

MOTION AND MATTER—*Investigation 2, Part 4*

Investigation 2, Part 4:
Tops



Teacher
Notes

Complete Teacher Notes



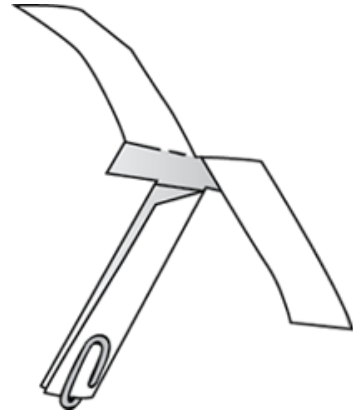
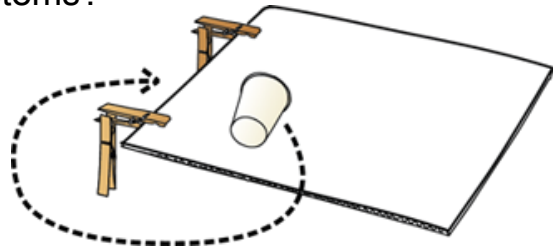
Investigation 2, Part 4

Motion and Forces



What are the forces at work in these systems?

- Roll a wheel-and-axle system or a cup down a ramp.
- Drop twirly birds from a high position.



IG pg. 155, Step 1

Investigation 2, Part 4

Tops



What is a **top**?

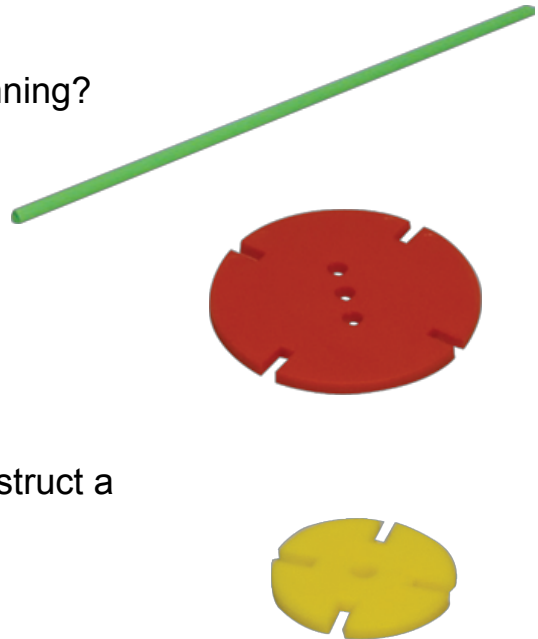
What force can you use to get a top spinning?

Materials (per student):

- 1 Shaft
- 2 Small disks
- 2 Large disks

How can you use these materials to construct a good top?

Time



IG pg. 155, Steps 2–4

Investigation 2, Part 4

Spinning



What did you use to make your top?

How do you get your top to start moving?

How does a top move when it is working?

What kind of motion does a top make when it is going?



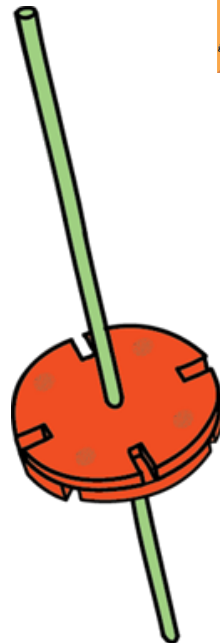
IG pg. 156, Step 5

Investigation 2, Part 4

Focus Question



➤ What is the best design for a top?



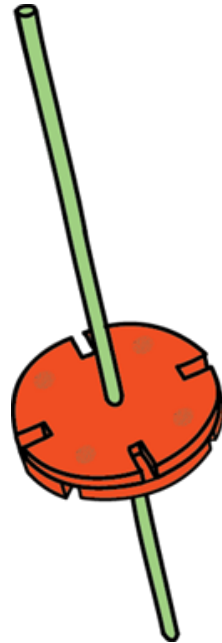
IG pg. 156, Step 6

Investigation 2, Part 4

Designing an Investigation



What are some questions you can test about the motion of tops?



Time



Teacher
Notes

IG pg. 156, Step 7

Investigation 2, Part 4

Top Results



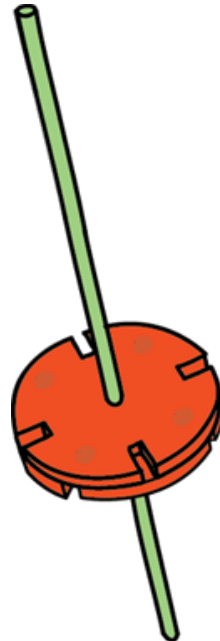
How do you get a top to spin?

What caused your top to start rotating?

What works better: a fast-spinning top or a slow-spinning top?

How does the way a top is made affect the way it spins? What are the effects of using different disks?

How does surface affect the spinning of a top?



IG pg. 156–157, Step 8

Investigation 2, Part 4

Vocabulary Review



Teacher
Notes

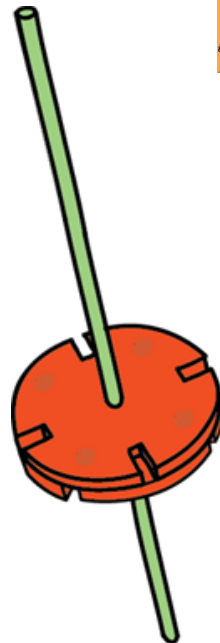
IG pg. 157, Step 9

Investigation 2, Part 4

Focus Question



➤ What is the best design for a top?



IG pg. 157, Step 10

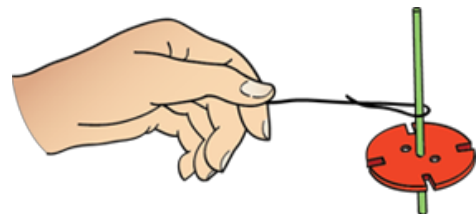
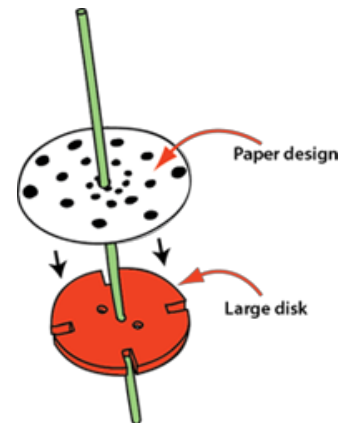
Investigation 2, Part 4

Spinning Designs



How do designs change on a spinning top?

- Cut a design along the outside line. Color it if you like.
- Poke a hole in the center of the design with a pencil.
- Slide the design on the top.
- Use tape (underneath the design) to hold the design in place.
- Use a paper clip to hold the top upright to observe slow rotation.
- When you use design B, don't color it. Put it on the top and observe the color of the design when it is spinning.
- Make your own design (design C) and observe that design when it is spinning.



IG pg. 157–158, Steps 11–13



Investigation 2, Part 4

Clean Up!



Collect all the disks and shafts and return them to the materials station.



Teacher
Notes

IG pg. 158, Step 14

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Investigation 2: Patterns of Motion

Patterns of Motion 16

→ What Goes Around 18



Teacher
Notes

IG pg. 159, Steps 15–17

Investigation 2, Part 4

Investigation 2 Vocabulary Review



ramp
slope
wheel
friction
pattern of motion

shaft
axle
system
twirly bird
standard

variable
outcome
top
rotate
axis



Teacher
Notes

IG pg. 160, Step 18

Wrap-Up

- How can we change the motion of wheels rolling down ramps?
- What rules help predict where a rolling cup will end up?
- What happens to the motion of a twirly bird when the design changes?
- What is the best design for a top?



Investigation 2, Part 4

Motion and Matter

Developed at



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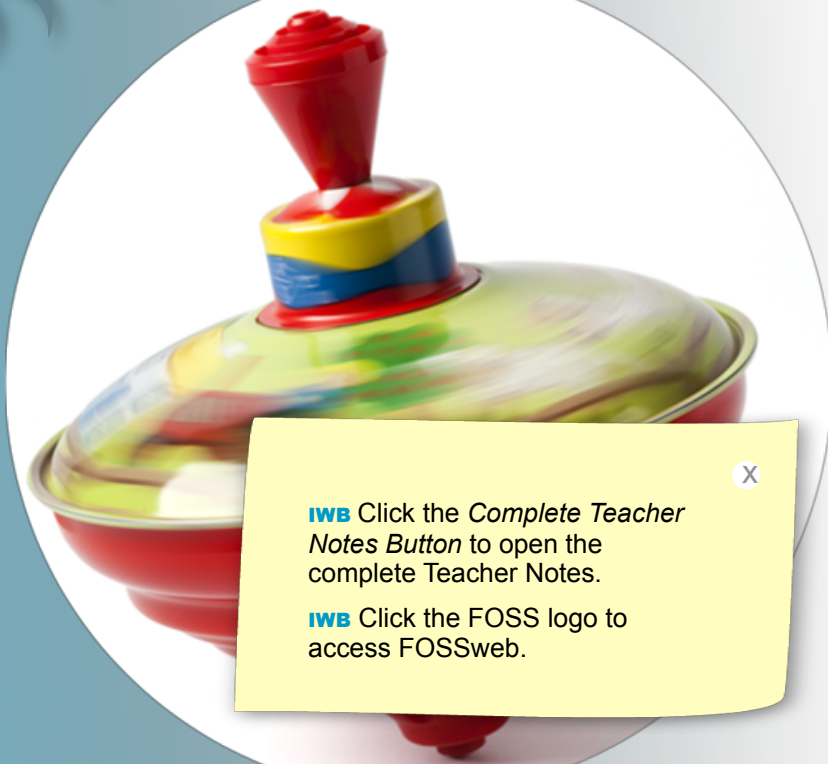
Teacher
Notes

FOSS Program Overview



MOTION AND MATTER—*Investigation 2, Part 4*

Investigation 2, Part 4: ***Tops***



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



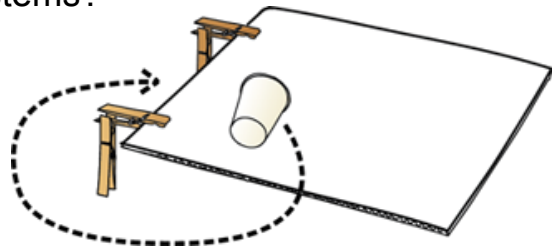
Investigation 2, Part 4

Motion and Forces



What are the forces at work in these systems?

- Roll a wheel-and-axle system or a cup down a ramp.
- Drop twirly birds from a high position.



Motion and Matter, IG pg 155, Step 1

Review the activities in this investigation and have students identify the forces at work in each system.

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

X



IG pg. 155, Step 1

Investigation 2, Part 4

Tops



What is a **top**?

What force can you use to

Materials (per student)

- 1 Shaft
- 2 Small disks
- 2 Large disks

How can you use these to make a good top?

Time



Teacher Notes

Motion and Matter, IG pg 155, Steps 2–4



Start an investigation on tops by asking students what a top is and what force is used to get a top spinning. Listen to their responses and then tell them they will build tops and use them to observe motion.

Have groups get 1 shaft, 2 small disks, and 2 large disks for each student in their groups and give them time to build and test their tops.

Visit students as they work. Remind students to insert the shafts carefully into the disks to minimize breakage.

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

New Word Introduce *top*.

top: a toy that spins

Add the new word to the word wall.

IG pg. 155, Steps 2–4

Investigation 2, Part 4

Spinning



What did you use to make your top?

How do you get your top to start moving?

How does a top move when it is spinning?

What kind of motion does a top have?



Motion and Matter, IG pg 156, Step 5

Discuss spinning by asking the questions in Step 5. Listen to their responses. See the Teaching Note in the margin next to Step 5.

IWB Click the arrow to summarize spinning.

New Word Introduce *rotate*.

rotate: to turn or spin

New Word Introduce *axis*.

axis: a straight line around which something turns

Add all new words to the word wall.



IG pg. 156, Step 5

Investigation 2, Part 4

Focus Question



➤ What is the best design for a top?



X

Motion and Matter, IG pg 156, Step 6

Ask students to write the focus question in their notebooks.



Teacher
Notes

IG pg. 156, Step 6

Investigation 2, Part 4

Designing an Investigation



What are some questions you can test about the motion of tops?

-

Time



Teacher
Notes

Motion and Matter, IG pg 156, Step 7

X

Have students develop questions about the motion of tops that they can investigate to refine the focus question. Generate a class list of questions. Start with the first bullet and add additional bullets as needed.

See Step 7 for some examples of questions students might develop.

Have students investigate the refined focus question by making, testing, and evaluating different tops.

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

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

IG pg. 156, Step 7

Investigation 2, Part 4

Top Results



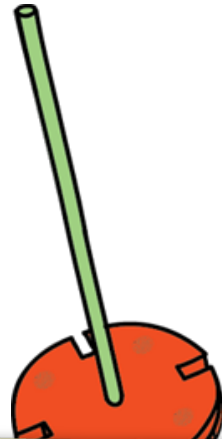
How do you get a top to spin?

What caused your top to start rotating?

What works better: a fast-spinning top or a slow-spinning top?

How does the way a top is made affect the way it spins? What are the effects of using different disks?

How does surface affect the spinning



X

Motion and Matter, IG pg 156–157, Step 8

Discuss the results of their designs.

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



IG pg. 156–157, Step 8

Investigation 2, Part 4

Vocabulary Review



Motion and Matter, IG pg 157, Step 9

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

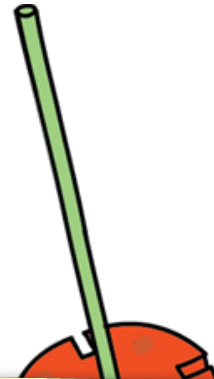
IG pg. 157, Step 9

Investigation 2, Part 4

Focus Question



➤ What is the best design for a top?



X

Motion and Matter, IG pg 157, Step 10

Ask students to answer the focus question in their notebooks. You can provide a sentence frame for those students who need scaffolding. See Step 10.



Teacher
Notes

IG pg. 157, Step 10

Spinning Designs



How do designs change on a spinning top?

- Cut a design along the lines.
- Color it if you like.
- Poke a hole in the center of the design with a pencil.
- Slide the design onto the string.
- Use tape (under the string) to hold the design in place.
- Use a paper clip to hold the string to observe slowly.
- When you use the string, put it on the top of the design with the string.
- Make your own design and observe that design.

Motion and Matter, IG pg 157–158, Steps 11–13



Propose that students add designs to the tops and observe the motion of the spinning designs. See the procedure in Step 11.

Distribute a half sheet of teacher master 11, *Spinning Designs*, to each student. Students should start with design A.

NOTE: The design that is half black should **not** be colored. This design produces colors when rotated at moderate speeds.

IWB Click the *Notebook Button* to open teacher master 11.

While students are working on their colorful spinners, visit the groups with a large sheet of chart paper and a drawing top from the kit. Challenge students to predict the path traveled by a spinning top. Move the drawing tops and a fresh sheet of chart paper from group to group to ensure that all students observe the interesting pattern produced by a spinning top, including the kick out as the top loses energy and falls over.

Students should observe, trace, and record the interesting pattern produced by a spinning top.



IG pg. 157–158, Steps 11–13

Investigation 2, Part 4

Clean Up!



Collect all the disks and shafts and return them to the materials station.



Motion and Matter, IG pg 158, Step 14

Clean Up.

Have groups collect the disks and shafts and return them to the materials station.

Put the disks in their storage sleeves to ensure that all have been returned.

X



Teacher
Notes

IG pg. 158, Step 14

Reading in Science Resources



Table of Contents

Investigation 2: Patterns of Motion

Patterns of Motion 16

→ What Goes Around



Motion and Matter, IG pg 159, Steps 15–17

Turn to page 18, "What Goes Around," in *Science Resources*. Have students preview and read the selection as described in Steps 15–16. Discuss the reading using the questions in Step 17.

For reading strategies to support English learners and below-grade-level readers, see the Science-Centered Language Development chapter in *Teacher Resources*.



Teacher
Notes

IG pg. 159, Steps 15–17

Investigation 2, Part 4

Investigation 2 Vocabulary Review



ramp
slope
wheel
friction
pattern of motion

shaft

variable
outcome

Motion and Matter, IG pg 160, Step 18

Review vocabulary.

Take a few minutes to review the key words developed throughout Investigation 2.

One way to assess understanding of the vocabulary words is to have students conduct a word sort. Make a set of word cards (or have students make them) for each pair of students. Tell them to work together to sort the words and label the categories they create.

Visit pairs as they work and ask them to explain how they are sorting the words. Once the words have been sorted and labeled by categories, have students observe how other pairs sorted them. Discuss similarities and differences in the ways pairs categorized the words.



IG pg. 160, Step 18

Wrap-Up



- How can we change the motion of wheels rolling down ramps?
- What rules help predict where a rolling cup will end up?
- What happens to the twirly bird when the...
- What is the best design...



Motion and Matter, IG pg 160–161, Steps 19–20

Conclude this Investigation by having students discuss the new words and focus questions in their groups.

Administer the I-Check.

See the Interdisciplinary Extensions following Investigation 2 for suggestions to extend learning across the curriculum.



IG pg. 160–161, Steps 19–20

Investigation 2, Part 4

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