Science 3-5: Motion

Intended Audience: Students with significant cognitive disabilities

# **Standards:**

SC.3.P.8.3 Compare materials and objects according to properties such as size, shape, color, texture, and hardness.

SC.3.N.1.2 Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups.

SC.3.N.1.3 Keep records as appropriate, such as pictorial, written, or simple charts or graphs, of investigations conducted.

SC.4.P.12.1 Recognize that an object in motion always changes its position and may change its direction.

SC.4.P.12.2 Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.

SC.4.N.1.2 Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.

SC.4.N.1.6 Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.

SC.5.P.13.2 Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.

SC.5.N.1.3 Recognize and explain the need for repeated experimental trials.

# **Learning Objectives:**

1. Students can describe that objects move at different speeds.

2. Students can explain that an object in motion may change its direction and speed depending on the force applied.

3. Students can describe the difference between the speeds of hard and soft objects.

# **Vocabulary:**

1. speed: the rate at which something moves

2. motion: the process of moving

3. force: physical strength or power

4. angle: describes something that leans and does not go straight up and down or directly forward

5. ramp: a sloping or angled plane

# Materials:

* Video: [Explanation of Force](http://fairfieldschools.org/schools/jen/activity/grade-4-force-and-motion/) (excerpt 0:00-0:53)
* Gather prior to exploration: small same-size pompoms, small same-size marbles, rulers and hardback books to make ramps, masking tape to mark length/room for objects to travel
* Gather prior to instruction: beach ball or playground ball
* Prepare prior to instruction: data collection sheet to include columns for recording time, distance and speed, space in the classroom or hallway to conduct exploration
* Science journals

# **Essential/Guiding Questions:**

1. Does the hardness or softness of an object affect its speed?

2. What are factors that affect the speed at which objects move?

3. How do objects change their direction or vary their speed?

# Lesson Presentation:

**Activating Prior Knowledge:**

1. Have students sit on the floor in a circle. Pass a large ball around the circle, first rolling it slow, then fast. Ask students “How is the ball moving?” (Answers vary.)

2. Tell students that they are going to explore the way other objects move.

**Modeled instruction:**

1. Show the video, [Explanation of Force](http://fairfieldschools.org/schools/jen/activity/grade-4-force-and-motion/) (excerpt 0:00-0:53). Tell students that they are going to explore the motion of 2 different objects, marbles and pompoms.

2. Introduce/review the vocabulary in the video as it relates to your investigation. Use visuals supports as needed.

3. Model how to set up the ramp with a ruler and a book. Mark a “finish line” with masking tape 100 cm (approx. 40 inches) away from the ramp.

4. Model how to roll the marble and the pompom down the length of the ruler/ramp.

5. Model how to measure time, distance and calculate speed. Review/show that Speed = Distance divided by Time. Model entering data on the data collection sheet.

6. Tell students that they will be doing an investigation to see if the height of the ramp affects the speed of the marble or pompom. On the Smart Board or doc camera write the Question of Inquiry: “How does increasing the height of the ramp affect the speed of the marble and the pompom?”

**Supported/Guided instruction:**

1. Replay the video, [Explanation of Force](http://fairfieldschools.org/schools/jen/activity/grade-4-force-and-motion/) (excerpt 0:00-0:53). Review related vocabulary and model the set up the ramp, etc.

2. Review the Question of Inquiry: “How does increasing the height of the ramp affect the speed of the marble and the pompom?” Tell students that they will be answering this later.

3. Divide students in to pairs or small groups. As students create their own ramps, provide adult support to student groups as needed.

4. Provide each student group with marbles and pompoms after predetermining how many trials they are to perform. Provide each group with a data collection sheet to be completed after each trial.

5. Measure the distance that each pompom and marble traveled. Measure the time that it took for the marble and pompom to travel the length of the ramp to the finish line. With adult support if needed, calculate the speed. Record your information on the data collection sheet

6. Allow ample time for groups to complete their investigations.

7. After investigations are complete, bring students back to the Gathering Area/carpet. Engage students in discussion with questions (i.e. What did you notice about the speeds of each object? Did one object move faster than the other? Why?). Other questions may be added, and students may ask questions of peers as well.

**Independent Work:**

1. Display the Question of Inquiry: “How does increasing the height of the ramp affect the speed of the marble and the pompom?” This may also be printed and distributed to students to glue in to their Science journals.

2. Students will answer the Inquiry Question in their journals or discuss with a partner or in a small group.

**Small group suggestions:**

1. Students may create other opportunities to explore motion (i.e. rolling a ball down a hill, moving a cube, prism or other shape down a ramp, moving an object on an incline by pulling).

2. Students may practically apply their investigation to their classroom or home environment.

3. Students can read a piece of informational text that related to motion, push and pull, as it related to sports and physical education. See ReadWorks: [An Article a Day Set: Ball Games](https://www.readworks.org/article/Ball-Games/32375cb4-ad31-46dd-9d01-79f5ec06fb9e#!articleTab:content/contentSection:c104f533-e96f-4f18-babd-0bc42933d16e/).

# Assessment:

1. Students will show and explain why objects made of different materials move at different speeds.

2. Teachers should utilize district created rubrics to score student work.

# UDL:

**Multiple means of representation:**

1. Students can use a graphic organizer to show the differences in motion of the two objects.

2. Students can write a song about their investigation.

3. Students can write additional journal entries about their investigation.

4. Students can draw pictures to show what they experienced.

5. Students can work individually, in pairs, or in a small group.

6. Students can work independently with adult supports.

**Multiple means of expression:**

1. Students can use an iPad or other touch device to show similarities and differences.

2. Text to speech options are available for computers, iPads and other hand held devices. Google Chrome offers free extensions, such as Selection Reader and Select and Speak-Text to Speech, and apps, such as Text to Speech, Text to Speech with Google Drive, and TTS Reader- Unlimited Text-to-Speech.

3. Speech to text options are also available from Google. Extensions include Voice Note II-Speech to Text, Online speech recognition, and Co: Writer Universal. Voice Note II is also available as an app; Speech notes-Speech to Text Notepad is available as well.

4. Additional information about text to speech and speech to text options are available through your district Assistive Technology Department.

5. Expression may come in the form of verbal responses, signed responses, pointing/gestures, eye gaze, or through the use of a low or high tech device.

6. All students should have access to expressive language/technology that is appropriate for their specific need.

**Multiple means of engagement:**

1. Students might sit in cube chairs, wiggle seat/sensory cushions, or small seats rather than sit on the floor.

2. Provide students with choices of how to interact with materials.

3. Provide students or small groups with various places in the classroom in which to work, i.e. floor, desks, at the board.

4. Limit distractions in the work areas.

5. Encourage collaboration with peers in partners or small groups.

6. Allow students to work independently.

7. Allow students to be positioned for maximum learning engagement.

8. Provide students with additional materials, if necessary.

9. Provide supervision to students who need assistance when handling hard, and potentially dangerous, objects. An item other than marbles should be considered with students who have pica behavior or mouth objects or might use a marble to throw or cause harm.

# Assistive Technology Recommendations:

1. All students should have a means of expressive communication and a way to be actively engaged in learning.

2. Response modes may include, but are not limited to: eye gaze, gesturing or pointing to pictures/words/phrases, signing, low tech devices (Go Talks, etc.), or dynamic devices (iPad, etc.)

3. Lesson vocabulary, photos/pictures and graphic representations should be created and/or printed prior to the lesson to provide all students with an opportunity to be engaged in discussion.

# Technology Needed:

* Smartboard, iPad

# Additional Resources:

* Website: [Force and Motion Experiments](http://www.teachjunkie.com/sciences/force-and-motion-experiments/)
* Website: [Free experiments- Fizzicseducation.com](https://www.fizzicseducation.com.au/Free+experiments/force+and+movement.html)
* Book: Forces and Motion by Jennifer Swanson, Bryan Stone illus.
* Book: Hands-On Science: Forces and Motion by Maggie Hewson and Sarah Angliss
* ReadWorks: [An Article a Day Set: Ball Games](https://www.readworks.org/article/Ball-Games/32375cb4-ad31-46dd-9d01-79f5ec06fb9e#!articleTab:content/contentSection:c104f533-e96f-4f18-babd-0bc42933d16e/)

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