Energy

SPH-3UI-02

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**Purpose:** There are three purposes to this lab. The first is to measure and record the duration of time in which a ball takes to slide down a wooden ramp. The second is to measure and record the duration of time in which a wooden block takes to slide down the same wooden ramp. The third is to measure and record the amount of energy lost from a bouncing ball between bounces.

**Background:** In all three experiments, gravity will contribute a large deciding factor for each outcome. The acceleration of an object due to gravity is 9.81m/s. Gravity is the single most important factor in this experiment because it creates the objects’ desired movement, moving down the ramp and freefalling from a drop. A factor that may sway the real outcome from the theoretical outcome is friction. The block of wood will experience more friction than the rolling ball and the falling ball simply because it is sliding and not rolling or falling. The height and length of the ramp in the first and second experiment is 0.81m and 1.94m, respectively. The mass of the rolling ball is 144.6g. The mass of the wooden block is 170.9g. The mass of the falling ball is 61.6g. The first and second experiments were measured thrice. The rolling ball averaged at 0.96 seconds while the sliding wooden block averaged at 1.46 seconds. Each height measured in the falling ball experiment is measured twice for accuracy and minimization of human error.

**Hypothesis:** In the first experiment, the ball rolling down the wooden ramp, it is safe to assume that the ball will roll down the ramp relatively quick. The duration of rolling will last approximately one second. The amount of gravitational potential energy in the beginning will transfer into thermal, kinetic, and sound energy by the end. Work will be done and energy will be lost. In the second experiment, the wooden block will slide down the ramp much slower than the rolling ball. It will reach the bottom in approximately two seconds. The block will suffer the same consequence as the ball in regards to energy loss, energy transfer, and work. In the third experiment, the ball will bounce and continue to bounce at least 10 times. Each time it bounces, it loses energy; therefore the next bounce will not be as high as the previous. Energy is lost from the ball by sound, kinetic, and potential energy. Energy is also lost because of air resistance and friction with the air and ground.

**Materials:** -A marble

-A wooden block

-A bouncy ball

-A wooden ramp

-A meter stick

-A flat surface to rest the ramp on (in this case, a desk)

-A stopwatch

**Procedure:** Experiment one: Raise the ramp to a desired height. In this case the desired height will be 0.81m. The height will be constant throughout the entire experiment. The ball will be placed at the top of the ramp and released. The timer will time the time it takes for the ball to hit the bottom of the ramp three times. The average of these three times will be used in any further equations.

Experiment two: Refer to experiment one. Instead of a ball, use a wooden block.

Experiment three: Place a meter stick against a wall. Make sure the wall is perfectly perpendicular to the ground. Place the bouncy ball at the desired rest height (in this case, 100cm) and drop. Catch the ball as it bounces back to max height and record the height. Repeat this twice or more for more accurate results. Repeat until the desired number of bounces is achieved.

**Observations**

**and Analysis:** Experiment one. The average time of the rolling ball is 0.96 seconds.

|  |  |
| --- | --- |
| Trial # | Time From Top to Bottom |
| 1 | 0.89 seconds |
| 2 | 0.92 seconds |
| 3 | 1.07 seconds |

Experiment two. The average time of the sliding block is 1.46 seconds.

|  |  |
| --- | --- |
| Trial # | Time From Top to Bottom |
| 1 | 1.50 seconds |
| 2 | 1.41 seconds |
| 3 | 1.46 seconds |

Experiment three. Each height is measured twice for accuracy and minimization of human error.

|  |  |  |
| --- | --- | --- |
|  | Height (cm) | Difference in Height (cm) |
| Bounces | 100 | N/A |
| 1 | 79 | 21 |
| 2 | 72 | 7 |
| 3 | 62 | 10 |
| 4 | 59 | 3 |
| 5 | 55 | 4 |
| 6 | 50.5 | 4.5 |
| 7 | 47 | 3.5 |
| 8 | 43 | 4 |
| 9 | 39 | 4 |
| 10 | 36 | 3 |

**Sources of**

**Error:** There are three main sources of error that may have caused distortion and variance to the data. The first is human error. The timer cannot synchronize perfectly with the dropper, therefore the timer will start the stopwatch too soon or too late, relative to the ball. The timer’s inability to perfectly start and stop the stopwatch in the beginning of the object’s journey and at the end of the object’s journey will cause slight distortion to the data, as the time will not be perfect. In experiment three, human error is fatal to the results of the station. The catcher must catch the ball at the very peak of its bounce. Most times the catcher could not catch it at its peak, but instead a little lower or a little higher. There is a high chance that the catcher also measured each height inaccurately, solely based on the fact that most measurements were from rough eye work and finger tracing. The final source of error is that the objects’ masses could have been inaccurately measured. The electronic scale could have been malfunctioning or buggy during the weighting session of the lab. An inaccurate measure of mass will distort the data in the lab, as the formula for gravitational potential energy and kinetic energy rely on accurate measurements.

**Conclusion:** This experiment shows that in reality, energy is always lost. Whether by kinetic, static, thermal, friction, or sound, energy will always find a way to escape. Energy loss will vary depending on the object with energy. As shown in experiments one and two, a rolling ball loses less energy than a sliding wooden block because it undergoes less friction. It can also be observed in this lab that energy cannot be gained, take experiment three for example. The ball is dropped 1 meter from the ground and each consecutive bounce afterwards is less than its initial height. If the ball gained energy, it would have bounced higher than its initial height. An object’s initial energy will always be greater than its final energy.

**Inquiry:** See attached paper.