Experimental No. (7)

Conservation of Energy

Objective:

Verification of the conservation of energy law.

Apparatus:

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

Theory:

If a ball of mass m is released from point A on the track AB, then the conservation of energy gives:

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 + workdoneagainstfriction. \tag{35}$$

where mgh is the potential energy of the ball relative to point B on

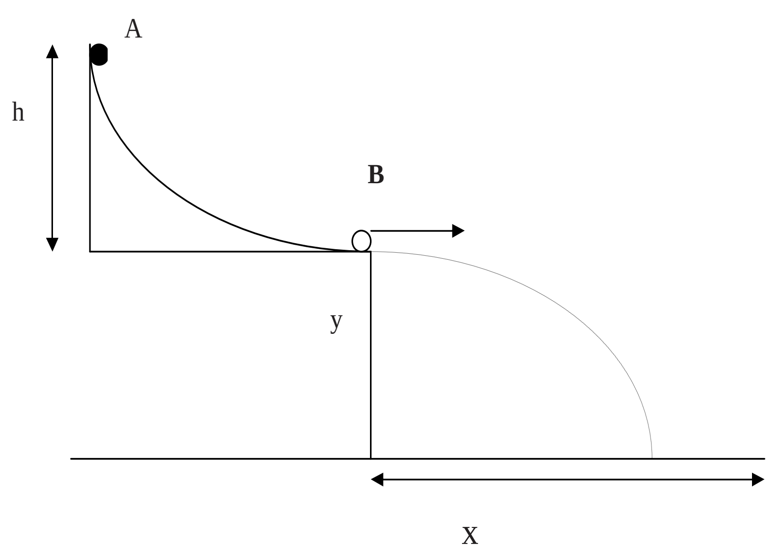

Figure 16:

the track (see fig. 1)

$\frac{1}{2}mv^2$ **is the transitional kinetic energy of the ball at point B.**

$\frac{1}{2}I\omega^2$ **is the rotational kinetic energy of the ball at point B.**

ω is the angular velocity of the ball at point B (and equals $\frac{v}{r}$).
I is the moment of inertia of the sphere about any axis passing through its center and is given by:$I = \frac{2}{5}mr^2$
If one neglect friction force, velocity can be expressed as:

$$v = \sqrt{\frac{10}{7}gh} \tag{36}$$

(Note that the velocity of the ball at point B is independent of its mass).
If we further assume that the track, at B is perfectly horizontal, then the ball will be treated as a projectile of horizontal velocity v. The horizontal velocity of the ball at point B could be found by different method . This is done by measuring x and y (refer to the figure) where,

$$\grave{v} = \frac{x}{t} = \frac{x}{\sqrt{\frac{2y}{g}}} \tag{37}$$

Procedure:

1. **Weigh a small ball(solid sphere) and record its mass.(If possible use an electrical balance).**
2. **Release the ball from point A on the track, (point A is arbitrary).**
3. **Repeat step 2 for the same height (for the same ball) two times.**
4. **Indicate the center of the group of points made by the ball when it hits the carbon paper and measure the horizontal displacement x.**
5. **Calculate v and v' by using Eq.(2) and Eq.(3) respectively.**

6. **Repeat the outlined procedure for another two balls of different masses.**

7. **Arrange your data as in table(l).**

Name: **Grade:**

Students No.: **Date:**

	m	**h**	**y**	**x**	**t**	**v**	**v'**	**mgh**	$\frac{7}{10}mv^2$	$\frac{7}{10}mv'^2$
Run1	m_1	h_1								
Run2	m_1	h_2								
Run3	m_2	h_1								
Run4	m_2	h_2								
Run5	m_3	h_1								
Run6	m_3	h_2								

h_1=**...............cm,** h_2=**..................cm.**

Questions:

1. **Compare the values calculated in columns 9, 10 and 11, Justify any difference?**

Discussion and Conclusion:

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"

$$\sum_{i=1}^{N} \overrightarrow{P_i} = \sum_{i=1}^{N} \overrightarrow{P_f} = constant \qquad (38)$$

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

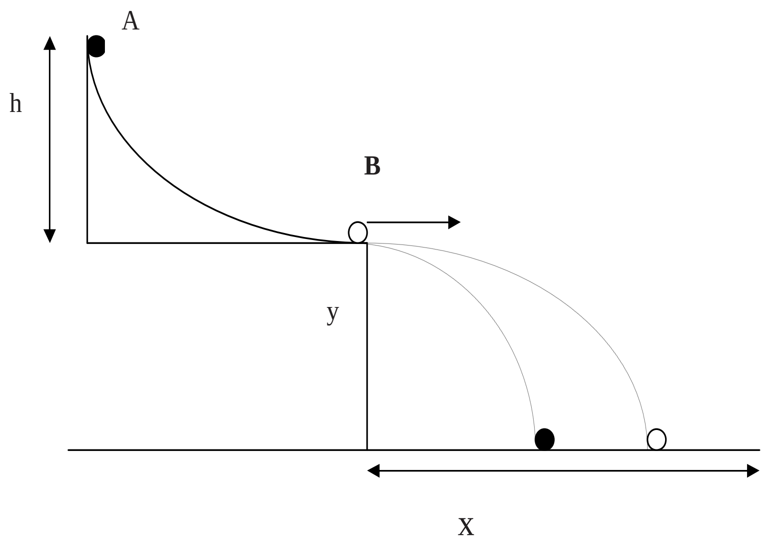

Figure 17:

linear momentum in a collision reduces to:

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