RAMP, ELASTIC COLLISION & PROJECTILE MOTION

Energy, elastic collision equations, rebound, and horizontal launch

Name: ___________________________	Period: ____________	Date: ______________

INVESTIGATION QUESTION **How can one continuous event be analyzed using energy, momentum, and projectile motion?**

TIME	SIMULATION	UNIT 4
30 minutes	BuildPhysics > Ramp, Elastic Collision & Projectile Motion	Linear Momentum

Learning targets

- Determine speed from a vertical drop using energy.
- Analyze a one-dimensional elastic collision between unequal masses.
- Connect post-collision velocities to rebound height and landing distance.

Model before you measure

A 0.500 kg block starts from rest 2.50 m above the table, collides elastically with a stationary 1.00 kg block, and both later leave a 2.00 m-high table.	$mgh = \frac{1}{2}mv^2$ $p_i = p_f$ $K_i = K_f$ $x = v_x\sqrt{(2H/g)}$

Important: Use $g = 9.8$ m/s². Pause immediately before and after collision so the recorded velocities are not changed by later motion.

Pre-lab prediction | 4 minutes

1. Predict the 0.500 kg block's speed immediately before collision.

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2. Predict which block moves faster immediately after the elastic collision.

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3. Predict whether both blocks have the same projectile flight time from the 2.00 m table.

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PART A Run and analyze the baseline problem

Setup | 3 minutes

- ☐ Load Ramp, Elastic Collision & Projectile Motion and verify the two masses and given heights.
- ☐ Turn on motion trails, vector values, momentum totals, and graphs of v_x and p_x.
- ☐ Run slowly. Pause immediately before collision, immediately after collision, at the rebound turning point, and after each landing.
- ☐ Use displacement measurements for the rebound height and both horizontal landing distances.

Baseline data | 10 minutes

Quantity	Unit	Calculated value	Measured value
Speed of 0.500 kg block before collision	m/s		
Velocity of 0.500 kg block after collision	m/s		
Velocity of 1.00 kg block after collision	m/s		
Rebound height above table	m		
1.00 kg landing distance	m		
0.500 kg landing distance	m		

Momentum and energy check | 3 minutes

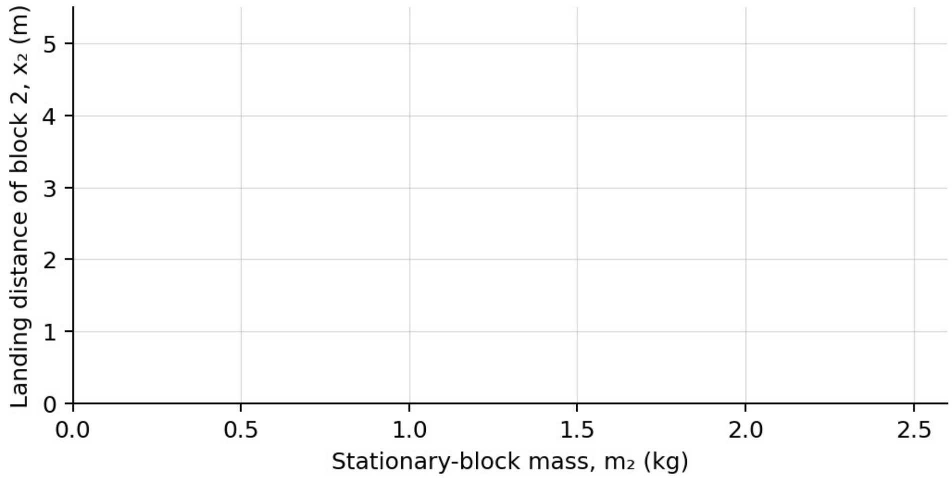
Total p_x before collision (kg·m/s)	Total p_x after collision (kg·m/s)	K before collision (J)	K after collision (J)

PART B Change the stationary block's mass

Mass test | 8 minutes

Controlled inputs: Keep the first block at 0.500 kg, release height at 2.50 m, collision elastic, and table height at 2.00 m.

Stationary mass m_2 (kg)	Block 1 v_1f (m/s)	Block 2 v_2f (m/s)	Block 2 landing distance (m)	Block 1 motion after collision
0.50				
1.00				
1.50				
2.00				
2.50				



4. Plot block 2 landing distance versus its mass. Draw a smooth trend.

Analysis | 6 minutes

5. Compare calculated and measured baseline values. Which stage showed the greatest difference?

6. How did increasing m_2 affect both post-collision velocities?

7. Why do the landing distances depend directly on the horizontal post-collision velocities?

8. Identify which conservation principle applies to each stage: descent, collision, rebound, and projectile flight.

Claim-Evidence-Reasoning conclusion

Evaluate this claim: Because the collision is elastic, each block keeps its own kinetic energy during the collision.

CLAIM	Accept, reject, or revise the statement.
EVIDENCE	Cite at least two measured trials or graph features.
REASONING	Use total-system momentum and kinetic-energy evidence and distinguish system totals from individual values.

Exit ticket

For a horizontal projectile launched from the same table height, what single measured quantity determines horizontal landing distance?