Picket Fence

Lab report: (on format – DATA sheet + questions)

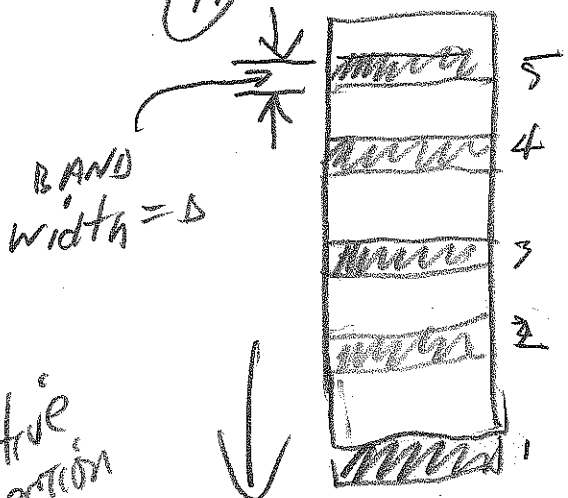
(A) Preliminary questions 1, 2, 3.

(B) analysis questions 1, 2, 3, 4, 5, 6, 7, 8

(C) Extensions: 1. only for now

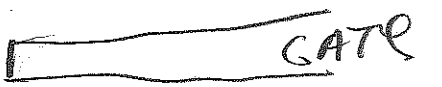
(A) prelim. questions (Hints)

(1) Drop from Here.

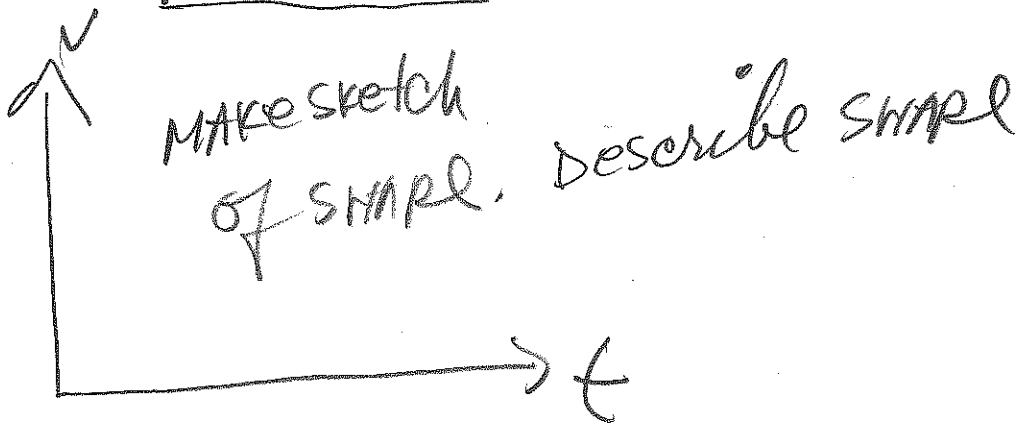


Explain WHY BAND 5 moves faster than Band 1.

($v_1 < v_5$ at gate)

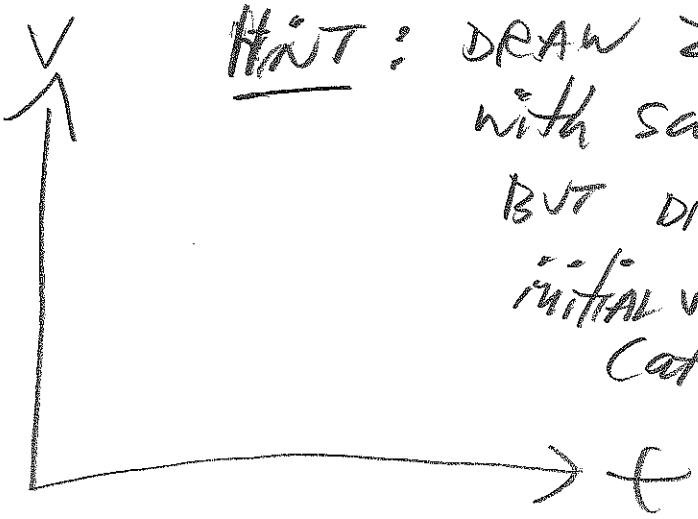


(2.)



MAKE sketch of SHAPE. Describe shape

prelim. questions (cont'd)

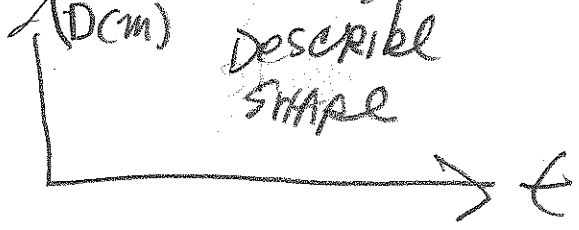
(3) 

HINT: DRAW 2 SHAPES with same acceleration BUT different initial velocities (at $t=0$).

(B) Analysis:

(1) Six values of "g".
identify max, min.
SHOW calculation of AVERAGE

$$= \frac{\sum_{i=1}^{6} g_i}{6} = g_{AV}$$

(2) 

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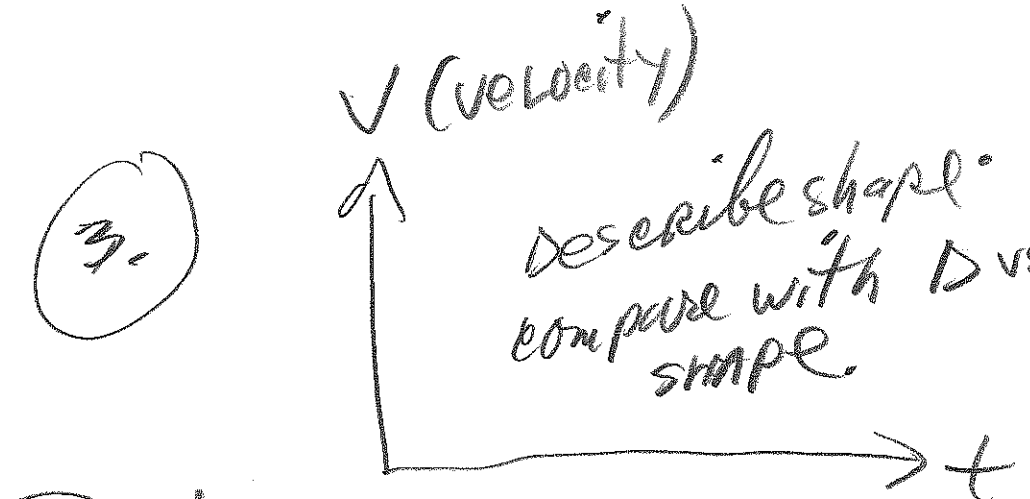
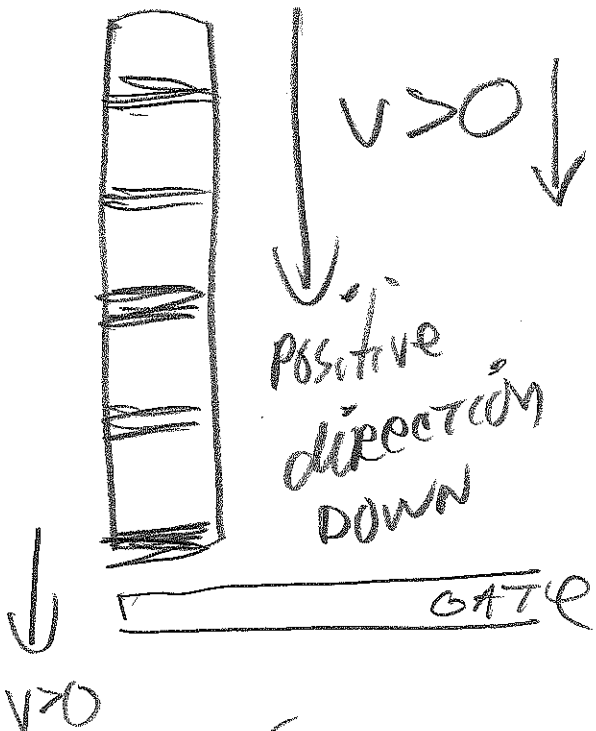




(4) NOTE: FIND:

$$\Delta = \frac{\text{MAX} - \text{MIN}}{2}$$ and ROUND TO one place.

Then write $g_{AV} \pm \Delta$

(g_{AV}: round to same place as Δ)

Example: $9.2815 \pm 0.02954\ldots$

Report $\longrightarrow$ 9.28 ± 0.03

(4.) (continued) see example in

handout: 9.787, 9.757 and 9.815

9.787 ↑ MIN 9.757 ↑ AVERAGE 9.815 ↑ MAX

$\Delta = \frac{MAX - MIN}{2} \approx 0.06$ AFTER ROUNDING

Report → 9.757 ± 0.06

9.76 ± 0.06

(5.) find precision: (see HANDOUT)

(6.) $g_{low} < g_{acc} < g_{vp}$

g_{acc}: google value of g in HAYWARD (cite source)

ALSO FIND

$P.E. = \left| \frac{g_{acc} - g_{AV}}{g_{acc}} \right| \times 100\%$

$g_{vp} = g_{AV} + \Delta$

$g_{low} = g_{AV} - \Delta$

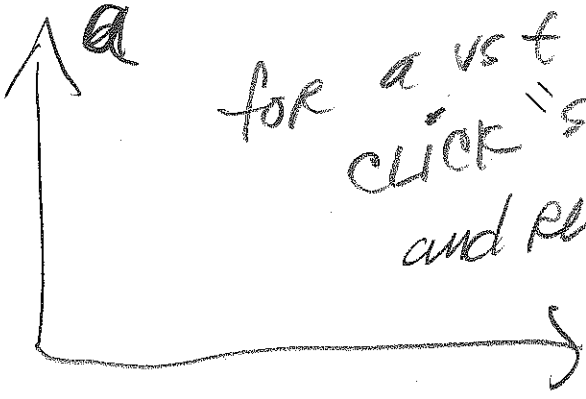
(7) given

V-SHAPE

WHAT does a vs t look like? (prediction)

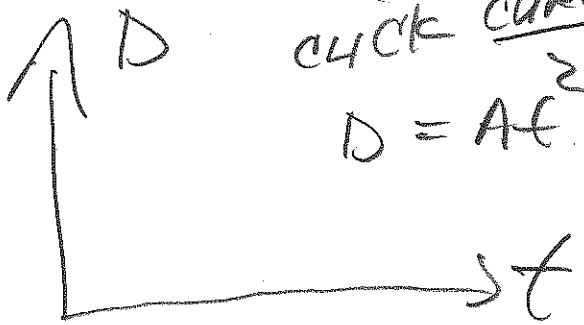
confirm: CLICK v (Y-AXIS) select acceleration and see a vs t (rescale if needed)

(8)



for a vs t CLICK "STAT" button, and RECORD "Mean"

Ext 1



click curve fit (f(x))

$D = At^2 + Bt + C$

Identify A and compare with g_{AV}.

Picket fence!

6. Examine your graphs. The slope of a velocity *vs.* time graph is a measure of acceleration. If the velocity graph is approximately a straight line of constant slope, the acceleration is constant. If the acceleration of your Picket Fence appears constant, fit a straight line to your data. To do this, click on the velocity graph once to select it, then click the Linear Fit button, , to fit the line $y = mt + b$ to the data. Record the slope in the Data Table.

7. To establish the reliability of your slope measurement, repeat Steps 5 and 6 five more times. Do not use drops in which the Picket Fence hits or misses the Photogate. Record the slope values in the Data Table.

DATA TABLE

RMSE ⇒ 0.0006 0.0008

Trial	1	2	3	4	5	6
Slope (m/s^2)	9.7720	9.7800				

	Minimum	Maximum	Average
Acceleration (m/s^2)			

Acceleration due to gravity, g	±	m/s^2
Precision		%

ANALYSIS

1. From your six trials, determine the minimum, maximum, and average values for the acceleration of the Picket Fence. Record them in the Data Table.

2. Describe in words the shape of the position *vs.* time graph for the free fall.

3. Describe in words the shape of the velocity *vs.* time graph. How is this related to the shape of the position *vs.* time graph?

4. The average acceleration you determined represents a single best value, derived from all your measurements. The minimum and maximum values give an indication of how much the measurements can vary from trial to trial; that is, they indicate the precision of your measurement. One way of stating the precision is to take half of the difference between the minimum and maximum values and use the result as the uncertainty of the measurement. Express your final experimental result as the average value, ± the uncertainty. Round the uncertainty to just one digit and round the average value to the same decimal place.

   For example, if your minimum, average and maximum values are 9.787, 9.757, and 9.815 m/s^2, express your result as $g = 9.76 \pm 0.06$ m/s^2. Record your values in the Data Table.

Lab Groups ← clearly!

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