جامعة بيرزيت

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9.5

Phys111 Report

Experiment #2: Conservation of Linear Momentum

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Section:	3		
Date:	13/4/2022		

(1) Abstract:

Aim of the experiment:

Calculate the ratio R between the linear momentum before and after collisions ($\frac{P_b}{P_a}$)

The main result is:

$$R = 1.02 \pm 0.03$$

(2) Data:

$m_1 = \pm$ 16.2 ∓ 0.1 gm $m_2 = \pm$ 5.3 ± 0.1 gm

	1.	2.	3.	4.	5.	6.
$x_{1b}\ (cm)$	45,8	47.5	46.5	47.0	47.4	47.3
$x_{1a}\ (cm)$	25,5	25,2	26.1	24.0	25,3	25,4
$x_{2a}\ (cm)$	69.2	68.7	68.9	69.5	69.6	68.2

(3)Calculations:

$\bar{x}_{1b} = 46.9$ cm	$\sigma_s(x_{1b}) = 0.65548$ cm	$\Delta\bar{x}_{1b} = 0.3$ cm
$\bar{x}_{1a} = 25.2$ cm	$\sigma_s(x_{1a}) = 0.68920$ cm	$\Delta\bar{x}_{1a} = 0.3$ cm
$\bar{x}_{2a} = 69.0$ cm	$\sigma_s(x_{2a}) = 0.54191$ cm	$\Delta\bar{x}_{2a} = 0.2$ cm

(4)

$A = m_1x_{1a} + m_2x_{2a} = 16.2 * 25.2 + 5.3 * 69.0 = 773.94$ g.cm $\approx$ 774 g.cm

$\Delta A = m_1\Delta x_{1a} + \Delta m_1 x_{1a} + m_2\Delta x_{2a} + \Delta m_2 x_{2a} = 16.2 * 0.3 + 0.1 * 25.2 + 5.3 * 0.2 + 0.1 * 69 = 15.34 \approx 15$ g.cm

$B = m_1x_{1b} = 16.2 * 46.9 = 759.78 \approx 760$ g.cm

$\Delta B = m_1\Delta x_{1b} + \Delta m_1 x_{1b} = 16.2 * 0.3 + 0.1 * 46.9 = 9.55 \approx 10$ g.cm

$R = \frac{A}{B} = \frac{773.94}{759.78} = 1.0186 = 1.02$

$\frac{\Delta R}{R} = \frac{\Delta A}{A} + \frac{\Delta B}{B} = \frac{15.34}{773.94} + \frac{9.55}{759.78} = 0.0323 \approx 0.032$

$\Delta R = 0.03$

(5)Results:

$$R = 1.02 \pm 0.03$$

(6)Conclusions:

The ratio we got in this experiment is 1.02 with random error 0.03, comparing this result with the true value which is 1 (because the conservation of linear momentum, $P_a = P_b$). And by the Discrepancy test $|R_{True} - R| \leq 2\Delta R \Rightarrow |1.02 - 1| \leq 2 * 0.03$

if the lower end of the track is not horizontal, then the velocity will have x any y components, so the horizontal range will change depending on the angle.