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Serial: 24

Lab Report 02

Name of the Experiment : Experiment with a Bouncing Ball

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Date : 07/10/2025

Instructor's comments:

Data tables:

Table A

Drop Height, H_1 (m)		First Bounce height (m)					Mean bounce height, H_2 (m)	Ratio of heights, H_1/H_2
		Trial 1	Trial 2	Trial 3	Trial 4	Trial 5		
Tennis	1.0	0.61	0.59	0.60	0.61	0.59	0.6	1.67
Golf		0.82	0.84	0.81	0.83	0.89	0.828	1.207
Table Tennis		0.72	0.70	0.73	0.71	0.72	0.716	1.396

Mass of the Tennis ball = 0.0580 kg

Mass of the Golf ball = 0.0462 kg

Mass of the Table Tennis ball = 0.0028 kg

Table B

Ball	$PE_1 = mgH_1$ (J)	$v_1 = \sqrt{2gH_1}$ (m/s)	$KE_1 = \frac{1}{2}mv_1^2$ (J)	E_1 ($PE_1 or\ KE_1$) (J)	$PE_2 = mgH_2$ (J)	$v_2 = \sqrt{2gH_2}$ (m/s)	$KE_2 = \frac{1}{2}mv_2^2$ (J)	E_2 ($PE_2 or\ KE_2$) (J)	Lost energy (J)	% Energy loss
Tennis	0.5689	4.4272	0.5684	0.5684	0.3410	3.93	0.3411	0.3410	0.2274	40%
Golf	0.9528	4.4272	0.9528	0.9528	0.3749	4.028	0.3748	0.3749	0.0779	17.20%
Table Tennis	0.0274	4.4272	0.0274	0.0274	0.0196	3.746	0.0196	0.0196	7.8×10^{-3}	28.96%

For Tennis,

$PE_1 = mgH_1$

$= (0.058 \times 9.8 \times 1)$ J

$= 0.5684$ J

$v_1 = \sqrt{2gH_1}$

$= \sqrt{2 \times 9.8 \times 1}$ m/s

$= 4.4272$ m/s

$KE_1 = \frac{1}{2}mv_1^2$

$= \frac{1}{2} \times 0.058 \times (4.4272)^2$ J

$= 0.5684$ J

$E_1 = KE_1 = 0.5684$ J

$PE_2 = mgH_2$

$= 0.0580 \times 9.8 \times 0.6$ J

$= 0.3410$ J

Data tables:

Table A

Drop Height, H_1 (m)		First Bounce height (m)					Mean bounce height, H_2 (m)	Ratio of heights, H_1/H_2
		Trial 1	Trial 2	Trial 3	Trial 4	Trial 5		
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Golf		0.82	0.84	0.81	0.83	0.84	0.828	1.207
Table Tennis		0.72	0.70	0.73	0.71	0.72	0.716	1.396

Mass of the Tennis ball = 0.0580 kg

Mass of the Golf ball = 0.0462 kg

Mass of the Table Tennis ball = 0.0028 kg

Table B

Ball	$PE_1 = mgH_1$ (J)	$v_1 = \sqrt{2gH_1}$ (m/s)	$KE_1 = \frac{1}{2}mv_1^2$ (J)	E_1 ($PE_1 or\ KE_1$) (J)	$PE_2 = mgH_2$ (J)	$v_2 = \sqrt{2gH_2}$ (m/s)	$KE_2 = \frac{1}{2}mv_2^2$ (J)	E_2 ($PE_2 or\ KE_2$) (J)	Lost energy (J)	% Energy loss
Tennis	0.5684	4.4272	0.5684	0.5684	0.3410	3.93	0.3411	0.3410	0.2274	40%
Golf	0.9528	4.4272	0.9528	0.9528	0.3749	4.028	0.3748	0.3749	0.0779	17.20%
Table Tennis	0.0274	4.4272	0.0274	0.0274	0.0196	3.796	0.0196	0.0196	7.8×10^{-3}	28.76%

For Tennis,

$PE_1 = mgH_1$

$= (0.058 \times 9.8 \times 1)$ J

$= 0.5684$ J

$v_1 = \sqrt{2gH_1}$

$= \sqrt{2 \times 9.8 \times 1}$ m/s

$= 4.4272$ m/s

$KE_1 = \frac{1}{2}mv_1^2$

$= \frac{1}{2} \times 0.058 \times (4.4272)^2$ J

$= 0.5684$ J

$E_1 = KE_1 = 0.5684$ J

$PE_2 = mgH_2$

$= 0.0580 \times 9.8 \times 0.6$ J

$= 0.3410$ J

$$v_2 = \sqrt{2gHk}$$

$$= \sqrt{2 \times 9.8 \times 0.6} \ m/s$$

$$= 3.43 \ m/s$$

$$KE_2 = \frac{1}{2} m v_2^2$$

$$= \frac{1}{2} \times 0.0580 \times (3.43)^2 \ J$$

$$= 0.3411 \ J$$

$$E_2 = PE_2 = 0.3410 J$$

Lost Energy, $= E_1 - E_2$

$$= (0.5684 - 0.3410) J$$

$$= 0.2274 \ J$$

$$\% \text{ energy loss} = \frac{E_1 - E_2}{E_1} \times 100\%$$

$$= \frac{0.2274}{0.5684} \times 100\%$$

$$= 40\%$$

Questions:

1. Which ball was the most efficient? What characteristics does that ball have that you think helped it be efficient?

Golf ball was the most efficient. The surface area of the ball is less in terms of mass; Golf ball is rigid, more rounded. Golf ball doesn't deformed easily that's why it is more efficient.

2. Why is it impossible for a ball to be 100% efficient?

Due to air resistance, shape or mass distribution, temparature and energy transfer to sound, heat and cause deformation.

3. How did the GPE change with height?

$GPE = mgh$

$\therefore GPE \propto h$ // So, if the height increase GPE will increase and if height decrease GPE will decreane.

4. What percentage of the initial potential energy was 'wasted' as the ball was hitting the ground?

For Tennis,

$$\left|\frac{PE_1 - PE_2}{PE_1}\right| \times 100\%$$

$$= \left|\frac{0.5684 - 0.3910}{0.5684}\right| \times 100\%$$

$$= 40\%$$

40% of the initial potential energy was wasted as the ball was hitting the ground.

Discussion:

Today our experiment was to use different 3 kinds of bouncing ball to practically examine how the conservation of energy works. In this experiment, we used a Tennis ball of 0.0580 kg mass, golf ball of 0.0462 kg , and table tennis ball of 0.0028 kg mass. For the first table we have to calculate the bouncing height of three different balls, while doing this, we encounter some complexity as we need to take the data by observing our eye. If we could use a laser machine, or slow motion device to observe, we could collect the data more accurately. During the experiment, we ~~show~~ watched that, all the ball during bouncing with the floor, we lose some energy due to collision with the surface, and this collision force these balls to lose the energy as sound, heat and cause deformation. That's why the balls could not reach the drop height even. But the total mechanical energy conserved, just the lost energy transfer from one system to another system.

Kinetic energy is related to any movable object, so if we drop the ball from height(h) it will gain kinetic energy, K.E = $\frac{1}{2}mv^2$. Where, potential energy P.E = mgh.

Energy conservation law states that,
Energy can neither be created or destroyed;
it can only change from one from to another,
but the total energy of an isolated system
remains constant.

H_2(m)

1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1

(1.1, 0.9)
Extrapolated

(.85, .7)
Interpolated

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 H_1(m)