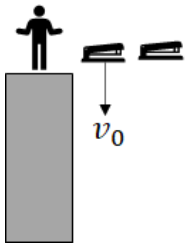
AP Physics 1 Name: _____

Unit 1: 1D Kinematics Test

Direction: Answer each question below with either sufficient explanation or mathematical work to justify your answer. You are graded for your method and reasoning rather than the final answer. Whenever necessary, use $g = 10\frac{m}{s^2}$. Work on a separate sheet of paper. Take a picture of your final test and upload it to Google Classroom when completed.

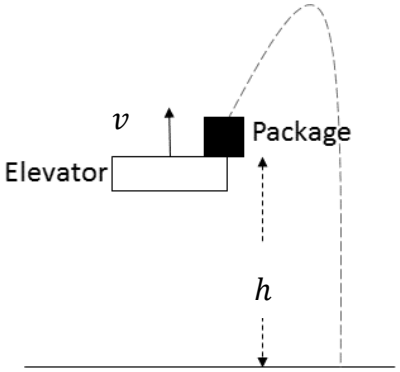
1. (10 points) Dave the Dude chucks 2 staplers off a cliff for science. He throws one directly downwards with a speed of v_0. He drops another one from rest. Bob the Bro makes the following statement:
"The stapler that was thrown down will gain more speed while falling and hit the ground traveling faster."



a) What aspect(s) of Bob's reasoning(if any) are correct?

b) What aspect(s) of Bob's reasoning(if any) are incorrect? If he's correct, justify why. If anything is incorrect, explain how it is incorrect.

2. (24 points) An elevator is traveling upwards with a package on it. The elevator travels upwards at speed $v = 20\ m/s$. When the elevator is a height $H = 50$ above the ground, a package falls of the elevator as it moves upward (the package will have an initial velocity of V upwards when it first slips off the elevator).



a) Calculate the maximum height of the package.

b) Calculate the speed at which the package hits the ground.

c) During part of its motion, the package's acceleration and velocity are in opposite directions. Identify which part of the motion this occurs in and explain how you know they are in opposite directions direction.

d) In a move that defies all logic and reason, the elevator and package are no longer on Earth, but are now placed the surface of the moon, which has a gravity smaller than earth (g=1.7 m/s^2).
i. Would the time in the maximum height increase, decrease, or remain the same compared to part a). Justify your answer conceptually WITHOUT using numbers.

ii. Would the final speed increase, decrease, or remain the same compared to part b). Justify your answer conceptually WITHOUT using numbers.

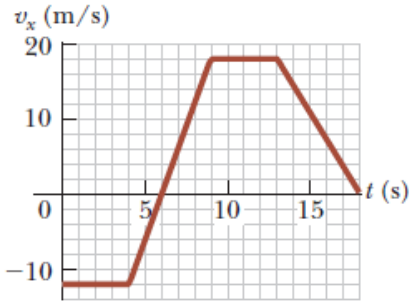
3. (18 points) A Shiba Inu is at the origin (x=0) at rest at time t = 0 s. It starts run in the negative direction from for 4 s until it reaches a velocity of -20 m/s. The Shiba Inu then runs at constant velocity for 6 s.

a) Calculate the acceleration of the Shiba Inu during the first 4 seconds of its motion.

b) Calculate the total displacement of the Shiba Inu after the 10 s.

c) Sketch graphs of the acceleration, velocity, and position of the Shiba Inu as a function of time.

4. (18 points) In order to give this test a 4th question, the Shiba Inu from Question 3 scares off a squirrel, who runs away with a velocity vs. time graph given below.



a) At what time(s) does the squirrel switch direction? How do you know?

b) Calculate the squirrel's total displacement from his starting point at t = 11 s.

c) Draw an acceleration vs. time graph for this motion.

d) At what time(s) is the squirrel slowing down?

e) At what time is the squirrel's furthest from its starting position?

f) Around what time after t = 5 s is the squirrel closet to its start position?