POPPY SCHOLARS · PHYSICS OF THE UNIVERSE

Home lab 3 · Unit 3 · about 45 minutes

Is momentum conserved when one coin hits another, and how much kinetic energy is lost?

Name _____ Date _____

MATERIALS

You supply everything. Tick each item as you gather it.

- ☐ Two identical coins (two quarters or two pennies)
- ☐ A smooth, flat table or hard floor
- ☐ A ruler or tape measure (cm), and masking tape for a launch line
- ☐ Paper, pencil and a calculator

SAFETY

Keep coins off the floor where they could be stepped on, and away from small children and pets, who may swallow them. Flick coins away from other people.

PROCEDURE

1. Tape a starting line on a smooth table. Place a coin on the line, and flick it with your finger along a straight line, always with the same flick. Measure how far it slides from the line to where it stops (d_0). Do 3 trials, and find the mean d_0.
2. Place one coin on the line and the second coin 10 cm in front of it, touching nothing, on the same line. Flick the first coin in the same way so that it hits the second one head on.
3. After the collision, measure how far each coin slides from the point of impact to where it stops. Call these d_1 (the first coin) and d_2 (the second coin). Measure along the line of the sliding.
4. Repeat for 5 good collisions, and discard any in which the coins do not collide head on.
5. Because the coins are identical, the speed after a collision is proportional to the square root of the sliding distance ($v^2 = 2\mu_k g d$). Compute $\sqrt{d_0}$, $\sqrt{d_1}$ and $\sqrt{d_2}$ for each trial. These are in the same units as speed, and the coin's mass cancels.
6. Compare $\sqrt{d_0}$ with $\sqrt{d_1} + \sqrt{d_2}$ to test momentum conservation, and compare d_0 with $d_1 + d_2$ to find how much kinetic energy remained.

RECORD YOUR DATA

Quantity	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Launched alone, d_0 (cm)					
After collision, d_1 (cm)					
After collision, d_2 (cm)					
$\sqrt{d_1} + \sqrt{d_2}$					
$(\sqrt{d_1} + \sqrt{d_2}) \div \sqrt{d_0} \times 100$					
$(d_1 + d_2) \div d_0 \times 100$					

LAB REPORT

Write a report that gives your table, shows how the sliding distance gives a quantity proportional to speed, tests whether momentum before equals momentum after, and finds the percent of the kinetic energy that was left. Explain where the missing energy went, and why momentum is conserved even when energy is not.

Report the numbers you actually got, even when they disagree with the lesson. Write on the lines, or type your report on the website and send it to a teacher there.

Question and hypothesis *State the question in your own words, what you expect to happen, and why you expect it.*

Method *What you changed, what you measured, what you kept the same, and how many trials you ran.*

Observations *Describe what you saw, including anything unexpected. Your data tables are added to the report automatically.*

Calculations *Show each calculation step by step, with units.*

Claim and reasoning *Answer the question using your numbers, then explain why, using the science from the unit.*

Limits and next step *What could have affected your results, and one change you would make next time.*