Lesson Plan | Ballistic Pendulum

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Physics

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Momentum

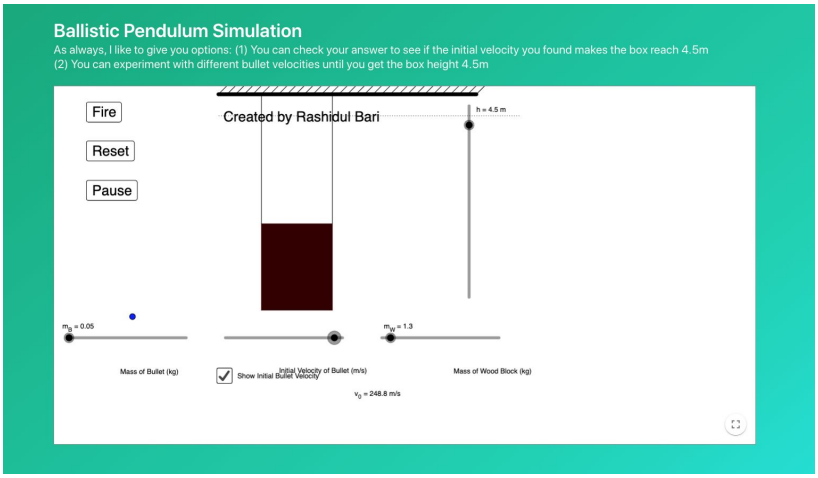
Website | https://barisciencelab.tech/L4BallisticPendulum.html

Objective	**NGSS**
SWBAT understand the momentum formula (p=m*v) by comparing the effects of momentum of a small ball and a heavy dumbbell on a glass.	PS2.A HS-PS2-2. Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object
SWBAT understands conservation of momentum using a ballistic pendulum. They will also use a Small Hint, Big Hint, and a Hands-on simulation to understand the phenomenon.	HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Summary:

1. Flipped Classroom (Outside Class)
2. Do Now (15 Minutes)
3. Student Presentations (15 Minutes)
4. Group activity (10 minutes)
5. Group Presentation/Class Discussion (15 minutes)
6. Exit Slip (10 minutes)
7. Discussion: (10 minutes)

Agenda	Action
Flipped Classroom (Outside Class)	Students instructed to watch video on the relationship between Newton's 3rd Laws and Momentum
Do Now Previously, students discovered that mass doesn't affect velocity (Galileo). After the Do Now, SWBAT understands that mass and velocity affect momentum. Thus, even though both objects were released from the same height (2 m) and had same velocity, the dumbell had a much greater mass and thus more momentum and broke the glass (Newton)	SWBAT connects what they learned from Galileo (mass  doesn't affect velocity) to discover that mass is important when it comes to momentum. Video will help visual learners

	grasp these abstract physical phenomena. The website is created to promote students' motivation.
Student Presentations	Upon checking the work students submitted on the Google Classroom, two student will be selected to present the Do Now
Solve Big Idea	Big Idea: Find initial velocity of the bullet that hits the pendulum and displaces it. Students will be provided four ways of solving the Big Idea: Without Hints in Breakout Rooms, With Small Hint, With Big Hint, and with Hands-On Activities using the Simulation. The teacher will be rotating around the breakout rooms.  Students will be sent to differentiated Breakout Rooms to solve the Big Idea problem. Every breakout room will have at least two top-performing students. Big Idea, here Three options: Hands-On, here Small Hint, here Big Hint, here Interactives on the Website is created to increase student enthusiasm
Group Presentation	Two groups will be selected to present the Big Idea.
Exit Slip	The Exit Slip : Students will Explain why momentum conserved using Newton's 3rd Law. A video is created to help support visual learners, Here
Discussion	One student will be randomly chosen to present the Exit Slip. The teacher will act as a facilitator
Across curriculum (Conservation of Mass)	Students would be encouraged to make across curriculum connections with conservation of mass. In fact, a video is created for students to encourage them making such connections, Here
Homework	Homework:

	 Explain why the following action won't satisfy the conservation of momentum: Mr. Bari throws an apple in the air. A video is created to help support visual learners. Link, here