جامعة بيرزيت

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Phys111 Report

Experiment #2: Conservation of Linear Momentum

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(1) Abstract:

Aim of the experiment:

is to calculate the ratio between the linear momentum before and after Collision. And also to test the law of Conservation of linear momentum.

The main result is:

$R = 1,02 \pm 0,03$

(2) Data:

$m_1 = 16,2 \pm 0,1\ g$ $\quad$ $m_2 = 5,3 \pm 0,1\ g$

	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
$x_{2a}\ (cm)$	69,3	68,7	68,8	69,5	69,6	68,2

Area
13/4/2022

(3)Calculations:

$\bar{x}_{1b} =$ 46,9166	cm	$\sigma_s(x_{1b}) =$ 0,65548	cm	$\Delta\bar{x}_{1b} =$ 0,3	cm
$\bar{x}_{1a} =$ 25,25	cm	$\sigma_s(x_{1a}) =$ 0,6892	cm	$\Delta\bar{x}_{1a} =$ 0,3	cm
$\bar{x}_{2a} =$ 69,0166	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 × 25,25 + 5,3 × 69,0116 = ~~977,9114~~ → 774,8114 → 775 g·cm

$\Delta A = m_1\Delta x_{1a} + \Delta m_1 x_{1a} + m_2\Delta x_{2a} + \Delta m_2 x_{2a} =$ 15,346 g·cm

$B = m_1x_{1b} =$ 16,2 × 46,9166 = 760,048 → 760 g·cm

$\Delta B = m_1\Delta x_{1b} + \Delta m_1 x_{1b} =$ 16,2(0,3) + 0,1(46,9166) = 9,551 g·cm

$R = \frac{A}{B} = \frac{774,81}{760,05} =$ 1,01942.

$\frac{\Delta R}{R} = \frac{\Delta A}{A} + \frac{\Delta B}{B} = \frac{15,346}{774,8114} + \frac{9,551}{760,048} =$ 0,03237.

$\Delta R =$ R × ⊖ = 0,03237 × 1,01942 = 0,033 → 0,03.

(5)Results:

$$R = 1,02 \pm 0,03$$

(6)Conclusions:

The ratio of(R) that we got is (1,02) with an expected error of 0,03, by using the discrepancy test ($|R_{true} - R| \leq 2\delta R$), with R_{true} equal (1) due the momentum is conserve. We will get ($0,02 \leq 0,06$), so our result is accepted. But our result is bigger than the true value (theoretical value), i think it's due to many factors (random error) such as? The air resistance, it works as a external force that resists the motion of balls and shorten the horizantal distance. ② maybe the rolling of the balls, its give the ball lower velocity when it reaches the bottom. Systematic error? the measurements started from a non-zero point and each measurment was subtracted by the starting point, so no problems with calibration.

No systematic error

Your result accepted.