

2nd Physical Science

Forces and Motion

Teacher Background Information – for teacher content knowledge only, NOT student learning goals

Motion is essential to understanding the physical world of matter and energy. Nothing in the universe is at rest. Since everything is moving, there is no fixed reference point. All motion is relative to whatever point or object we choose. Changes in motion – speeding up, slowing down, changing directions – are due to the effects of forces. Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it. Newton's laws of motion are simple to state, but the fact that it took so long historically, to codify the laws of motion suggests that they are not self-evident truths.

Instructional Implications

Students need a great deal of hands on experiences observing and describing motion. They should manipulate objects, including themselves, by pushing, pulling, throwing, dropping, and rolling, so they begin to focus on the position and movement. Also encourage students to describe the location as up, down, in front of, behind, and so on.

Provide opportunities for children to be observe when and how things seem to move or not move. They can make lists and draw pictures of different kinds of motion and what things move that way. They should notice that things fall to the ground if not held up. Encourage them to ask questions, not worrying about the answers.

When children sing or use instruments, have them notice the vibrations that they can feel as they hear the sounds.

Science centers or stations are an effective way to give students opportunities to explore physical science concepts (magnets, rolling objects, sound, etc.)

Big Idea

Forces make objects move in different ways.

Essential Question

In what ways do objects move?
How do forces affect the motion of objects?

AAAS Benchmarks/National and Science Education Standards

Motion

- LM 1. The way to change how something is moving is to give it a push or a pull. 4F/P2
- LM 2. Things move in many different ways, such as straight, zigzag, round and round, back and forth, and fast and slow. 4F/P1 (Also goes with Waves)
- W1. Things that make sound vibrate. 4F/P3

Forces of Nature

- G1. Things near the earth fall to the ground unless something holds them up. 4G/P1
- EM 1 Magnets can be used to make some things move without being touched. 4G/P2

Local Connections

Playgrounds (slides, swings, tetherball, etc.)
Gym (balls, running, etc.)
Seasonal – winter skiing, sledding

Materials/Resources

FOSS: Balance and Motion
AIMS: Sound and Magnets
“Roller Coasters” Ch. 14 from Picture Perfect Science K-4
Bill Nye Video: All About Forces & Gravity

Student Difficulties and Misconceptions

Research shows that students have difficulties relating formal ideas of motion and force to their personal view of how the world works due to these 3 obstacles:

1) The ancient perception that sustained motion requires sustained force. The contrary notion that it takes force to change an object’s motion, that something in motion will move in a straight line forever without slowing down unless a force acts on it, runs counter to what we can see happening with our eyes.

2) Limitations in describing motion may keep students from learning about the effect of forces. Students of all ages tend to think in terms of motion or no motion. We need to help students divide the category of motion into *steady motion, speeding up, and slowing down*.

3) Newton’s 3rd law, the action-equals-reaction principle is counterintuitive. To understand that a table pushes back up with exactly the same force as a book presses down on the table seems false.

Sounds are not intuitively associated with the characteristics of their source by young students, but by investigating a variety of sound producing objects, they will begin to build a foundation to build on.

Alaska GLE’s

Currently there are no GLE’s for 2nd grade, so GLE’s were taken from 3rd grade. Motion is not taught in 3rd grade in JSD.

The student demonstrates an understanding of the process of science by

[3] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating

[3] SA1.2 observing and describing the student’s own world to answer simple questions

The student demonstrates an understanding of the attitudes and approaches to scientific inquiry by

[3] SA2.1 answering “how do you know” questions with reasonable answers

The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by

[3] SB4.2 recognizing that objects can be moved without being touched (e.g., using magnets, falling objects, static electricity)

Assessments

Uncovering Student Ideas Assessments;
Volume 3 Probe 9: Rolling Marbles
Volume 1 Probe 4: Making Sound

Science Notebooks

Related Scientist or Career Path

Physicists: Newton & Einstein