

## Exploring Forces and Motion

**NGSS Standard: 3-PS2-4 Forces and Interactions:** *Define a simple design problem that can be solved by applying the principles of forces and motion.*

**A. GRADE LEVEL:** 3rd – 5th Grade

**B. SUBJECT:** STEM / Science

**C. DATE:**

**D. DURATION:** 2-3 days

**E. LESSON FOCUS:**

- Newton's Laws of Motion
- Forces and their impact on motion in engineering designs

**F. MATERIALS:**

- Toy cars
- Ramps (can be made from books or cardboard)
- Measuring tape
- Stopwatch or timer
- Markers (chalk or tape to mark starting positions)
- Data recording sheets (for students to note distances and times)

**G. LESSON OBJECTIVES:**

- Students will understand how forces affect the motion of objects.
- Students will explore Newton's Laws of Motion through a hands-on experiment.
- Students will observe and record how different forces (push and pull) change the motion of toy cars.
- Students will use data to draw conclusions about how force and motion are related.

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**H. PROCEDURES:**

**1. INTRODUCTION:**

- Begin by introducing the concept of forces and motion. Explain that a force is a push or pull that can change an object's motion.
- Discuss Newton's First Law of Motion: An object at rest stays at rest, and an object in motion stays in motion unless acted upon by a force.
- Introduce the toy car experiment: "Today, we are going to test how forces affect the motion of toy cars using ramps and measuring how far and how fast the cars go!"

**2. EXPERIMENT:**

- Divide students into small groups and give each group a toy car, ramp, measuring tape, and stopwatch.
- Have students place the ramp at a slight incline and release the toy car from the top to see how far it travels on the floor.
- Each group will conduct multiple trials, adjusting the angle of the ramp and recording how far the car travels, as well as the time it took to reach the end.
- Encourage students to experiment with different forces, such as pushing the car with their hands and letting gravity act as the only force.

**3. OBSERVATION:**

- Have students observe how different forces affect the motion of the toy car. Do cars move faster when the ramp is steeper? What happens when they apply a push to the car?

- As a class, discuss how the speed and distance of the toy car change based on the force applied. Record observations on the board.

#### **4. GENERALIZATION:**

- Explain that Newton's Second Law of Motion shows that the force applied to an object changes its acceleration. The more force you apply, the faster the object moves.
- Discuss how the experiment demonstrated Newton's Third Law: for every action (push or pull), there is an equal and opposite reaction (the toy car moves).

#### **5. ASSESSMENT:**

- Students will complete a worksheet to record their observations and results from the experiment.
- Ask students to draw conclusions about how force and motion are related, using evidence from their experiments to support their answers.

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#### **Note 1: (Safety Precautions)**

- Ensure students are careful when handling the toy cars to avoid accidents.
- Make sure that the ramps are stable and will not topple over while the students are experimenting.
- Remind students not to push the toy cars too hard, as they could move too fast or hit something unexpectedly.

#### **Note 2: (Accommodation for ELL, ESE, etc.)**

- For English Language Learners (ELL), provide visual aids, such as pictures of toy cars, ramps, and force diagrams. Use simple language and repeat key vocabulary such as *force*, *motion*, *push*, and *pull*.
- For Exceptional Student Education (ESE) students, pair them with peer buddies who can help explain instructions and assist with the experiment.
- Offer additional time for data collection and encourage students to express their findings through drawings or verbal explanations if needed.