Launch Tube

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Subject: Scientific Method, Physics

Grade Level: Grade 3 to 5

Standards: *New York State- Intermediate Science* *(www.emsc.nysed.gov/ciai/)*

Standard 1- Analysis, Inquiry and Design
Standard 4- The Physical Setting
Standard 6- Interconnectedness: Common Themes
Standard 7- Interdisciplinary Problem Solving

Next Generation Science Standards (www.nextgenscience.org)

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Schedule: Two 40-minute class period

CCMR Lending Library Connected Activities:

Objectives:	**Vocabulary:**
Practice the scientific method through accurate data collection, graphing, and making predictions.	Scientific Method Estimate Predict Accuracy Replication Variable
Students Will: • Take measurements. • Use graphs and tables to record data • Make estimations. • Students will use collected data to make scientific predictions. • Replicate their results for accuracy.	**Materials:** **For Each Group:** PVC Ramp Base Support Clamp 2-3 Balls Landing Mat **For Each Student:** Activity Sheet Stickers **Provided by Teacher:** Calculator Ruler
Safety	Be sure that the ramps and supports are properly secured with the clamp. If they aren't, they could easily fall if bumped.

Science Content:

This lesson builds upon students' prior knowledge and intuition about motion and momentum. These concepts are not introduced formally; however, students are encouraged to think about these concepts informally as they complete the activity.

The focus of this lesson is on the scientific process and quantifying students' intuitions. The graphs and charts used by the students as they work through the activity require them to record data accurately and make predictions based on their findings. Students must also be aware of human error and make sure they are measuring only one variable.

Preparation:

1. Photocopy print materials (*Activity Sheets*) for each student.
2. Materials should be divided based on the number of student pairs/groups.

Classroom Procedure:

Day 1: *(Activity Sheets 1 – 3)*

On the first day, the teacher has one Launch Tube set up at the front of the class and the class goes through activity sheets 1 – 3 together, performing a portion of the experiment and discussing key points involved.

Activity Sheet 1

Motivate the students to think about the experiment they are going to be performing. Encourage them to think about what they expect to happen before collecting any data.

Activity Sheet 2

Inviting student volunteers up to participate, demonstrate to the class the experiment focusing on the idea of repeatability. Scientists need to document their testing procedure so that other scientist can perform the same experiment and get the same results. The main two areas that the students can choose different testing procedures are:

(1) Release Point: Do the students place the center of the ball on the release position? The front of the ball? The back of the ball?

(2) Distance Measurement: Do the students read the landing distance while looking right over the ball, rather than off to the side? Do they read the measurement from the front, middle, or back of the ball?

Whichever method the students select is correct, as long as they document it.

NOTE: If the balls aren't broken in enough, the loops don't catch on the Velcro hooks every time it lands. Especially when released from higher release positions, the ball may roll a few cm before stopping. Ask the student's input on if they feel that distance is a good data point, and if they think the data point should be thrown out. (If the ball doesn't catch, one of the students can "scuff" the ball by dragging it across the Velcro. This can help loosen up some of the loops and make it catch better the next roll)

Activity Sheet 3

Inviting other student volunteers up, collect 5 data points from the 70cm release position. Have the students calculate the average, and discuss why the average is a better predictor of landing distance. Emphasize that scientists often collect many data point from the same experiment.

Day 2: *(Activity Sheets 4 – 6)*

On the second day, there are multiple Launch Tubes set up around the room and students are divided into teams of 3-5 to collect and analyze data.

Activity Sheet 4

Students can be assigned roles for each height:

- "Dropper" – releases the ball
- "Measurer" – reads the launch distance
- "Recorder" – writes down the distance read by the Measurer (or each student could write down themselves)
- "Scuffer" – when a ball rolls and the data point is discarded, the Scuffer drags the ball along the Velcro to help it catch the next time

Before collecting data, have the students practice the experiment and develop a testing procedure, as discussed on Day 1.

Activity Sheet 5

Students graph the data they collected in Activity Sheet 4. Questions lead them through determining which variables to put on each axis and what the end points of the axes should be. Students use stickers to plot the averages, and connect them by using a ruler and drawing a line that runs through their sticker data.

Activity Sheet 6

Using their graph from Activity Sheet 5, students predict where the ball will land for a release point that has not been tested. They place the target on the mat where they think it will land, and test their prediction by trying to hit the target.

Assessment:

The following rubric can be used to assess students during each part of the activity. The term "expectations" here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

1= exceeds expectations
2= meets expectations consistently
3= meets expectations occasionally
4= not meeting expectations

	Engage	Explore	Explain
1	Shows leadership in the discussion and an understanding of the concept of momentum.	Completes work accurately while providing an explanation for what is observed. Works very well with partner.	Provides and in-depth explanation of findings. Fills out worksheet clearly.
2	Participates in the discussion and shows some understanding of the concept of momentum.	Completes work accurately and works cooperatively with partner.	Provides clear explanation of findings. Fills out worksheet clearly.
3	Contributes to the discussion, but shows little understanding.	Works cooperatively with partner, but makes some mistakes with the procedure.	Provides a limited explanation of findings. Fills out some of the worksheet.
4	Does not participate in discussion. Shows no understanding.	Has trouble working with partner. Does little to complete the procedure.	Is not clear in explanation of findings. Does not fill out worksheet.