V. Data Analysis – Part 1

1. Calculate the initial and final velocities of the cart, $v_1 = \frac{\Delta x}{\Delta t_1}$ and $v_1' = \frac{\Delta x}{\Delta t_2}$. Record your results in Table 6.1.

2. Calculate the rebound coefficient $r = \frac{|v_1'|}{|v_1|}$. Record your results in Table 6.1.

Table 6.1

Δx = ...4......... cm

Mass of cart (g)	Δt_1 (s)	Δt_2 (s)	v_1 (cm/s)	v_1' (cm/s)	$r = \frac{\lvert v_1' \rvert}{\lvert v_1 \rvert}$
100 g	0.055	0.058	72.7	-69.0	0.949
125 g	0.061	0.063	65.6	-63.5	1.03
150 g	0.084	0.088	47.62	-45.5	1.05

3. Answer the following:

- If $r = 1$ this means that

...elastic collision...

- If $r < 1$ this means that

...inelastic collision...

VII. DATA ANALYSIS – PART 2

1. Calculate the initial and final velocities of the two carts (initial velocity of cart 2 is zero) and record the results in Table 6.2.

Table 6.2

m_1 = ...100............. g $\qquad v_2 = 0 \qquad$ DX = 4 cm

	Before collision		After collision			
m_2 (g)	Δt_1 (s)	v_1 (cm/s)	$\Delta t_1'$ (s)	v_1' (cm/s)	$\Delta t_2'$ (s)	v_2' (cm/s)
100 g	0.066	60.6		2.6	0.069	58.0
125g	0.058	69.0		-8.5	0.065	62.0
150g	0.053	75.5		-15.4	0.066	60.6

In the following,

- p_i, K_i are the initial momentum and kinetic energy of cart i (i=1,2).
- p_i', K_i' are the final momentum and kinetic energy of cart i.
- $p_{tot} = p_1 + p_2$ and $K_{tot} = K_1 + K_2$ are the total initial momentum and kinetic energy.
- $p_{tot}' = p_1' + p_2'$ and $K_{tot}' = K_1' + K_2'$ are the total final momentum and kinetic energy.

2. Calculate the following and record the results in Table 6.3.
    - p_1, p_2, p_1', and p_2'
    - p_{tot} and p_{tot}'.

3. Calculate the following and record the results in Table 6.4.
    - K_1, K_2, K'_1, and K_2'
    - K_{tot} and K_{tot}'

Table 6.3

m_1 = ...100............. g $v_2 = 0$

m_2 (g)	p_1 (g cm/s)	p_2 (g cm/s)	p'_1 (g cm/s)	p'_2 (g cm/s)	p_{tot} (g cm/s)	p'_{tot} (g cm/s)	$\frac{\lvert p'_{tot} - p_{tot}\rvert}{p_{tot}} \times 100\%$
						6060	
100	6060	0	260	5800	6060	6900	
125	6906	0	-850	7750	6900	7550	
150	7550	0	-1540	9090	7550		

Table 6.4

m_2	K_1	K_2	K'_1	K'_2	K_{tot}	K'_{tot}	$r = \frac{K'_{tot}}{K_{tot}}$
100	183618	0	338	168200	183618	168538	0.0901 0.9
125	238050	0	3612.5	240250	238050	243862	1,02
150	285013	0	11858	279437	285013	287285	1,01

1 erg = 1 dyne. 1 cm = 10^{-5} N 10^{-2} m = 10^{-7} J

4. Within experimental error, was linear momentum conserved in each of the four collisions?

Hint: Use the last column in Table 6.3.

.................yes ,, $P_i = P_f$..

....

....

....

5. For each of the four collisions, was kinetic energy, within experimental error, conserved (*i.e.* was the collision elastic)? Justify your answer.

Hint: Use the last column in Table 6.4.

..............yes.. $(K_E)_i \approx (K_E)_f$..

....

....

....

IX. Data Analysis – Part 3

1. Calculate the initial and final velocities, v and v', respectively, and record the results in Table 6.5.

In the following:

- p and K are the initial momentum and kinetic energy of cart 1. Since cart 2 is initially at rest they are equal to the total initial momentum and kinetic energy of the system.
- p' and K' are the final momentum and kinetic energy of the system composed of cart 1 and cart 2 stuck together.

2. Calculate p and K and record the results in Table 6.5.
3. Calculate p' and K' and record the results in Table 6.6.

Table 6.5

m_1 = ...100........... g $v_2 = 0$ ΔX = 4 cm

m_2 (g)	Δt_1 (s)	v (cm/s)	Δt_2 (s)	v' (cm/s)	p (g cm/s)	p' (g cm/s)	$\frac{\lvert p'-p \rvert}{p} \times 100\%$
100	0.148	27	0.193	20.7	2700	4140 5560	?
125	0.114	35	0.165	24.2	3500	5445	
150	0.108	37	0.111	36	3700 4000	9000	

Table 6.6

m_2 (g)	K (erg)	K' (erg)	$r = \frac{K'}{K}$
100	36450	42849	1.2
125	61250	65885	1.1
150	68450	162000	2.4

4. Within experimental error, was linear momentum conserved in each of the four collisions? Justify your answer.

Hint: Use the last column in Table 6.5.

........yes, because ..... $P_i = P_f \rightarrow$ always conserve........

....

....

....

5. For each of the four collisions, was kinetic energy conserved (*i.e.* was the collision elastic) within experimental error? Justify your answer.

Hint: Use the last column in Table 6.6.

....

....No because ....$(K_E)_i \neq (K.E)_f$..

....

....

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

1) friction

2) A.C track

3) The precision of the timer

4) error in calculation