**📍 Station 2: Force & Motion Fun**

**NGSS: 3-PS2-1, 4-PS3-1**

**🛠️ Materials at this station:**

* Your completed catapult
* Cotton balls or pom-poms (projectiles)
* Measuring tape or ruler (marked in centimeters)
* Data table (provided on your worksheet or in your notebook)
* Pencil or pen

**Student Directions:**

**Step 1: Set up your launch area.**

* Use the measuring tape to create a clear path where you will launch the cotton ball.
* Place your catapult at the “0 cm” starting line.

**Step 2: Load your projectile.**

* Place one cotton ball in the spoon of your catapult.

**Step 3: Test with LOW force.**

* Gently pull the spoon back **just a little bit**—this is a **small or low force**.
* Let go and **watch where the cotton ball lands**.
* Use the measuring tape to measure how far it flew (from the front of the catapult to the landing spot).
* Write the **distance in centimeters** in the data table.
* Write an **observation** (e.g., "It barely moved," or "It rolled a short distance").

**Step 4: Test with MEDIUM force.**

* Pull the spoon back **about halfway**—this is **medium force**.
* Launch, measure, and record your results and observation.

**Step 5: Test with HIGH force.**

* Pull the spoon **all the way back**, as far as it can go without breaking.
* Launch, measure, and record the final distance and your observations.

**Record Your Results Below:**

| **Pull Force** | **Distance (cm)** | **Observation** |
| --- | --- | --- |
| Low |  |  |
| Medium |  |  |
| High |  |  |

**Reflection Question:**

**→ What did you notice about how the force changed the motion of the cotton ball?**  
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📍 **Station 2: Force & Motion Fun**  
🔬 **NGSS Connection:**  
**3-PS2-1** – Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.  
**4-PS3-1** – Use evidence to construct an explanation relating the speed of an object to the energy of that object.

✅ **ITEEA STEL Standards – Elementary School**

**STEL 1B** – Technologies are developed to meet human needs and wants.  
 → Students investigate force using their self-built catapults to explore motion in a hands-on way.

**STEL 2B** – The core concepts of technology apply to all technological activities.  
 → Students engage with the concept of force and motion, applying them through a physical system (catapult).

**STEL 4B** – The engineering design process includes defining the problem, generating ideas, testing, and refining solutions.  
 → Students test variables (low, medium, high force) to observe performance and improve understanding.

**STEL 5A** – Asking questions and gathering information helps solve problems.  
 → Students collect data on motion and use observations to draw conclusions about cause and effect.

**STEL 7B** – Mathematics helps support technological development.  
 → Students measure distances and analyze how force affects motion.

✅ **Common Core Math Standards – Elementary School**

**3.MD.A.2** – Measure and estimate liquid volumes and masses of objects using standard units.  
 → Students use standard units (cm) to measure how far the projectile traveled.

**3.MD.B.4** – Generate measurement data and represent it using line plots.  
 → Students collect and record motion data that can be used for graphing and analysis.

**4.MD.A.1** – Know relative sizes of measurement units within one system of units.  
 → Students apply centimeter measurements consistently across trials to compare distances.

**4.MD.A.2** – Use the four operations to solve word problems involving distances.  
 → Students compare motion data and use addition/subtraction to analyze how distance changes with force.

💡 **Summary:**  
This station emphasizes how varying force affects motion. Through structured investigation, students measure distances, record observations, and reflect on relationships between force, energy, and motion. This hands-on experience strengthens understanding of physics concepts and supports foundational skills in measurement and data collection—essential for NGSS, ITEEA, and Common Core Math standards.