cart then moves toward position E, where it reverses direction and returns again to position A.



Using Representations

PART A: Show with a sketch of a position diagram how the velocity of the cart changes between the points indicated.

Position Diagram for motion between points A and E



PART B: The dots below represent the cart at the different labeled positions. Draw free-body diagrams showing and labeling all the forces (not components) exerted on the cart at each labeled position. Draw the relative lengths of all vectors to reflect the relative magnitudes of all forces. You will create one set of sketches for when the cart is moving to the right and a second set for when the cart is moving to the left.

FBD of Cart at Point A	*FBD of Cart at Point B*	*FBD of Cart at Point C*	*FBD of Cart at Point D*	*FBD of Cart at Point E*
Moving Right				
Moving Left				

Argumentation

PART C: **Claim and Evidence:** Do the diagrams above indicate whether the cart is moving left or right? Justify your claim with evidence.

No, the free-body diagrams do not indicate whether the cart is moving to the left or right. The net force represents the direction of the spring force and is not related to the direction the cart is moving (but is related to the direction the cart is accelerating).

PART D: **Reasoning:** At each position, compare the direction of the net force exerted by the spring on the cart and the cart's displacement from equilibrium when at that position. Note that this question IS NOT asking whether the cart is moving right or left. Use these results to briefly explain why your claim in Part C makes sense.

	Position A	*Position B*	*Position C*	*Position D*	*Position E*
Direction of the Net Force	RIGHT	RIGHT	NONE	LEFT	LEFT
Direction of Displacement from Equilibrium	LEFT	LEFT	NONE	RIGHT	RIGHT

The net force will point toward equilibrium to bring the cart back to the equilibrium point, regardless of which direction the cart is moving.