Name _____ Date _____

AP Physics

Period _____

AP Review # 16

Mrs. Nadworny

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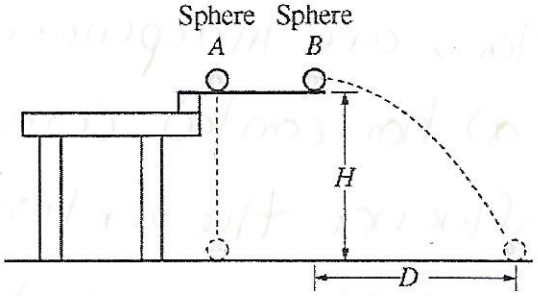
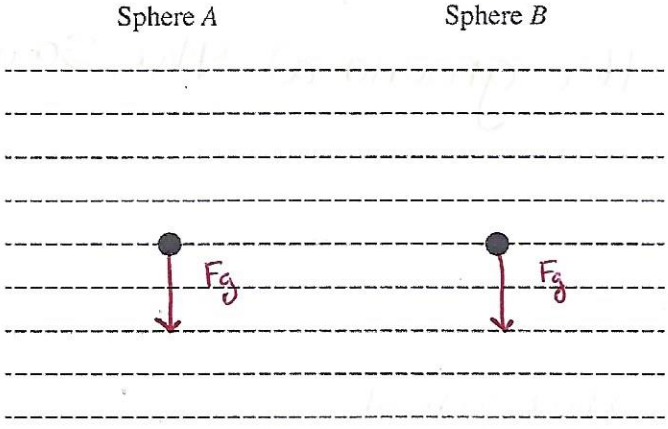


4. (7 points, suggested time 13 minutes)

Two identical spheres are released from a device at time $t = 0$ from the same height H, as shown above. Sphere A has no initial velocity and falls straight down. Sphere B is given an initial horizontal velocity of magnitude v_0 and travels a horizontal distance D before it reaches the ground. The spheres reach the ground at the same time t_f, even though sphere B has more distance to cover before landing. Air resistance is negligible.

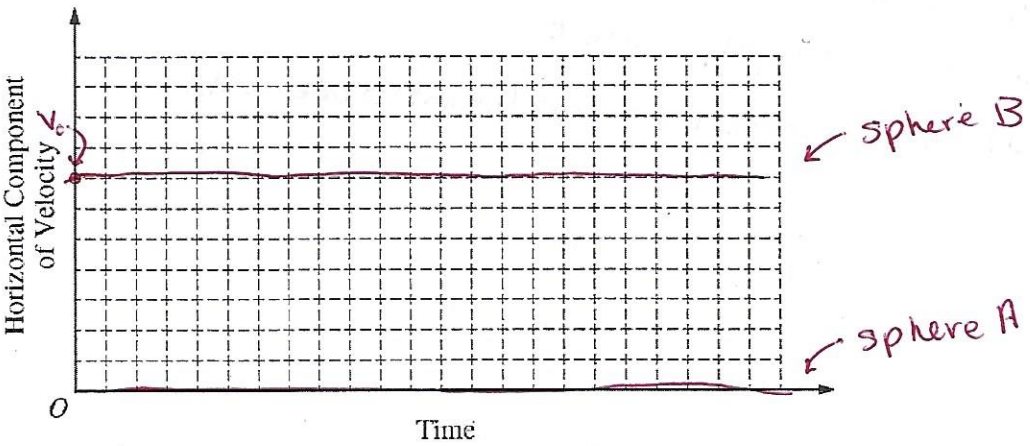
(a) The dots below represent spheres A and B. Draw a free-body diagram showing and labeling the forces (not components) exerted on each sphere at time $\frac{t_f}{2}$.

(1) only 1 arrow each
same size
label



(b) On the axes below, sketch and label a graph of the horizontal component of the velocity of sphere A and of sphere B as a function of time.

(1) A-zero
B-nonzero
labels



(c) In a clear, coherent, paragraph-length response, explain why the spheres reach the ground at the same time even though they travel different distances. Include references to your answers to parts (a) and (b).

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The spheres reach the ground at the same time because their vertical information ($v_0 + a$) is the same. Perpendicular vectors are independent of each other. The initial horizontal component of B does not influence the vertical motion. The horizontal velocity causes it to travel a greater horizontal distance. Since the force of gravity is the cause of falling, and is the same for both of them, they will reach the ground at the same time.

(1) horizontal not affect vertical
(1) same initial vertical velocity
(1) same vertical acceleration
(1) same height, same t
(1) no incorrect or irrelevant statements