PHASE TWO: BUILD UP
BOUNCY BEHAVIORS

Mission: How does changing the recipe affect how materials behave?

Age: 8+

Materials: $15

Time: 1 hour
(Set-up: 10 min | Activity: 35 min | Clean-up: 15 min)

NGSS Alignment of Bouncy Behaviors 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

- **Grade 3**
  - ◇ The patterns of an object's motion in various situations can be observed and measured; when the past motion exhibits a regular pattern, future motion can be predicted from it.
- **Middle School**
  - ◇ A system of objects may also contain stored (potential) energy, depending on their relative positions.

PS3.A: Definition of Energy

- **Grade 4**
  - ◇ Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer

- **Grade 4**
  - ◇ Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion.

PS3.C: Relationship Between Energy and Forces

- **Grade 4**
  - ◇ When objects collide, the contact forces transfer to the conversion of stored energy into a desired form for practical use.
- **Middle School**
  - ◇ When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.

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Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Grade 5
  - ◇ Measurements of a variety of properties can be used to identify materials.

PS1.B: Chemical Reactions

- Grade 5
  - ◇ When two or more different substances are mixed, a new substance with different properties may be formed.

ETS1.A: Defining Engineering Problems

- Grade 3-5
  - ◇ Possible solutions to a problem are limited by available materials and resources.
- Middle School
  - ◇ The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful.

ETS1.B: Developing Possible Solutions

- Grade 3-5
  - ◇ Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that needs to be improved.
  - ◇ Research on a problem should be carried out before beginning to design a solution.
- Middle School
  - ◇ There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
  - ◇ Models of all kinds are important for testing solutions.

ETS1.C: Optimizing the Design Solution

- Grade 3-5
  - ◇ Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
- Middle School
  - ◇ The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.

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Performance Expectations

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.

4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

5-PS1-3 Make observations and measurements to identify materials based on their properties.

5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

3-5-ETS-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Crosscutting Concepts:

Patterns

- Grade 3
  - ◇ Patterns of change can be used to make predictions.

Energy and Matter

- Grade 4
  - ◇ Energy can be transferred in various ways between objects.

Cause and Effect

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

Scale, Proportions, and Quantity

- Grade 5
  - ◇ Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

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Crosscutting Concepts:

Influence of Science, Engineering and Technology on Society and the Natural World

- Grade 3-5
  - ◇ People's needs and wants change over time, as do their demands for new and improved technology.

Systems and System Models

- Middle School
  - ◇ Models can be used to represent systems and their interactions - such as inputs, processes, and outputs - energy and matter flows within systems.

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.
  - ◇ Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- 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 many data are needed to support a claim.

Asking Questions and Defining Problems

- Grade 3-5
  - ◇ Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- Middle School
  - ◇ Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Constructing Explanations and Designing Solutions

- Grade 3-5
  - ◇ Apply scientific ideas to solve design problems.

Developing and Using Models

- Middle School
  - ◇ Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.