11. Repeat step (3) for the other two photogates.
12. Press the RESET button and set up the system for a new run.
13. Repeat steps 1 through 6 three times, adding 25 g to the cart each time, thus varying the system's mass.

V. ANALYSIS OF DATA – PART 1

1. For each value of m_a, use Equation 5.7 and Table 5.1 to calculate the cart's velocity at each of the three photogate positions.
2. Record your results in the appropriate cells in the table.

Table 5.1

Δx = ...4.......... cm $m_h = 20$ g

للحسابات فقط ما بنحتاجها للرسم

$V = \frac{\Delta X}{\Delta t}$

$m_a = 0$			$m_a = 25$ g			$m_a = 50$ g			$m_a = 75$ g		
t (s)	Δt (s)	v (cm/s)	t (s)	Δt (s)	v (cm/s)	t (s)	Δt (s)	v (cm/s)	t (s)	Δt (s)	v (cm/s)
0	0	0	0	0	0	0	0	0	0	0	0
0.69	0.047	85.11	0.723	0.0508	78.74	0.781	0.0549	72.85	0.813	0.059	67.79
0.988	0.033	121.21	1.12	0.033	121.21	1.168	0.037	108.1	1.203	0.04	100
1.162	0.03	133.33	1.264	0.029	137.93	1.291	0.033	121.2	1.32	0.036	111.11

3. On one graph sheet, plot v *versus* t for each value of the added mass and draw the best fit line through the data points.
4. Label each line with the corresponding value of the added mass m_a.
5. Determine the acceleration (a) for each case from the slope of the corresponding line, and enter your values in Table 5.2 below:

Table 5.2

op = $a = \frac{\Delta V}{\Delta t}$

m_a (g)	a (cm/s²)	$1/a$ (s²/cm)
0	120	8.3×10^{-3}
25	110	9.09×10^{-3}
50	90	$0.011 = 11 \times 10^{-3}$
75	85	$0.012 = 12 \times 10^{-3}$

6. Plot m_a versus $1/a$.

7. From the graph, what conclusion can you make about the way the acceleration of the cart depends on the system's total mass?

acceleration reducing when total mass increase

$(m, \frac{1}{a}) \Rightarrow$ increasing

$(m, a) \Rightarrow$ decreasing

8. From your graph, find the mass of the cart, m_c.

$m_c + m_h = 163$ $(m_h = 20)$

$m_c = 163 - 20$

$m_c = 143$ g

VI. Procedure - Part 2: Acceleration under Variable Net Force and Constant System Mass

In this part, you will use two photogates.

1. Set up the system as indicated in Figure 5.1, starting with $m_a = 30$ g and $m_h = 10$ g.
2. Reset the photogates by pressing the RESET button.
3. Press the START button to start the motion.
4. Read off the times t_1, t_2, Δt_1, and Δt_2 following the same procedure from part 1. Record your results in Table 5.3.
5. Repeat steps 2 through 4 three more times, reducing m_a by 10 g and increasing m_h by the same amount.

VII. Analysis of Data – Part 2

Table 5.3

Δx = ...4........ cm

	Time (s)		$v = \frac{\Delta x}{\Delta t}$ (cm/s)	$v_2 - v_1$ (cm/s)	$a = \frac{v_2 - v_1}{t_2 - t_1}$ (cm/s²)
m_a = 30 g, m_h = 10 g	t_1= 1.02	Δt_1= 0.077	51.9		
				19.5	54.3
	t_2= 1.379	Δt_2= 0.056	71.4		
	Time (s)		$v = \frac{\Delta x}{\Delta t}$ (cm/s)	$v_2 - v_1$ (cm/s)	$a = \frac{v_2 - v_1}{t_2 - t_1}$ (cm/s²)
m_a = 20 g, m_h = 20 g	t_1= 0.711	Δt_1= 0.053	75.4		
				29.8	101.01
	t_2= 1.006	Δt_2= 0.038	105.2		
	Time (s)		$v = \frac{\Delta x}{\Delta t}$ (cm/s)	$v_2 - v_1$ (cm/s)	$a = \frac{v_2 - v_1}{t_2 - t_1}$ (cm/s²)
m_a = 10 g, m_h = 30 g	t_1= 0.613	Δt_1= 0.041	97.5		
				40.4	161.6
	t_2= 0.863	Δt_2= 0.029	137.9		
	Time (s)		$v = \frac{\Delta x}{\Delta t}$ (cm/s)	$v_2 - v_1$ (cm/s)	$a = \frac{v_2 - v_1}{t_2 - t_1}$ (cm/s²)
m_a = 0 g, m_h = 40 g	t_1= 0.489	Δt_1= 0.036	111.1		
				42.7	227.1
	t_2= 0.677	Δt_2= 0.026	153.8		

2. For each run, calculate the averag...

$a = (v_2 - v_1)/(t_2 - t_1)$.

3. Enter your data for the hanging weight ($m_h g$) and the corresponding acceleration (a) in Table 5.4. (Take $g = 980\ cm/s^2$).

Table 5.4

Hanging weight $m_h g$ (dyne)	Acceleration a (cm/s^2)
9800	54.3
19600	101.01
29400	161.2
39200	227.1
1 dyne = 1 g cm s^{-2} = 10^{-5} N	

4. Plot a graph of the hanging weight ($m_h g$) against the acceleration (a).

5. Calculate the slope of your graph. What does the slope of your graph represent?

171.5 it represent the ~~value of the~~ sum of the total masses.

6. State and discuss three sources of error in this experiment.

1) experimented error.
2) error in calculation.
3) error in reporting of result.

See also:

http://www.phywe-es.com/index.php/fuseaction/download/lrn_file/versuchsanleitungen/p1199705/e/p1199705e.pdf

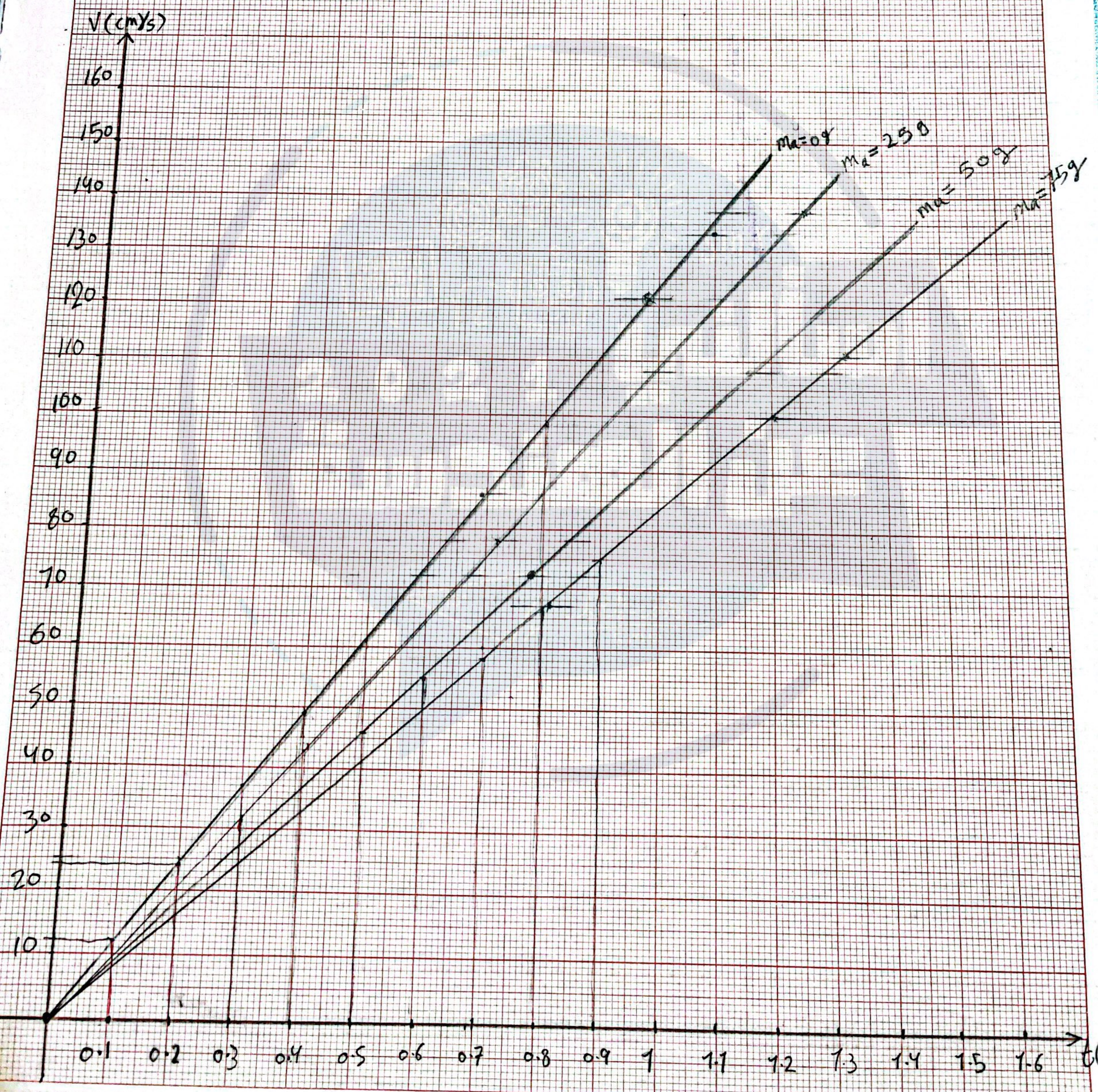
* slope = $a = \frac{\Delta V}{\Delta t}$

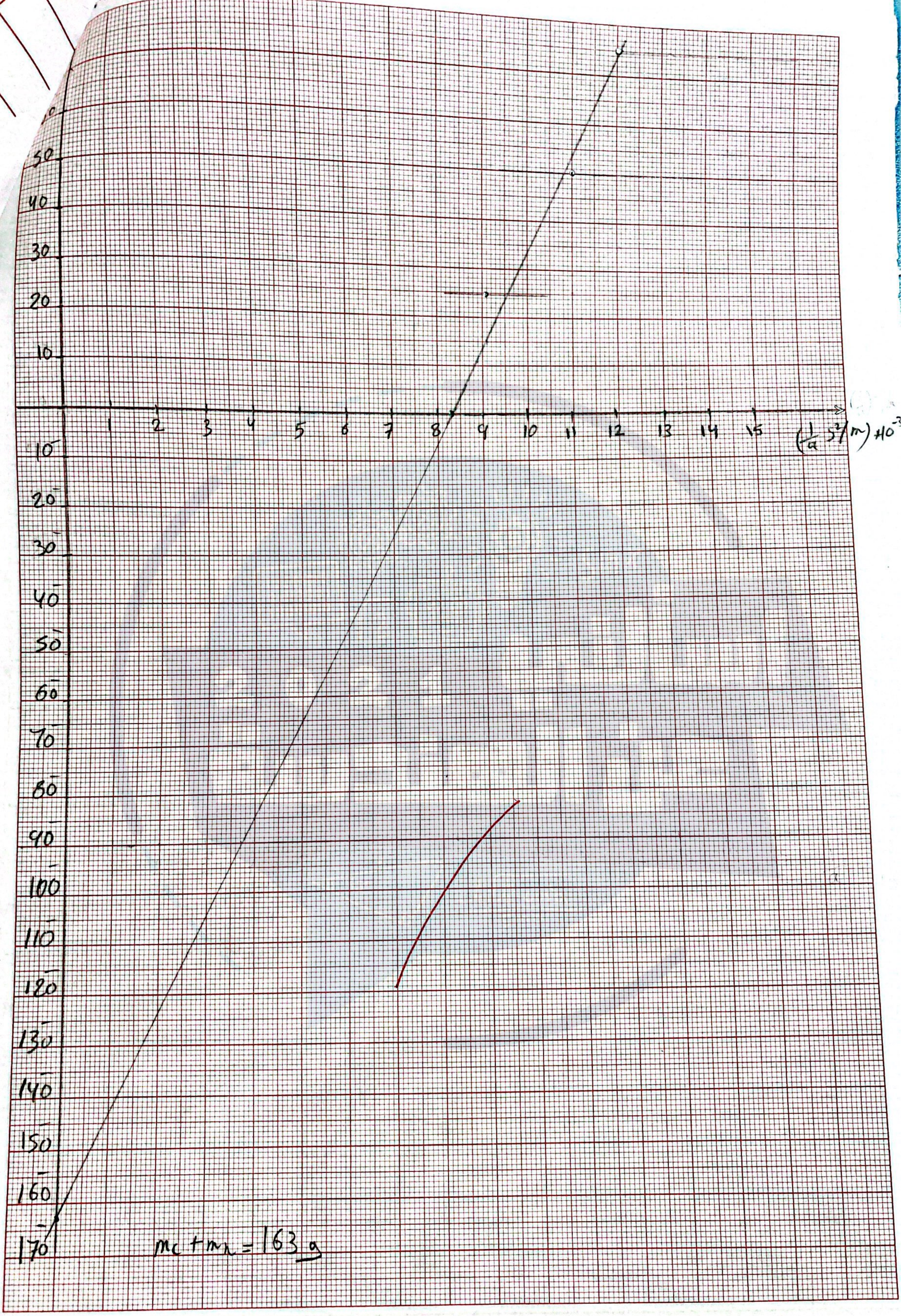
1) ma = 0g (0.1, 12) (0.2, 24) ⇒ a = 120 cm/s²

2) ma = 25g (0.3, 32) (0.4, 43) ⇒ a = 110 cm/s²

3) ma = 50g (0.5, 46) (0.6, 55) ⇒ a = 90 cm/s²

4) ma = 75 (0.7, 58) (0.9, 75) ⇒ a = 85 cm/s²

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150
160
170
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
(1/a s²/m) ×10⁻³
mc + mh = 163 g

slope :- $\frac{34300 - 17150}{200 - 100} = 171.5$ g