Theme 1: On the Move

Aim : Experiment to investigate the principle of the conservation of Momentum .

OBJECTIVE: **To study the principle of conservation of momentum in one dimension involving elastic and inelastic collisions and an explosion.**

Focus Questions

- **What do you understand by Momentum?**
- **How do you measure Momentum?**
- **Is Momentum a vector or a scalar quantity?**
- **Must there be external forces during this experiment to obtain good results?**
- **Do you expect the momentum before and after collision to be exactly the same or very close to each other? Why?**
- **In the explosion is the direction of the two trolleys the same or opposite?**
- **Is momentum in this case conserved? How did you arrive at this conclusion?**
- **By varying the mass during an explosion type of collision is momentum still conserved?**

In this experiment the students are to measure velocitity and from it calculate momentum . It is wise to limit the number of decimal places displayed to two places . Errors may be kept to a minimum by strategically placing the light gates so that they capture the motion as close as possible to before and after a collision.

Date:

Theme 1: On the Move

Aim : Experiment to investigate the principle of the conservation of Momentum .

Apparatus : Air track, light gates to measure the velocities of the carts , two different carts and a balance to weigh the carts. Two Nova 5000 data loggers.

Sources of error and precautions -

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Method

1. **Inelastic Collision:** The air track is set up and adjusted on a horizontal surface. The first light gate is fixed at 60 cm and attached to the Nova data logger Input 1 (I/O-1). The second light gate distance is set up at 90 cm and attached to another Nova data logger Input 1 (I/O-1).

2. Launch MultiLab software. *Click Logger on the menu bar, and then click Timing Wizard. Choose velocity and click timing wizard – Method. Choose at one gate. Enter width of paper rider in cm. Press OK. Repeat for second data logger.*

3. The trolleys are placed on the air track one before light gate 1 and one before light gate 2. A magnet is fixed on trolley A so that when pushed it collides and sticks with trolley B. Trolley A is pushed and the velocity recorded by the data loggers is written down in table 1.

4. This procedure is repeated using different masses on the trolley. The velocity and momentum of the two trolleys before and after collision is calculated.

5. **Elastic collision :** Trolleys A and B are arranged with their magnets facing each other that when pushed trolley A collides and repels trolley B . Trolley A is pushed and the velocity recorded by the data loggers is written down in table 2. The momentum of the two trolleys before and after collision is calculated.

6. **Explosion :** Trolleys A and B are arranged with their magnets facing each other and they are placed in the middle of the runway. The light gates are fixed 30 cm away from each trolley.

7. The two trolleys are pressed close together in the centre. They are released and the velocity recorded by the data logger is written down in table 3. This procedure is repeated using different masses on the trolleys. The momentum of the two trolleys before and after collision is calculated.

Results:

Table 1 – Inelastic collision					
	Momentum	**Trolley**	Mass of trolley Kg	Velocity m/s	Momentum **M = M * V** **Kg m/s**
1 st Try	**Before**	A			
		B			
	After	A + B			
2 nd Try	**Before**	A			
		B			
	After	A + B			

Table 2 – Elastic collision					
	Momentum	**Trolley**	Mass of trolley Kg	Velocity m/s	Momentum **M = M * V** **Kg m/s**
1 st Try	**Before**	A			
		B			
	After	A			
		B			
2 nd Try	**Before**	A			
		B			
	After	A			
		B			

Table 3 – Explosion					
	Momentum	**Trolley**	Mass of trolley Kg	Velocity m/s	Momentum **M = M * V** **Kg m/s**
1 st Try	**Before**	A			
		B			
	After	A			
		B			
2 nd Try	**Before**	A			
		B			
	After	A			
		B			

Conclusion/Evaluation:

- Draw a diagram of the apparatus set up.
- Is the momentum of trolley A and B the same before and after collision in the three types of collision? Why ?
- Is momentum conserved?
- Give the main sources of error! How could we reduce them?
- State the law of conservation of momentum? Does this experiment prove it?
- Do you think that the experimental error in this experiment is big or small? Why?