Uniform Acceleration Lab Name_____

AP Physics 1

Kinematics Date_____Hour_____

DIRECTIONS:

1. Drop a mass and obtain a ticker-tape recording for the motion of the accelerating mass.

2. Describe what happens to the dots on the ticker tape as the object moved away from its starting position.

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3. What do you think the points would look like for an object slowing down?

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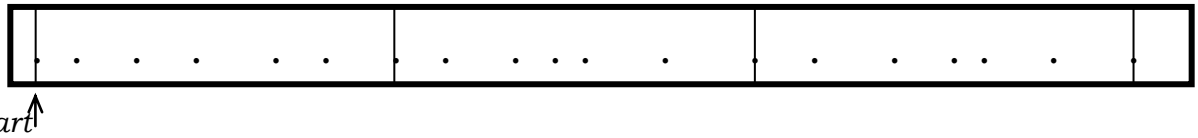
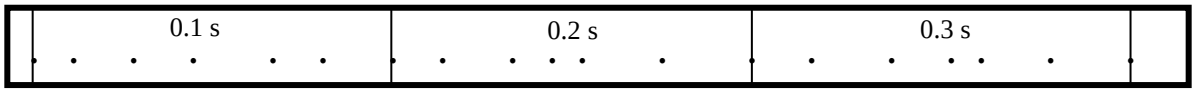
4. Split the ticker-tape up into sections of 6 dots (it will seem like 7), as demonstrated below. Note that each set of 6 dots represents 0.1 s of time (as the ticker marks the tape 60 dots/s). (Note: This example intentionally looks different than yours!)



start

5. Measure the position of each line, from the starting point, to the nearest 0.1 cm. Enter the values into the 1st data table, in the column titled **x (cm)**.

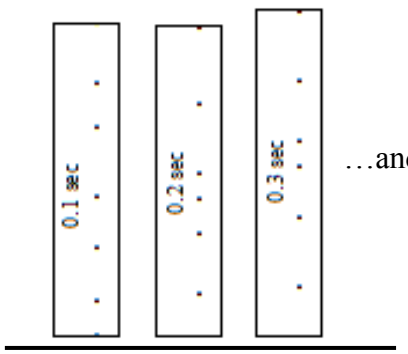
6. Mark each segment of the tape with their appropriate times, starting with 0.1 s, then proceeding with 0.2 s, 0.3 s, etc – as demonstrated on the diagram below.



start

7. Measure the distance between each line, to the nearest 0.1 cm, and record the values in the change in position column, **Δx (cm)**, in the 2nd data table.

8. Cut the strips along the lines and place them vertically on end, side by side, as demonstrated below.



…and so on…

9. When all of your strips are placed next to one another in this manner, describe the shape that forms. Explain why you believe this has occurred.

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10. Compute the average velocity, using the equation: $v_{ave} = \frac{\Delta x}{\Delta t}$, ***where*** Δt ***= 0.1 sec each time***, and enter your values in the data table.

Data Tables:

Δt (s)	**x (cm)**
0	0.0
0.1	
0.2	
0.3	
0.4	
0.5	
0.6	
0.7	
0.8	
0.9	
1.0	

Δx (cm)	**$t_{average}$ (s)**	**$v_{average}$ (cm/s)**
0.0	X	X
	0.05	
	0.15	
	0.25	
	0.35	
	0.45	
	0.55	
	0.65	
	0.75	
	0.85	
	0.95	

Note: You may not have enough data to complete these tables…that's o.k!

11. Use this space to show an example $\mathbf{v_{ave}}$ calculations that you entered in the data table.

GRAPHING TIME!!!!!!!

Graph #1: x vs. **Δt**

Use Excel to plot your **x** vs. **Δt** data.

Draw a quick sketch of your results below.

12. Describe the shape of the curve. How does it compare to the shape you saw when you lined up your tape segments side-by-side?

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13. What does an x-Δt graph of this shape tell you about the motion of an object?

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14. What can you say about the slope of the curve as time increases? What does that imply?

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15. After producing a best-fit curve for the position-time graph, what was the equation of the line?

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16. What was the R^2 value for that best-fit curve? What does that tell us?

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17. Does the data need linearized? If so, describe how you would linearize the data.

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Graph #2: $\mathbf{v}_{ave}$ vs. $\mathbf{t}_{ave}$

Use Excel to plot your $\mathbf{v}_{ave}$ vs. $\mathbf{t}_{ave}$ data.

Draw a quick sketch of your results below.

18. Describe the shape of the curve above.

19. What does a v-t graph of this shape tell you about the motion of an object?

20. Does that agree with the x-Δt graph's meaning? Why or why not?

21. What can you say about the slope of the curve as time increases? What does that imply?

22. After producing a best-fit curve for the velocity-time graph, what was the equation of the line?

23. What was the R^2 value for that best-fit curve? What does that tell us?

24. Does the data need linearized? If so, describe how you would linearize the data.

CONCLUSIONS: After the post-lab class discussion, answer the following questions:

A. What general equations for accelerating objects did this activity verify? Write each equation and label all variables in the space below.

B. When you match the equation of the curve for your position-time graph up with the quadratic equation, what value do YOU get for the acceleration of your mass from this graph? (Show your work)

C. When you match the equation of the line for your velocity-time graph up with the linear equation, what value do YOU get for the acceleration of your mass from this graph? (Show your work)

D. Do your two values agree with one another, within reason? Explain.

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