BIRZEIT UNIVERSITY

SS

Faculty of Science كلية العلوم

Department of Physics دائرة الفيزياء

Phys111 Report

Experiment #2: Conservation of Linear Momentum

Name:	Malek Abdullah Zeghari	**ID #:**	1230358
Partner:	\\\\\\\\\\\\\\\\\\\\\\\\	**ID #:**	\\\\\\\\\\\\\\
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(1) Abstract:

Aim of the experiment:

Prove the low of conservation of linear momentum, by calculating the ratio of **R** between linear momentum of two balls collusion in an **isolated system**.

The main result is:

$$\boldsymbol{R} = \ 1.05 \ \pm 0.04$$

(2) Data:

$\boldsymbol{m_1} = 16.5 \pm 0.1\ \mathbf{g}$ $\quad\quad$ $\mathrm{m}_2 = 5.5 \pm \ 0.1\ \mathbf{g}$

	1.	**2.**	**3.**	**4.**	**5.**	**6.**
$\boldsymbol{x_{1b}}\ (\boldsymbol{cm})$	48.4 **cm**	48.6 **cm**	48.1 **cm**	48.7 **cm**	47.4 **cm**	46.6 **cm**
$\boldsymbol{x_{1a}}\ (\boldsymbol{cm})$	27.4 **cm**	26.1 **cm**	25.1 **cm**	25.1 **cm**	26.2 **cm**	25.8 **cm**
$\boldsymbol{x_{2a}}\ (\boldsymbol{cm})$	74.2 **cm**	73.2 **cm**	71.5 **cm**	73.4 **cm**	73.9 **cm**	71.2 **cm**

(3) Calculations:

$\bar{x}_{1b} = 47.96666667$ cm	$\sigma_s(x_{1b}) = 0.81649658$ cm	$\Delta\bar{x}_{1b} = 0.333333333$ cm
$\bar{x}_{1a} = 25.95$ cm	$\sigma_s(x_{1a}) = 0.85498538$ cm	$\Delta\bar{x}_{1a} = 0.349046319$ cm
$\bar{x}_{2a} = 72.9$ cm	$\sigma_s(x_{2a}) = 1.255388386$ cm	$\Delta\bar{x}_{2a} = 0.512510162$ cm

(4)

$A = m_1x_{1a} + m_2x_{2a}$ = **(**16.5 **x** 25.95) **+** (5.5 **x** 72.9) **=** 829.125 **g.cm**
$\Delta A = m_1\Delta x_{1a} + \Delta m_1x_{1a} + m_2\Delta x_{2a} + \Delta m_2x_{2a}$ = (16.5 **x** 0.349046319) **+** (0.1 **x** 25.95) **+** (5.5 **x** 0.512510162) **+** (0.1 **x** 72.9) **=** ➔ (5.759265452) **+** (2.595) **+** (2.818805891) **+** (7.29) **=** 18.46307134 **g.cm**
$B = m_1x_{1b}$ = 16.5 **x** 47.96666667 **=** 791.4500001 **g.cm**
$\Delta B = m_1\Delta x_{1b} + \Delta m_1x_{1b}$ =(16.5 **x** 0.333333333) **+** (0.1 **x** 47.96666667) **=** ➔ (5.499999995) **+** (4.796666667) **=** 10.29666666 **g.cm**
$R = \frac{A}{B}$ = 829.125 ÷ 791.4500001 **=** 1.047602502 ➔ 1.05
$\frac{\Delta R}{R} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$ = (18.463071 ÷ 829.125) **+** (10.29666666 ÷ 791.4500001) **=** 0.035278015
ΔR = 0.035278015 **x** 1.047602502 **=** 0.036957337 ➔ 0.04

(5) Results:

$$R = 1.05 \pm 0.04$$

(6) Conclusions:

$$R \pm \Delta R = 1.05 \pm 0.04$$

Discrepancy Test = |true value – exp. Value| ≤ 2 * error
= | 1-1.05| ≤ 2*0.04 ➔➔➔ 0.05 ≤ 0.08.
The result is accepted. (the true value = 1, Because its isolated system "That's mean : $\{\Delta P = 0\}$ ➔ $P_{Before} = P_{After}$ ➔ The ratio (R) = $\frac{P.A}{P.B}$ = 1") .
After I did the calculations, I make the discrepancy test To check if the result is accepted or not.

First of all, I think that my experimental value isn't agree exactly with the true value because it will be many errors such as random errors. Now if the lower end of the track is not horizontal, it will be affect in the result because it can make the balls moves differently, while the iron ball (the heavier) might go back, and the glass ball (the lighter) may go a bit higher before it landing, This can lead to different and inaccurate measurements.
In the experiment, there aren't systematic errors, Because the experiment is acceptable. Also it may be error when I do the readings values because I do the experiment reading on the zoom meeting not in the laboratory.