

Speed Down the Ramp

Grade K: Motion Probe

Aligned with National Standards

overview

This is a teacher-led class inquiry where students will observe how the height of a ramp changes the speed of a ball (or freely moving car).

This activity uses the WARD's Single Motion Probe to collect data, allowing students to focus on the science discovery and leaving more time for learning and developing higher level thinking skills.

time requirement:

This activity can be completed in one session of 20 - 30 minutes.

materials required for the activity:

WARD's Single Motion Probe
Ramp (able to be variable heights)
Ball (or toy car)
Ruler
Instructions (this guide)

safety precautions

general safety:

- Consider establishing a safety contract that students and their parents must read and sign. This is a good opportunity to identify students with allergies (e.g., latex) so that you (and they) will be reminded of specific lab materials that may pose risks to individuals.
- Read all instructions before starting the lab activity. Review the safety and lab procedures with your students and remind them to ask questions.
- Have students be mindful of where the ball (or car) is during the activity; it may be a tripping hazard.



Ward's in-house scientists are always on call to assist you with your questions. Our experts can provide personal solutions and product advice for your curriculum.

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DIMENSION 1 Science and Engineering Practices	×	Asking questions (for science) and defining problems (for engineering)		Use mathematics and computational thinking
	×	Developing and using models	×	Constructing explanations (for science) and designing solutions (for engineering)
	×	Planning and carrying out investigations		Engaging in argument from evidence
		Analyzing and interpreting data		Obtaining, evaluating, and communicating information
DIMENSION 2 Cross Cutting Concepts		Patterns	×	Energy and matter: Flows, cycles, and conservation
	×	Cause and effect: Mechanism and explanation		Structure and function
		Scale, proportion, and quantity		Stability and change
		Systems and system models		
DIMENSION 3 Core Concepts	Discipline		Core Idea Focus	
	Physical Sciences		PS2.A: Forces and Motion	

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NGSS STANDARDS	Elementary School Standards Covered	
	K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	

national science education standards © 1996

Content Standards (K-12)			
	Systems, order, and organization		Evolution and equilibrium
×	Evidence, models, and explanation	×	Form and function
×	Constancy, change, and measurement		
Physical Science Standards Elementary School			
×	Position and motion of objects		

× Indicates standards covered in activity

prior to class

- Review the basic information about how to use the WARD's Single Motion Probe. The motion probe has three units that it can measure; the units can be changed by touching the "m" to the right of the motion icon and then touch the box showing one of the below units.



m

m	Measures distance in meters
m/s	Measures speed
m/s ²	Measures acceleration

It is recommended for this activity that the probe measure speed.

- Set up a ramp and the motion probe. Have a way to increase the ramps height.
- Make a simple data chart on the board or a large sheet of paper.

objective

Students will understand the relationship between the effect of a push or pull on an object's speed and motion.

background

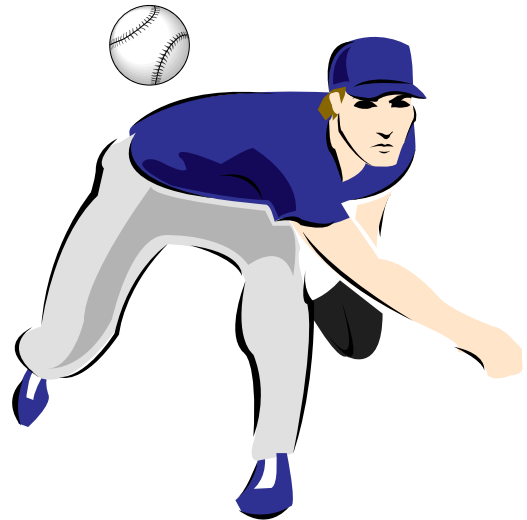
A force is required to create motion and to change the speed and direction of motion. Once an object is in motion, its speed can be measured.

A force is a push or pull on an object. Gravity can be used as a force to cause motion. Gravity is the force that causes everything that goes up to fall back down to Earth. We experience gravity every time we jump because it is what pulls us back down to the ground. Without gravity, we'd float off into the atmosphere.

Speed is the rate at which an object covers a distance, in other words, how fast an object is going. A fast-moving object has a high speed and covers a relatively large distance in a short amount of time. A slow-moving object has a low speed and would cover a smaller distance in the same amount of time. Zero speed means that an object has no movement at all.

build upon prior knowledge:

Ask the students if they think a ball gently rolling on the floor or a ball that was thrown by a professional baseball pitcher would have more speed. (*Student response: the gently rolling ball has less speed than a ball thrown in a baseball game.*)



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guiding questions

- What do you think will happen? (Hypothesis)
- What do you expect to learn?
- What tools are needed?
- How can we record our findings?

procedure

Change Force/Height - Change Speed

1. With a ramp setup as shown below, ask a student to assist in measuring the height of the ramp using a ruler. Record the height in a simple data table for the students to see.

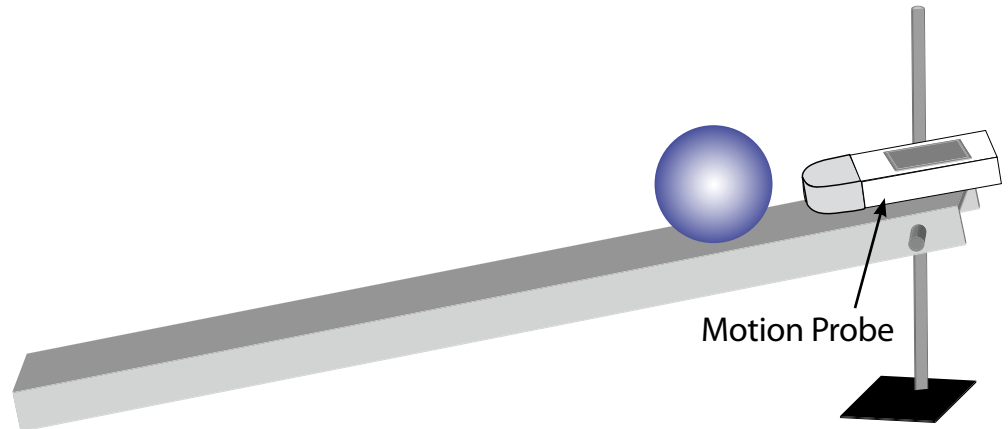


Figure 1: Ramp Set Up

Sample Data Table

Height of Ramp	Speed

2. Select one student to release the ball from the top of the ramp. Have another student ready to stop the ball after it rolls clear of the bottom of the ramp. Note the highest number displayed on the Ward's Single Motion Probe. This is best seen on number mode ("123") but can also be seen on graph mode.
3. Record the highest speed attained.
4. Increase the height of the ramp and repeat the activity.

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Change Direction

The motion probe is not required for the rest of the activity.

1. Ask a student to place their hand at the end of the ramp to push the ball in a different direction.
2. Again have a student release the ball from the top of the ramp and have another student ready to catch the ball from the side.

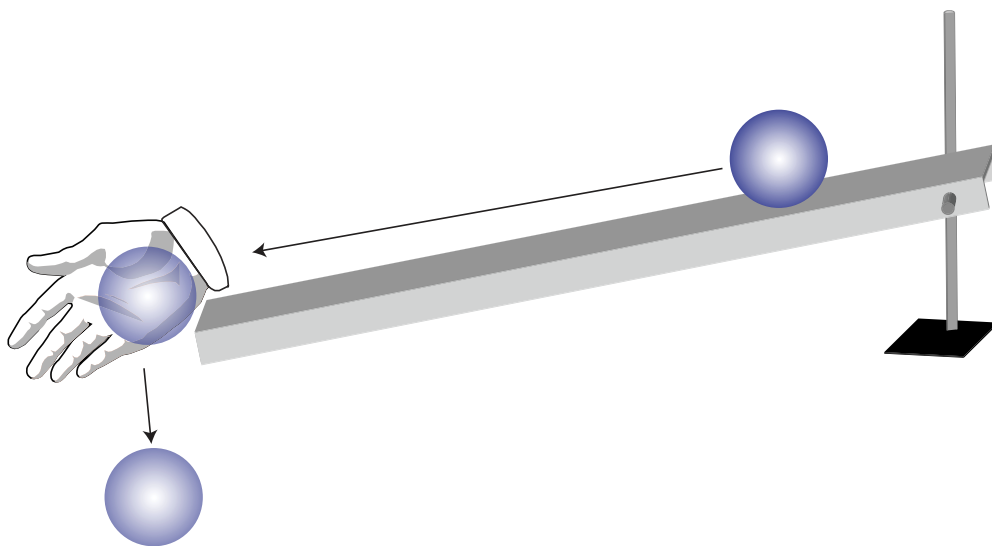


Figure 2: Change Direction

summarize

Ask the students what they have learned about how the speed of an object can be changed. (*Student responses may include: If you raise an object higher, you can make it go faster.*)

Ask the students what they have learned about how a force affects the direction of an object. (*Student responses may include: a push can change the direction of an object's motion.*)

extension

Students can try the experiment with small blocks set up at the end of the ramp. It can be seen that the more speed or force the ball has the more blocks it will knock over.



teacher notes

- ✦ The Ward's Single Motion Probe sends out a sonic cone that it uses to determine the distance of an object. The probe will yield better results if held up off the surface of the ramp.

