

# MeTEOR Learning Modules

## STEM MEA (Model Eliciting Activity)

### Understanding Chemical Reactions





## Happy Hopping: Newton's First Law

### Reflective Planning

#### Description/Summary of Lesson:

In this activity students will put effervescent tablets inside a film canister with a little bit of water. As gas is produced, pressure will build in the film canister causing the cap to pop off. Students will color and tape a creature of their choice to the bottom of the film canister and see how high it can go. The students can experiment with the amount of tablet and water to see what works best. This is an introduction to the STEM engineering design, build and modify process.

#### Essential Questions:

- What does a chemical reaction look like?
- Can we see gas being formed?
- What happens when gas bubbles are trapped?

**Suggested Grade Level:** Grades K-2

**Approximate Time:** One day (30 minute class period)

**Teacher's Role:** Demonstrator and Facilitator

**Class set-up:** Groups of two students at tables or desks put together

#### Success Standards:

- Students can plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball and two objects colliding and pushing on each other.)
- Students can raise questions about the natural world, investigate them in teams through free exploration and systematic observations and generate appropriate explanations based on those explorations.
- Students can explain that empirical evidence is information, such as observations or measurements that are used to help validate explanations of natural phenomena.
- Students can recognize the importance of communication among scientists.
- Students can recognize that scientists question, discuss and check each other's evidence and explanations.
- Students can develop and use models.

**Learning Purpose:**

- Students will plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- Students will make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- Students will ask questions, make observations and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

**Vocabulary:**

- Gas
- Newton's First Law of Motion
- Expand
- Motion

**Math Practices**

- MP 1: Make sense of problems and persevere in solving them.
- MP 3: Construct viable arguments and critique the reasoning of others.
- MP 6: Attend to precision.

**Depth of Knowledge:**

- DOK Level 3: Strategic Thinking

**Materials: (per group)**

- 2-3 Film Canisters with Lids (either 1 per student or 1 per group)
- Tape (scotch or masking)
- 2-3 Scissors
- Beaker or Cup with Water in it
- 2" x 1" Rectangular Piece of Cardstock
- 2-4 "Alka-Seltzer" tablets (1-2 packets)
- Markers or Crayons
- 1 Meter Stick (for the teacher to use)

## Summary of Tasks/Experiences

### Spark Activity:

- Have students view this 2:48 animated video that sings a nursery rhyme as frogs jump into the lake: <https://www.youtube.com/watch?v=FfBX4s5i5WA>.
- Tell the students they will be creating a jumping creature, and make it jump off a log.

### Lesson Descriptions:

#### Introduction: Day 1

The teacher will:

- begin discussion by taking one Alka-Seltzer tablet and dropping it into a beaker or cup of water and asking students to observe what's happening. Then pose the question “I wonder what would happen if I trapped the gas bubbles coming from that tablet?”
- Optional: Read Newton's First Law.
  - Newton's First Law: “An object at rest will remain at rest unless acted upon by an outside force.” Today's activity is possible because of this law.
- tell students that this challenge will test their groups ability to work together to make a creature, sitting on a film canister, jump off the ground. Tell the students that this challenge will be based on the height of the best bug jump. (You the teacher are the judge on the official height.)
- direct students to follow their student instructions. As students are working, circulate the classroom and ask questions about why they are doing what they are doing. If students ask you questions, encourage them or their group to answer.  
(Note: Don't allow students to stand above the "jumping bug," and make sure you are launching from a place that can get wet and messy.)

### Construction

The students will:

- draw and color a small creature on cardstock. Bend very bottom for the “stand.”
- tape it to the top of the canister.
- fill canister  $\frac{1}{2}$  full with water
- drop a small piece of “Alka-Seltzer” into the canister and close it quickly.
- stand back and see if creature jumps.
- repeat several times with more and less water.
- repeat several times with more and less “Alka-Seltzer.”

Teacher facilitates class asking guiding questions as students work in groups:

- Why do you think the creature jumps?

- What is your height prediction?
- After a few attempts, can you improve on your design?

### Practice Time

The students will:

- test their creature jumps a minimum of three times, making modifications each time.

## Student Engagement

**Social/Emotional Engagement:** Students will use social, interaction skills for completing projects with peers.

**Physical Engagement:** Students will design, create and engage the creature and chemical reaction while working in small groups.

**Cognitive Engagement:** Students will work together to understand why the creature jumps. (Chemical Change, Newton's First Law of Motion)

## Evidence of Learning

### Checks for Understanding/Expected Outcomes:

- Students will build their creatures and canisters.
- Students can recite Newton's First Law of Motion.
- Students will understand that a chemical reaction caused the motion needed to enact Newton's First Law of Motion.
- Students will articulate what made the creature jump.
- Students will be evaluated using the included rubric.

### Teacher Notes

- Through this STEM activity, students should be exposed to the engineering process of design, build and modify.
- Students' should discover that more effervescent tablets create more "pop," with at least  $\frac{1}{2}$  a canister of water. (Use attached data sheet to record hops.)
- Students should identify the creation of gas bubbles as the chemical reaction that forced the top of the cap open.
- Students should be able to state Newton's First Law of Motion: "An object at rest will remain at rest unless acted upon by an outside force."

## Happy Hopping Rubric

Category	4	3	2	1
<b>Problem Solving</b>	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions but is willing to try other's solutions.	Does not try to solve problems or help others solve problems. Lets others do the work.
<b>Contributions</b>	Routinely provides useful ideas. Leader.	Occasionally provides useful ideas. Strong team leader.	Rarely provides useful ideas. A satisfactory team member.	Provides no useful ideas or refuses to participate.
<b>Attitude</b>	Never is publicly critical of the project or others. Positive attitude.	Rarely is publicly critical of the project or others. Often has a positive attitude.	Occasionally is publicly critical of the project or others. Sometimes has a positive attitude.	Often is publicly critical of the project or others. Has a negative attitude.
<b>Focus on the Task</b>	Constantly stays focused on task.	Mostly stays focused on task.	Hardly stays focused on task.	Rarely stays focused on task.
<b>Working with others</b>	Almost always listens and shares with others.	Mostly listens and shares with others.	Occasionally listens and shares with others.	Rarely or never listens or shares with others.
<b>Comprehension of Concepts</b>	Demonstrates understanding of concepts.	Demonstrates understanding of most concepts.	Demonstrates understanding of a few concepts.	No demonstration of understanding of concepts.

**Total \_\_\_\_\_/24 Points**

## Happy Hopping: Newton's First Law Data Sheet

How much effervescent?	How much water?	How high did the frog jump?





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