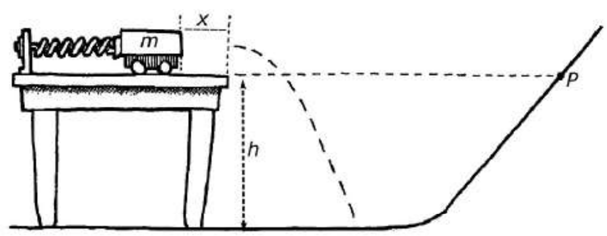
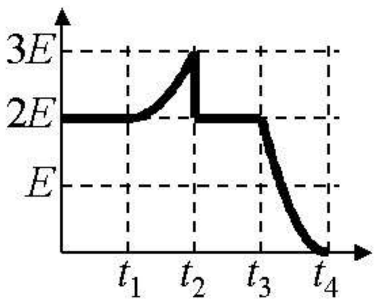
NAME ______________________ **DATE** ______________

Scenario

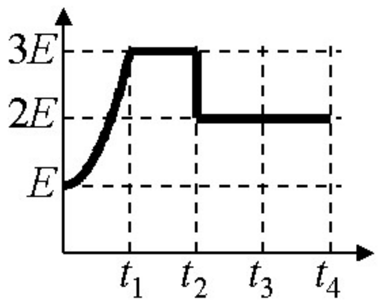
A cart of mass m with frictionless bearings and very light wheels initially compresses a spring (force constant k) a distance x from its equilibrium length. The cart and spring are on a table of height h. Suppose that E represents an amount of energy so that $E = mgh$ and $\frac{1}{2}kx^2 = 2E$.



At time $t = 0$, the cart is released, and the spring begins to expand. At time $t = t_1$, the spring returns to its natural length just as the cart leaves the table. At time $t = t_2$, the cart lands on the floor, losing all its vertical velocity but none of its horizontal velocity. At time $t = t_3$, the cart reaches the bottom of a slope, and at time $t = t_4$ the cart comes momentarily to rest on the slope.



Graph A



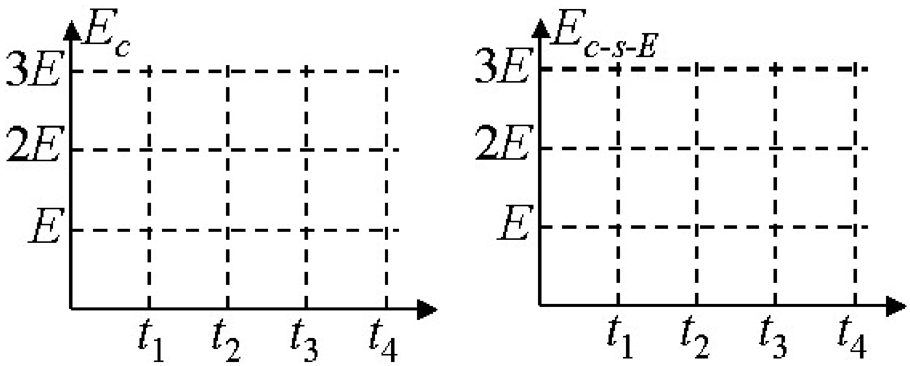
Graph B

PART A: One of the graphs shown (Graph A or Graph B) represents the mechanical energy of the cart-Earth system as a function of time, and the other represents the mechanical energy of the cart-spring system vs. time. Which graph represents the mechanical energy of the cart-Earth system?

________ Graph A ________ Graph B

Explain how you know, justifying by citing relevant features of the graph.

PART B: Create a graph of E_c, the mechanical energy of the cart system as a function of time, and a graph of $E_{c\text{-}s\text{-}E}$, the mechanical energy of the cart-spring-Earth system as a function of time. Be sure your graphs have straight or curved segments so that they are consistent with the graphs above.



PART C: The ramp is much longer than shown. Does the cart stop below, at, or above point P on the ramp? Explain your reasoning.