Third Grade Physical Science

PATTERNS AND PREDICTIONS: Forces and Motion

Background Information

A push or a pull, a force, is needed to set an object in motion. This requires objects to interact with one another. Types of interactions may be grouped into two broad categories. Direct contact between and among objects, such as friction, is one group. Interactions may also occur across a distance. Magnetic and gravitational forces are included in this category. Results of these forces are observable. Careful observations can lead to prediction of future results of interactions. The use of qualitative and quantitative observations assists in the development of predictions.

Performance Expectation

3-PS2-2: Motion and Stability: Forces and Interactions

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

https://www.nextgenscience.org/pe/3-ps2-2-motion-and-stability-forces-and-interactions

Disciplinary Core Ideas

PS2.A: Forces and 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. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)

Science and Engineering Practices

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

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.

Crosscutting Concepts

Patterns of change can be used to make predictions.

Objectives

- Students will identify a question to investigate patterns of motion.
- Students will develop and conduct a procedure, identify data to be collected, and interpret data for investigating the identified question.

- Students will collect qualitative and quantitative data.
- Students will use evidence to support prediction of future motion.

Advanced Preparation

- Determine what materials will be available for investigation.
- Determine how materials will be arranged for student use.
- Determine if additional materials will be available for the second part of the investigation, such as more/multiple sizes of marbles.
- Determine what formats and materials are available for presentations

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Materials

- *Ruler/Tape Measure*
- *3 Tennis Balls*
- *Washers*
- *String/Yarn Marble Runs*
- *Car Tracks*
- *Bowl*
- *Items that roll, such as marbles, multiple sizes of ball bearings, ping pong balls*
- *Chart Paper*
- *Art Supplies, such as markers, coloring materials*
- *Presentation Materials*
- *Ping Pong Balls and Other Objects that Roll (Optional)*

Suggested Implementation

Groups of 2-4 are suggested. You may wish to ask the class a question such as, "*What is needed for something to move?"* (Note: Students would have been introduced to forces in Kindergarten.)

Share with the class that they are going to observe how objects behave when forces are applied to the objects. Introduce each of the stations and materials to the group. Stations such as the following may be included:

- ☆ *One tennis ball: Tennis ball stays in contact with the floor.*
- ☆ *Two tennis balls: Tennis balls stay in contact with the floor.*
- ☆ *A string and washer suspended from a dowel/ruler: (Students may bring up the idea of a swing.)*
- ☆ *A bowl with a marble in it*
- ☆ *Car tracks with a car*
- ☆ *Marble run stations: Separate pieces into multiple stations*

At each station, students should explore how the materials move and interact with one

another, as well as what they wonder about these interactions. Recording of observations and questions occurs as exploration happens. Divide students into groups and the stations at which they will begin. Provide plenty of time for groups to explore prior to having groups switch to new stations. Groups should visit multiple stations as this will provide more details and ideas for further investigation. When completed, have students return to their seats.

Host a discuss regarding the results of each station. It may be helpful to record notes and drawings during the discussion for all to see. There are multiple methods for this discussion. The objectives of the discussion are examining data, identification/development of potential investigable questions, and the connection between the use of patterns to develop predictions of future motion. Based on your advanced decision regarding additional materials, share what will be available for student use. Once this has been completed for each station, assign groups to a station, and allow ample time for investigation. Each group identifies a problem/question to be investigated, develops a method for investigation, and completes the investigation.

Based on your prior decision regarding the sharing of findings, groups should organize how they will share results and predictions of future motion. Student groups will then share their findings and predictions.

Debrief

- What patterns did you observe at the various stations?
- How do you think (fill in the blank) would move if you (fill in the blank)?
- What evidence do you have to support your prediction(s)?
- How does this evidence support your predictions?
- Why would it be helpful to observe motion patterns and make predictions about future motion of objects?
- What is an example?

Resources:

http://www.physicsclassroom.com/Class/newtlaws/u2l2a.cfm#category

Suggested books from http://www.kbs.msu.edu/wp-content/uploads/2017/02/NGSS-Interactive-Read-Alouds.pdf

- Tompert, A. (1996). *Just a little bit.* When an elephant and a mouse try to play on a seesaw, they need help from a vast number of animal friends to balance the scales.
- Walsh, E. (2010). *Balancing act.* Two mice make a teeter-totter. They're balancing just fine, but then along comes a frog. Can they make room for one more friend on their teeter-totter? What about two? What about more? But then a big bird comes along and wants to play too.

- Waring, G. (2009). *Oscar and the cricket: A book about moving and rolling.* A boy works with his cricket friend to learn how objects and animals move.
- Mason, A. (2005). *Move it! Motion, forces, and you*. Simple language explores two forces of motion: push and pull. Readers learn that objects are moved by pushing or pulling. This could include lifting, jumping, blowing, throwing, and kicking.

Assessment

The following single point rubric can be used to assess student understanding. For each of the criteria listed below, either circle the proficient description or add notes to a box indicating why the student's performance was either lacking or exceptional.

Areas that need improvement. **Developing Performance**	Criteria for **Proficient Performance**	Evidence of exceeding standards. **Advanced Performance**
	Can provide an example of a pattern of motion from forces.	
	Can explain a simple investigation about forces and motion.	
	Given a scenario involving force and motion, can provide evidence to support the predication of motion.	