Investigation 2: Patterns of Motion

Part 1: Wheel-and-Axle Systems
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

**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?

IG pg. 129, Steps 5–6
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?
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.
Focus Question

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

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

 IG pg. 132–133, Steps 15 and 17
Disassemble the wheel-and-axle systems.

Return material to the materials station.
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?
Investigation 2: Patterns of Motion
Part 1: Wheel-and-Axle Systems

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IWB Click the FOSS logo to access FOSSweb.
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
What forces are working on the wheel right now?

Are the forces balanced on the wheel?
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?
Motion and Matter, IG pg 130, Step 8

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.
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.

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 book.

What happens if you

- use wheels the same size?
- use a small wheel and a large axle?
- put the axle in different locations?
- use two axles?
- put axles on the outside or the inside 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.
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.
Motion and Matter, IG pg 132, Step 14

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Focus Question

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

Write about one or two systems you constructed.
   a. draw a picture or describe the system;
   b. describe the pattern of motion of the system as it rolls down the ramp;
   c. explain how the arrangement of 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.

IG pg. 132–133, Steps 15 and 17
Clean Up!

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

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