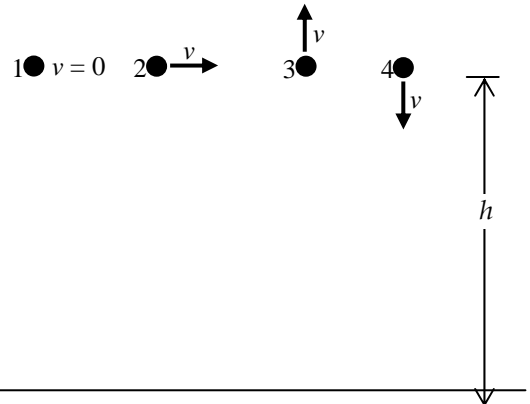


For each question (except multiple choice and fill in the blank), your solution must show work/calculations and display/explain your reasoning.

1. Four identical marbles (labeled 1 – 4) each start at the same height h above the ground. Each is launched at the same time but with a different velocity. Neglect air resistance.



Marble 1 is released from rest.

Marble 2 is launched horizontally with speed v .

Marble 3 is launched with the same speed v but straight up.

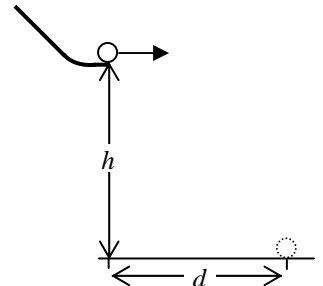
Marble 4 is launched with the same speed v but straight down.

Rank in order, from shortest to longest, the amount of time it takes each of these marbles to hit the ground. Indicate any ties with an equal sign.

shortest time

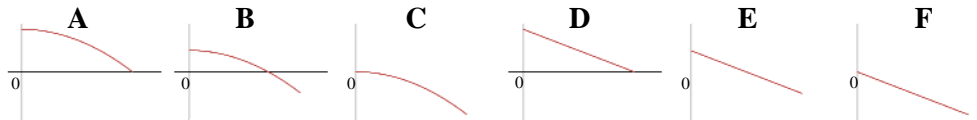
longest time

2. A steel marble rolls off a level ramp, similar to that in lab, and hits the table. The marble falls a distance $h = 0.196$ m and travels horizontally a distance $d = 0.10$ m. Consider the initial time as the instant the marble leaves the ramp, the **origin** as the point at which the **marble leaves the ramp**, and use a standard coordinate system, with $+x$ to the right and $+y$ to the top of the page. Neglect air resistance.



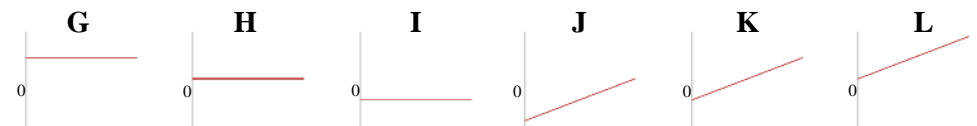
a) In the spaces provided, write down the letter of the graph which best represents the marble's:

a_x vs. t : _____ a_y vs. t : _____



v_x vs. t : _____ v_y vs. t : _____

x vs. t : _____ y vs. t : _____



b) Determine the amount of time the ball is in the air (between leaving the ramp and hitting the table).

c) Determine the launch speed of the ball (the speed of the ball the instant it leaves the ramp).

3. Solve for x :

$$\frac{1}{x} + \frac{2}{x+1} = 2$$

4. Working together, Tom and Becky can paint a fence in 6 hours. If he worked alone, Tom would take 15 hours to paint the fence. How long would it take Becky to paint the fence if she worked by herself?

5. A motorboat travels 12 miles down the river with the current. When the motorboat returns, it is moving against the current, so it travels 2 miles per hour slower and the trip takes 3 hours longer. Write down an equation or equations that model this scenario. Clearly describe the meaning of any variable you use.