Experimental No. (8)

Conservation of Linear Momentum

Objective:

Verification of the conservation of Linear Momentum.

Apparatus:

Flex-track, balls, ruler, and carbon paper.

Theory:

The law of consecration of linear momentum states that:

"bf the total linear momentum of an isolated system is constant"

$$\sum_{i=1}^{N} \overrightarrow{P_i} = \sum_{i=1}^{N} \overrightarrow{P_f} = constant \tag{38}$$

For a system consisting of two particles, the law of conservation of

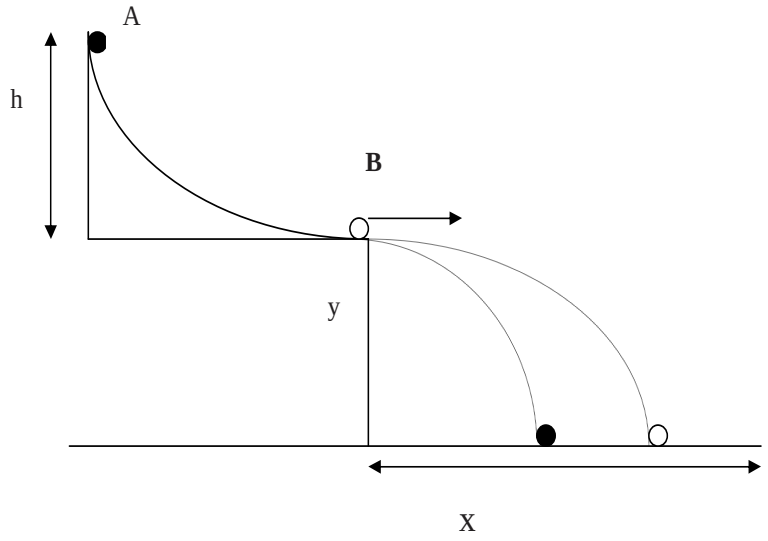

Figure 17:

linear momentum in a collision reduces to:

$$(\overrightarrow{P_1} + \overrightarrow{P_2})_{beforecollision} = (\overrightarrow{P_1} + \overrightarrow{P_2})_{aftercollision} \tag{39}$$

$$M\overrightarrow{V} + m\overrightarrow{v} = M\overrightarrow{V'} + m\overrightarrow{v'} \tag{40}$$

if we choose m initially to be at rest, the equation will be given as:

$$M\overrightarrow{V} = M\overrightarrow{V'} + m\overrightarrow{v'} \tag{41}$$

$$M\frac{\overrightarrow{r_1}}{t} = M\frac{\overrightarrow{r_1}}{t} + m\frac{\overrightarrow{r_2}}{t} \tag{42}$$

Where,

V : is the velocity of the mass M before the collision in x direction, $\overrightarrow{r_1}$ **is the position vector of the falling ball without collision,** V', $\overrightarrow{r_1}$**: is the velocity and displacement of the falling mass after collision,** v', $\overrightarrow{r_2}$**: is the velocity and displacement of the hitted mass after collision, since we choose the two masses are equaled, and the time of flight for all the masses is the same, the above equation become:**

$$\overrightarrow{r_1} = \overrightarrow{r_1} + \overrightarrow{r_2} \tag{43}$$

Procedure:

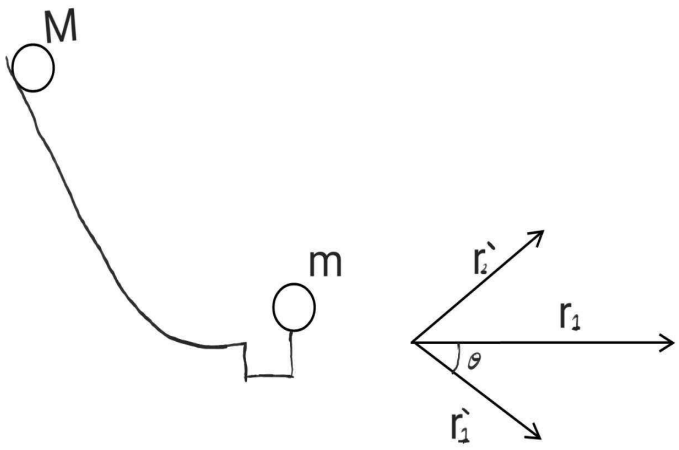

Figure 18:

1. **Place one ball near the end of the horizontal portion of the flex-track (see Fig. 1)**

2. **Release the ball from point A on the track and mark the position of the ball as $\overrightarrow{r_1}$.**

3. **Record the height h from which the ball is released. This should be measured . relative to the horizontal end of the track (see the figure).**

4. **Rerelease the ball again from the same height and put the other ball to make collision. Make sure that the collision is making small angle between the balls**

5. **Measure the distance of ball one and mark it as $\overrightarrow{r_1}$, and the other as $\overrightarrow{r_2}$.**

6. **Repeat the outlined procedure for the same pair of balls and for the same h with a slight change in angle.**

7. **Repeat the above steps for the same pair of balls but for a different h.**

8. **Tabulate your results as in Table (1).**

Name: **Grade:**

Students No.: **Date:**

	h	θ	$\overrightarrow{r_1}$	$\overrightarrow{r_1'}$	$\overrightarrow{r_2'}$	$\overrightarrow{R_1'}=\overrightarrow{r_1'}+\overrightarrow{r_2'}$	**error**
Run1							
Run2							
Run3							
Run4							
Run5							
Run6							

Questions:

1. **What is the main sources of error in your experiment?**

Discussion and Conclusion: