**📍 Station 3: Mass Matters**

**Focus:** Mass, Force & Motion  
**NGSS:** MS-PS2-2, MS-PS3-1, 2-PS1-1

### **Goal**:

Test how the **mass** of an object affects how far it moves when you apply the **same force**. Learn how mass, motion, and energy are connected.

**Materials Needed:**  
 Digital scale or spring scale

 3 blocks or objects of different masses

 Flat surface or ramp

 Ruler or measuring tape

 Tape (optional, for start lines)

**Student Directions:**

#### Step 1: Measure Mass

1. Use the **scale** to find the **mass (in grams)** of each object or block.
2. Label them as **Mass 1**, **Mass 2**, and **Mass 3** (lightest to heaviest).
3. Write down the mass of each.

#### 🏁 Step 2: Set Up the Test Area

1. Choose a flat surface or a small ramp.
2. Use tape to mark the **starting line** for each object.
3. Place the first object behind the line.

#### 💨 Step 3: Push and Measure

1. Gently push **Mass 1** with the **same light push** each time.  
   (Tip: Use just one finger or push for one second to keep it consistent.)
2. Measure how far it slides **from the start line** using a ruler.
3. Record the **distance (in cm)**.
4. Repeat for **Mass 2** and **Mass 3**, using the same force.

### 📊 Record Your Results:

| **Object** | **Mass (g)** | **Distance Moved (cm)** |
| --- | --- | --- |
| Mass 1 (Light) |  |  |
| Mass 2 (Medium) |  |  |
| Mass 3 (Heavy) |  |  |

### 💬 Think & Reflect:

📝 **How did the object’s mass affect how far it moved with the same push?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🧠 **Why do you think heavier objects don’t move as far with the same force?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### 📍 **Station 3: Mass Matters**

**Focus:** Mass, Force & Motion  
**NGSS Standards:**

* **MS-PS2-2** – Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.
* **MS-PS3-1** – Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass and speed of an object.
* **2-PS1-1** – Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

### ✅ ITEEA STEL Standards – Middle School

**STEL 1E** – Technological systems use inputs, processes, outputs, and feedback to solve problems.  
→ Students apply input force to objects of varying mass and observe output motion—analyzing how systems respond to different parameters.

**STEL 3E** – The study of technology uses measurement.  
→ Students measure mass, distance, and apply consistent force to explore the relationship between variables in a systematic way.

**STEL 6E** – Energy is the capacity to do work.  
→ Students examine how kinetic energy (motion) is affected by mass under constant force conditions.

**STEL 7F** – Technological products and systems can be used to apply energy in a variety of ways.  
→ This station illustrates mechanical energy use and its effects on motion and performance of materials.

**STEL 11E** – Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.  
→ Learners model force and motion scenarios, test outcomes, and evaluate how mass influences movement.

### ✅ Common Core Math Standards – Middle School

**CCSS.MATH.CONTENT.6.SP.B.4** – Display numerical data in plots on a number line, including dot plots, histograms, and box plots.  
→ Students can create charts or graphs showing how distance changes with increasing mass.

**CCSS.MATH.CONTENT.6.RP.A.3** – Use ratio and rate reasoning to solve real-world and mathematical problems.  
→ Exploring how distance/mass ratios change under constant force applications.

**CCSS.MATH.CONTENT.7.EE.B.3** – Solve multi-step real-life problems using numerical and algebraic expressions.  
→ Students calculate, interpret, and compare quantitative relationships among mass and motion.

**CCSS.MATH.PRACTICE.MP2** – Reason abstractly and quantitatively.  
→ Students use measurement data to make sense of the relationships between force, mass, and motion.

**CCSS.MATH.PRACTICE.MP5** – Use appropriate tools strategically.  
→ Rulers, scales, and consistent procedures are used for reliable data collection.

### ✅ Summary:

This activity bridges physical science and engineering by helping students **test and quantify how mass affects motion**. It aligns with **ITEEA STEL standards** for measurement, energy, and system behavior and supports **Common Core Math standards** through data collection, ratio reasoning, and mathematical modeling of motion.