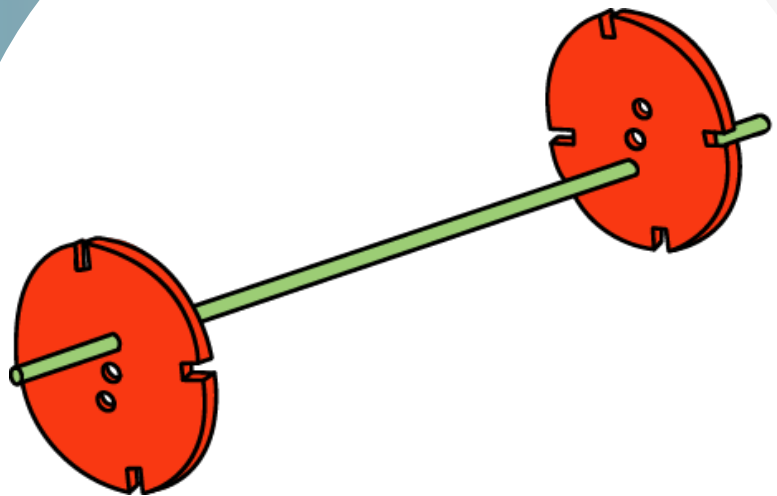


MOTION AND MATTER—*Investigation 2, Part 1*

Investigation 2:
***Patterns of
Motion***

Part 1:
***Wheel-and-
Axle Systems***



Teacher
Notes

Complete Teacher Notes



Investigation 2, Part 1

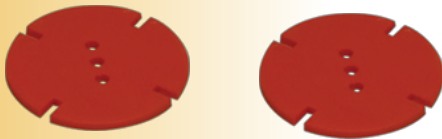
Wheel Systems



What can you find out about wheels?

Materials (per pair)

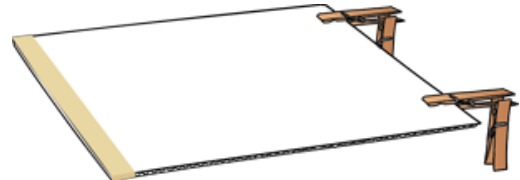
- 1 cardboard ramp
- 4 clothespins
- 4 large red plastic disks



Time

Procedure:

1. Set up your **ramp** to make a **slope** as demonstrated.
2. Using your plastic disks like wheels, observe how they interact with the ramp.



IG pg. 129, Steps 1–4

Investigation 2, Part 1

Forces at Work



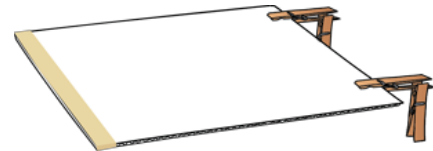
What forces are working on the **wheel** right now?

Are the forces balanced or unbalanced? Why do you think that?



Are the forces balanced now? Why do you think that?

Why does the wheel eventually stop rolling?



Teacher
Notes

IG pg. 129, Steps 5–6

Investigation 2, Part 1

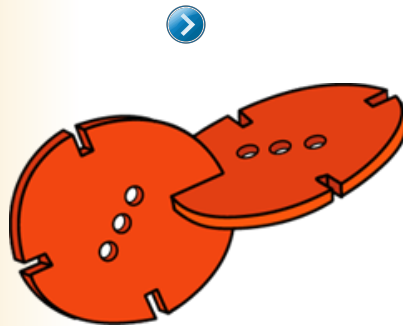
Patterns of Motion



When you let go of one wheel at the top of the ramp, what direction did it roll?

Did it ever roll up?

What other **patterns of motion** did you observe?



Investigation 2, Part 1

Axle

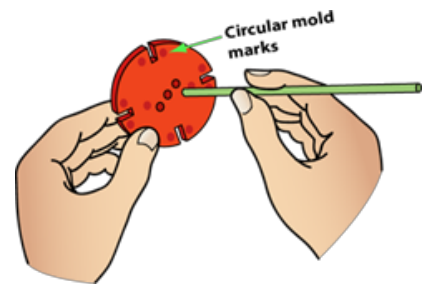


Do you have any ideas for getting the wheels to roll better or more effectively?



A **shaft** can be used as an **axle**. An axle is a rod or shaft to which wheels can be attached.

When we put these different pieces together, we can create different **systems**.

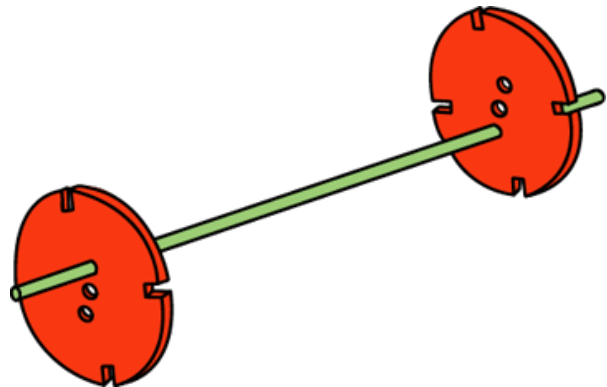
Teacher
Notes*IG pg. 130, Step 8*

Investigation 2, Part 1

Focus Question



- How can we change the motion of wheels rolling down ramps?



IG pg. 130, Step 9

Investigation 2, Part 1

Wheel-and-Axle Systems



Build some different systems and observe their motion.



Record your designs in your notebooks.

What happens if you

- use wheels the same size?
- use a small wheel and a large wheel?
- put the axle in different wheel holes?
- use two axles?
- put axles on the outside indentations of the wheels?
- put a third wheel in the middle?



Time



Teacher
Notes

IG pg. 130–132, Steps 10–13

Investigation 2, Part 1

Vocabulary Review



IG pg. 132, Step 14

Investigation 2, Part 1

Vocabulary Review



IG pg. 132, Step 14

Focus Question

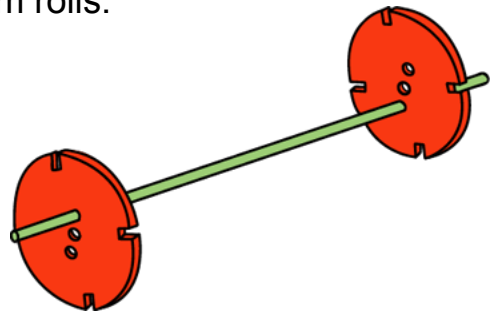


- How can we change the motion of wheels rolling down ramps?



Write about one or two systems you constructed.

- draw a picture or describe the system;
- describe the pattern of motion of the system as it rolls down the ramp;
- explain how the arrangement of the wheels and axles affects the way the system rolls.



Investigation 2, Part 1

Clean Up!



- Disassemble the wheel-and-axle systems.
- Return material to the materials station.



IG pg. 132, Step 16

Investigation 2, Part 1

Wrap-Up/Warm-Up



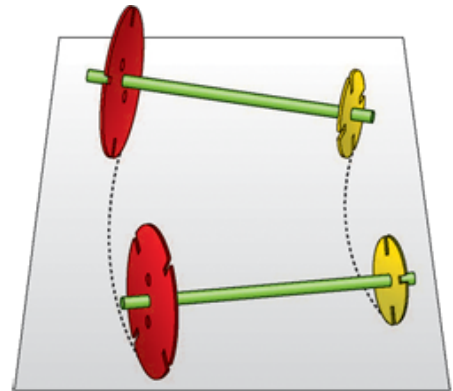
➤ How can we change the motion of wheels rolling down ramps?

Pair up with a partner to

- share the systems you built;
- share the pattern of motion you observed.



How could you use the patterns of motion to predict how other systems might move on a ramp?



Teacher
Notes

IG pg. 133, Step 18

Investigation 2, Part 1

Motion and Matter

Developed at



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Teacher
Notes

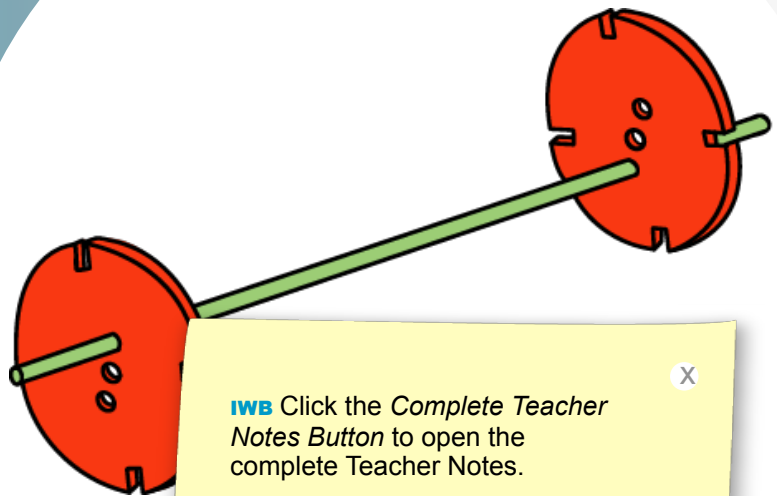
FOSS Program Overview



MOTION AND MATTER—*Investigation 2, Part 1*

Investigation 2: ***Patterns of Motion***

Part 1: ***Wheel-and-Axle Systems***



IWB Click the *Complete Teacher Notes Button* to open the complete Teacher Notes.

IWB Click the FOSS logo to access FOSSweb.



Teacher
Notes

[Complete Teacher Notes](#)



Investigation 2, Part 1

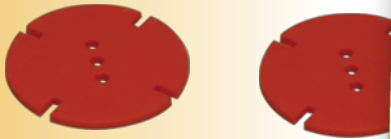
Wheel Systems



What can you find out about wheels?

Materials (per pair)

- 1 cardboard ramp
- 4 clothespins
- 4 large red plastic disks



Time



Motion and Matter, IG pg 129, Steps 1–4



Hold up a large plastic disk and tell students they will use the disks like wheels.

Demonstrate how to set up a ramp as described in Step 2.

Distribute materials and have students free explore with disks and ramps to discover information about wheels.

New Word Introduce *ramp*.

ramp: an object that has a slope

New Word Introduce *slope*.

slope: a surface that is higher on one end

Add all new words to the word wall.

IWB Use the *Pen Tool* to write when you want students to finish the activity.

IG pg. 129, Steps 1–4

Investigation 2, Part 1

Forces at Work



What forces are working on the **wheel** right now?

Are the forces balanced or unbalanced?



Motion and Matter, IG pg 129, Steps 5–6



Call for attention. Hold the wheel still at the top of the ramp as you ask the first two questions in Step 5.

IWB You can use the *Pen Tool* to record students' responses.

IWB Click the arrow to continue the discussion.

Release the wheel so it rolls down the ramp and ask the last two questions on the slide.

New Word Introduce *wheel*.

wheel: an object that is a circle in only one direction and can fall over

New Word Introduce *friction*.

friction: a force between objects that are touching each other that opposes their motion, slowing them down

Add all new words to the word wall.



Teacher
Notes

IG pg. 129, Steps 5–6

Investigation 2, Part 1

Patterns of Motion



When you let go of one wheel at the top of the ramp, what direction did it roll?

Did it ever roll up?

What other **patterns of motion** did



Motion and Matter, IG pg 130, Step 7



Ask the questions in Step 7 to focus students on patterns of motion.

If students did not try connecting their disks together, have them explore with them now.

IWB Click the arrow to reveal an image of connected disks.

IWB You can use the *Pen Tool* to record students' responses.

New Word Introduce *pattern of motion*.

pattern of motion: the manner in which objects move due to their structure

Add the new word to the word wall.



Teacher
Notes

IG pg. 130, Step 7

Investigation 2, Part 1

Axle



Do you have any ideas for making the wheels roll more effectively?

Motion and Matter, IG pg 130, Step 8

X

Ask students if they have any ideas for making the wheels roll more effectively. Listen to their responses.

IWB Click the arrow to introduce the idea of an axle.

Be sure to demonstrate how to carefully put the wheels on the shaft as the shafts are fragile and can bend or break easily.

Have students explore with their new systems.

New Word Introduce *shaft*.

shaft: a long, thin structure that can be used as an axle or axis

New Word Introduce *axle*.

axle: a shaft that runs through the center of a wheel

New Word Introduce *system*.

system: two or more objects that work together in a meaningful way

Add all new words to the word wall.



IG pg. 130, Step 8

Investigation 2, Part 1

Focus Question



- How can we change the motion of wheels rolling down ramps?



Motion and Matter, IG pg 130, Step 9



Ask students to write the focus question in their notebooks.



Teacher
Notes

IG pg. 130, Step 9

Investigation 2, Part 1

Wheel-and-Axle Systems



Build some different systems and observe their motion.

Record your designs in your notebook.

What happens if you

- use wheels the same size
- use a small wheel and a large wheel
- put the axle in different places
- use two axles?
- put axles on the outside of the wheels?
- put a third wheel in the middle?

Motion and Matter, IG pg 130–132, Steps 10–13

Ask students to think about the pattern of motion they might see if they change something in the wheel-and-axle system.

Ask the questions in Step 10 if students need some help getting started.

Have students show, describe, and demonstrate some of the interesting wheel systems they created and describe the pattern of motion. See Step 11 for some systems students may have created.

Allow time for more wheel construction. See Step 12 for suggestions on other things students might try.

Have students share what they changed and what they created. Have other students predict what pattern of motion they will see prior to the presentation.

iwb Use the *Pen Tool* to write when you want students to finish the activity.



IG pg. 130–132, Steps 10–13

Investigation 2, Part 1

Vocabulary Review



Motion and Matter, IG pg 132, Step 14



Review vocabulary.

IWB You can use the *Pen Tool* to write class definitions beside the words or use this slide as a vocabulary resource/reminder.

IWB Click each word to reveal its definition at the top of the page.

These words should find a permanent place on a word wall in your classroom so that they are always accessible to students.

The vocabulary review continues on the next slide.



Teacher
Notes

IG pg. 132, Step 14

Vocabulary Review



Motion and Matter, IG pg 132, Step 14



Review vocabulary.

IWB You can use the *Pen Tool* to write class definitions beside the words or use this slide as a vocabulary resource/reminder.

IWB Click each word to reveal its definition at the top of the page.

These words should find a permanent place on a word wall in your classroom so that they are always accessible to students.



Teacher
Notes

IG pg. 132, Step 14

Focus Question



► How can we change the motion of wheels rolling down ramps?



Write about one or two systems you constructed.

- draw a picture or describe the system;
- describe the pattern of motion of the system as it rolls down the ramp;
- explain how the arrangement of the axles affects the way the system moves.

Motion and Matter, IG pg 132–133, Steps 15 and 17



Ask students to answer the focus question in their notebooks.

Students should write about one or two systems they constructed as described in Step 15.

Assess progress using the "What to Look For" in Step 17.

Clean up is on the next slide.

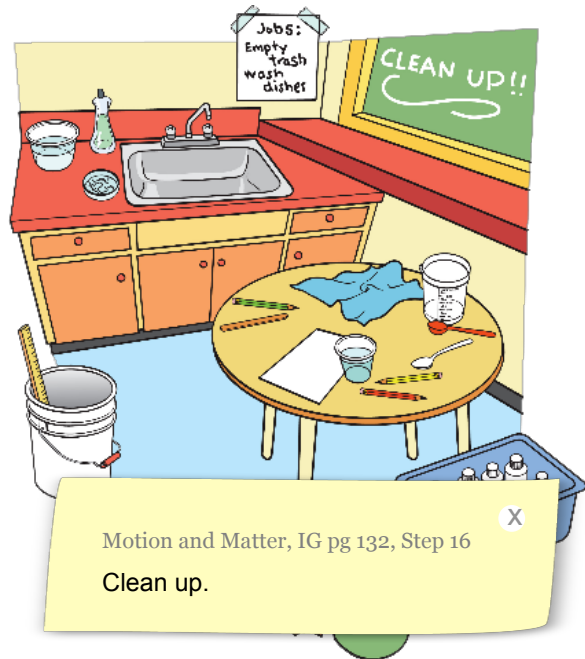


Teacher
Notes

IG pg. 132–133, Steps 15 and 17

Clean Up!

- Disassemble the wheel-and-axle systems.
- Return material to the materials station.



IG pg. 132, Step 16

Investigation 2, Part 1

Wrap-Up/Warm-Up



► How can we change the motion of wheels rolling down ramps?

Pair up with a partner to

- share the systems you built;
- share the pattern of motion you observed.

How could you use the patterns of motion to predict how other systems might move on a ramp?



Motion and Matter, IG pg 133, Step 18



Wrap-Up/Warm-Up

Conclude this part or start the next part by having students share their notebook entries with a partner.

See the Science-Centered Language Development chapter in *Teacher Resources* for suggestions for how students can share responses.



Teacher
Notes

IG pg. 133, Step 18

Investigation 2, Part 1

Motion and Matter

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Notes

FOSS Program Overview

