Ice Cubes and Elastic Collisions

Physics 11 - Mr. Gullo

Name: _____ Date: _____

Introduction

This activity investigates elastic collisions by sliding ice cubes on a smooth surface. By minimizing friction and heat loss, the collision closely approximates perfect elastic behavior where both momentum and kinetic energy are conserved.

Materials Needed

- Several ice cubes (uniform cube shape required)
- Smooth surface (kitchen tabletop or glass table)

Procedure

1. Find several ice cubes that are approximately the same size and a smooth kitchen tabletop or table with a glass top.
2. Place the ice cubes on the surface several centimeters away from each other.
3. Flick one ice cube toward a stationary ice cube and observe the path and velocities of the ice cubes after the collision. Try to avoid edge-on collisions and collisions with rotating ice cubes.
4. Explain the speeds and directions of the ice cubes using momentum principles.

Tips for Success

Here's a trick for remembering which collisions are elastic and which are inelastic: **Elastic** is a bouncy material, so when objects bounce off one another in the collision and separate, it is an elastic collision. When they don't, the collision is inelastic.

GRASP CHECK

Was the collision elastic or inelastic?

a. perfectly elastic

b. perfectly inelastic

c. nearly perfect elastic

d. nearly perfect inelastic

Lab Report

Name: _____ Partner: _____
Date: _____ Class: _____

Pre-Lab Checklist

☐ Ice cubes obtained (uniform size) ☐ Smooth surface identified ☐ Clear space for collision observations

Procedure Notes

Record observations during the collision experiments:

Data Table: Collision Observations

Trial	Collision Setup	A Initial	B Initial	A Final	B Final	Type
1	A moving, B stationary		0 (rest)			
2	A fast, B stationary		0 (rest)			
3	A slow, B stationary		0 (rest)			
4	A fast, B slow (same dir)					
5	Head-on collision					
6	Glancing/off-center					
7	Melted ice (wet)		0 (rest)			
8	Your choice:					

Additional Observations

Note any sticking, rotation, unusual motion, or surface conditions:

Analysis Questions

1. Describe the motion of both ice cubes after the collision. Did the moving ice cube stop? Did the stationary ice cube move?

2. Using the principle of conservation of momentum, explain why the ice cubes moved the way they did after the collision.

3. Was kinetic energy conserved in this collision? Explain your reasoning based on your observations.

4. What factors might cause this collision to be slightly inelastic rather than perfectly elastic?

5. As ice cubes melt, a thin layer of water forms between the ice and the surface. Explain how this water layer could cause surface tension effects that might make the ice cubes stick together momentarily during collision, resulting in a seemingly inelastic collision.

6. If this same experiment were performed outdoors in Canada during winter (at $-20°C$), how would the results differ? Would the collision be more or less elastic? Explain your reasoning.

7. As the ice cubes sit on the warm surface, they lose mass due to melting. If one ice cube has been on the surface longer than the other and has melted more, how would this

mass difference affect the collision outcomes? Use momentum equations to support your answer.

8. Compare the results when a fast-moving ice cube hits a stationary one versus when both ice cubes are moving toward each other at similar speeds. Which scenario shows more dramatic post-collision velocities? Explain using conservation of momentum.

GRASP CHECK Response

Selected answer: _____
Explanation:

Photo Documentation

Include photos showing:

- Experimental setup with ice cubes on smooth surface
- Collision sequence (if possible)
- Final positions after collision

Submission: Submit this completed template along with all graphs and photos as a single document (LastName_FirstName.PDF required).