

The Law of Conservation of Linear Momentum with Money

Procedure:

1. Using a flat surface and a meter stick (or ruler), place the penny so that its midpoint is at the 10-cm line. Then, place the nickel so that its midpoint is at the 0-cm line.
2. Push the nickel so that it slides and hits the penny. Do not slide it too hard. Be careful not to knock the coins on the floor. The nickel must slide on its own until it hits the penny.
3. When you have finished this collision, answer question 1 and all of its parts (A – D) under the “Questions” heading.
4. Now put the penny next to the meter stick so that its midpoint is at the 0-cm line. Then place the nickel so that its midpoint is at the 10-cm line.
5. Slide the penny so that it hits the nickel.
6. When you have finished this collision, answer question 2 and all of its parts (A – G) under the “Questions” heading.

Questions

1. Answer the following questions.
 - A. Did the nickel stop when it hit the penny?
 - B. Did the penny move after being hit by the nickel? If so did it move the same distance as the nickel?

C. Did the penny move with the same velocity as the nickel? Was its velocity higher or lower?

D. Is the penny more or less massive than the nickel? Explain your answer.

2. Answer the following questions. You can assume the coins are a closed system.

A. Did the nickel move after the penny hit it?

B. Did the penny keep moving after hitting the nickel?

C. Did the nickel move as far as the penny?

D. By looking at them which one had the higher velocity, the penny or the nickel?

E. If the momentum of the coins is the same, why are the velocities different? (momentum = mass \times velocity)

F. If you do the 1st and 2nd steps with a penny and a quarter will the penny move more or less after the collision than it did with nickel? **Test your answer by repeating steps 1 and 2 with a penny and quarter.**

G. If you do the 4th and 5th steps with a penny and a quarter will the quarter move? **Test your answer by repeating steps 4 and 5 with a penny and quarter.**

3. Answer the questions below regarding the 1st collision (steps 1 and 2) when the nickel hit the penny. You can assume the coins are a closed system.

A. The nickel has a mass of 0.015 kg and a velocity of +0.3 m/s. What is its momentum?

B. If the nickel transfers all of its momentum to the penny, what is the momentum of the penny?

C. If the penny has a mass of 0.005 kg what is its velocity? Use the momentum you found in part B above.

4. Answer the questions below regarding the 2nd collision (steps 4 and 5) when the penny hit the nickel. You can assume the coins are a closed system.

A. If the penny has a mass of 0.005 kg and a velocity of +0.4 m/s, what is its momentum?

B. If the penny transfers all of its momentum to the nickel, what is the nickel's momentum?

C. What is the mass of a nickel with the above momentum (from part B) if its final velocity is +0.1 m/s?