For Teachers
MINI MOTORS

Mission: How do chemical forces control how tiny things move?

Age: 5+

Materials: $4

Time: 20 min
(Set-up: 5 min | Activity: 10 min | Clean-up: 5 min)

NGSS Alignment of Mini Motors Activity

The information below may not include every area that this activity can be linked to NGSS concepts

Disciplinary Core Ideas

PS2.A: Forces and Motion

- 3rd Grade
  - Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.
  - The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.

- Middle School
  - The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.
  - All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.

PS2.B: Types of Interactions

- 3rd Grade
  - Objects in contact exert forces on each other.

Performance Expectations

- 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.
- 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.
- 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.

Crosscutting Concepts

Cause and Effect: Mechanism and Prediction

- Grade 3-5
  - Cause and effect relationships are routinely identified, tested, and used to explain change.

- Middle School
  - Cause and effect relationships may be used to predict phenomena in natural or designed systems.
  - Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

Engineering and Science Practices

Planning and Carrying Out Investigations

- Grade 3-5
  - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
  - Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.
  - Make predictions about what would happen if a variable changes.

- Middle School
  - Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data is needed to support a claim.
  - Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.