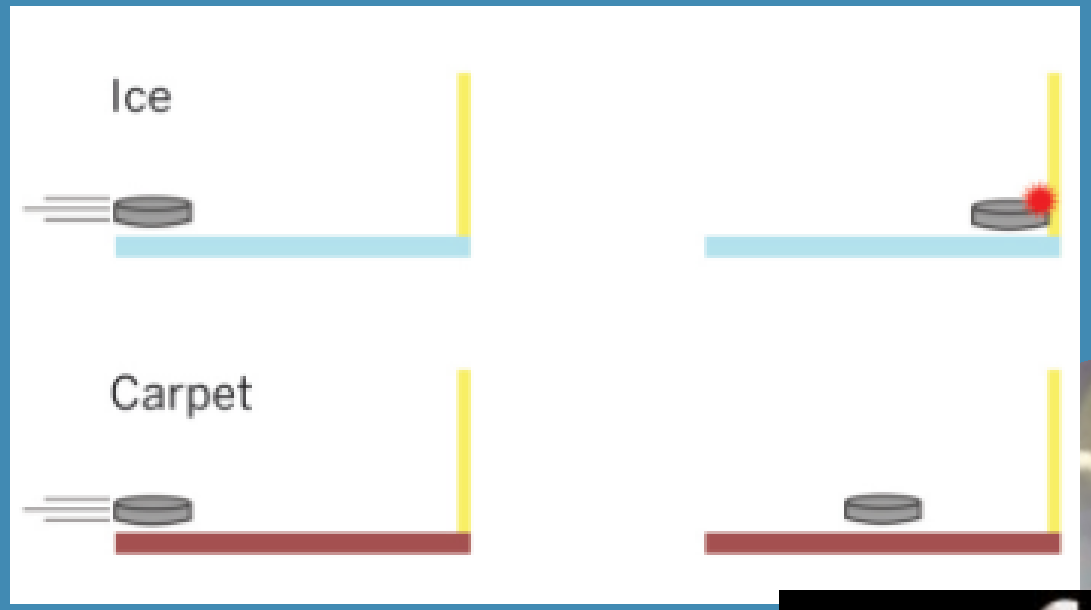
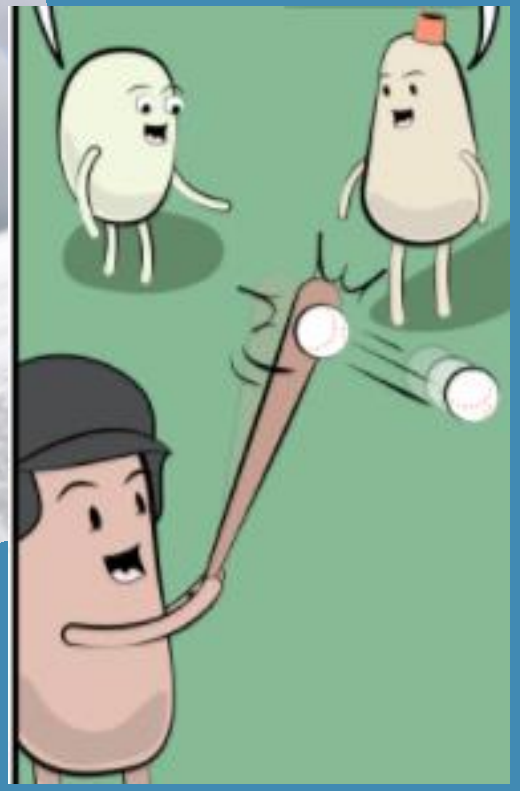
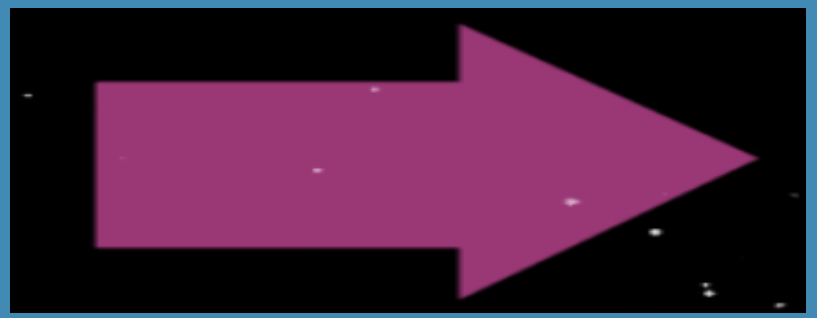
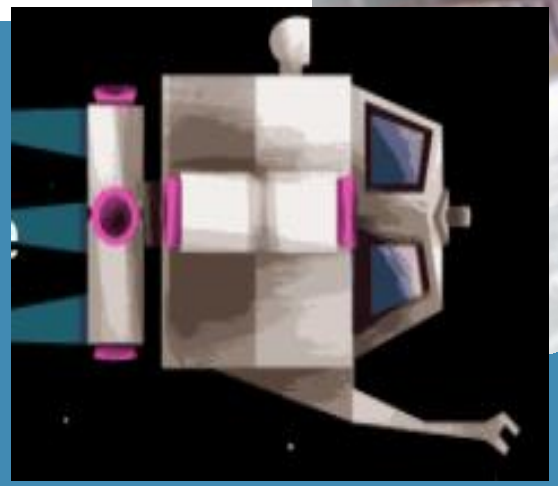
# 4 | 1.4: Explaining Force and Velocity

CH.1 FORCE AND VELOCITY





1 WARM UP
Warm-Up

# FM: 1.4.1 WARM-UP

Students read and respond to a story about a fictional character named Sherman who is confused about the difference between force and velocity. 10 min

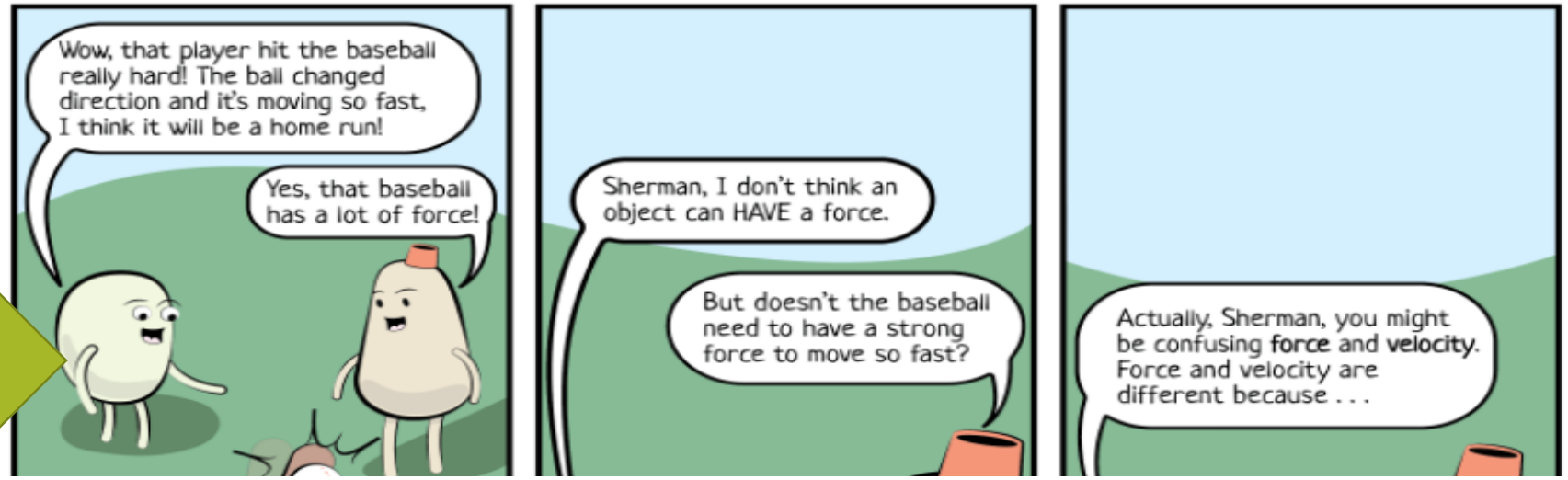
## Sherman's Story

What would you say?

Respond to Sherman in the text box below the image.

READ FIRST

Then RESPOND



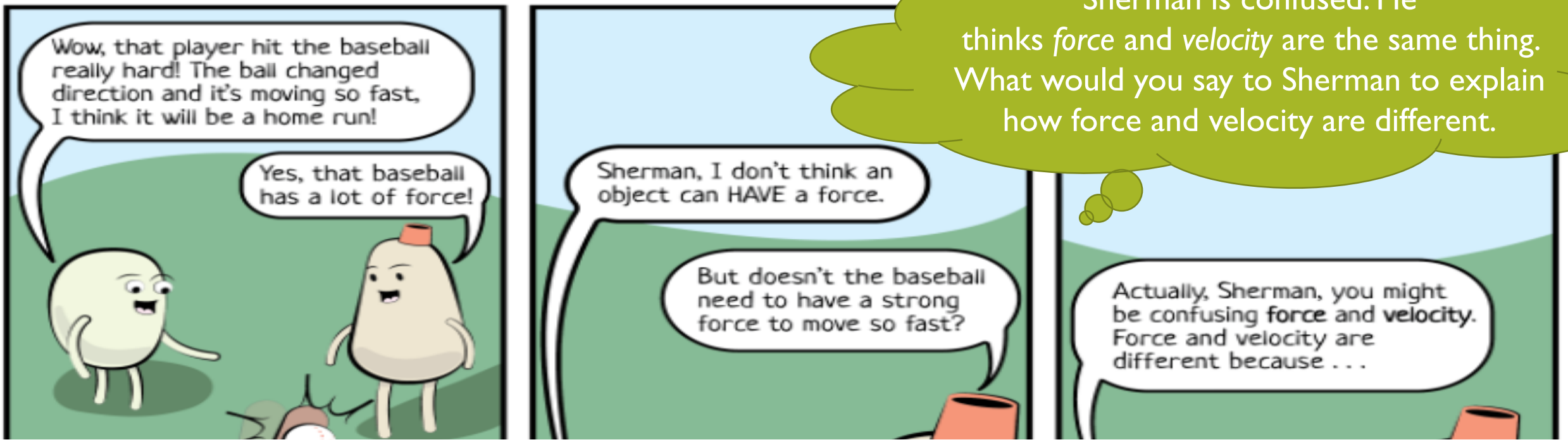

How would you finish the last sentence? What would you say to Sherman so he understands that *velocity* and *force* are different? Write a response and be prepared to share it with a partner.

PLACE ANSWERS HERE!

1 WARM UP
Warm-Up

# FM: 1.4.1 WARM-UP

## Sherman's Story: Force and Velocity




Sherman is confused. He thinks *force* and *velocity* are the same thing. What would you say to Sherman to explain how force and velocity are different.

How would you finish the last sentence? What would you say to Sherman so he understands that *velocity* and *force* are different? Write a response and be prepared to share it with a partner.

**DISCUSS WITH YOUR GROUP!**

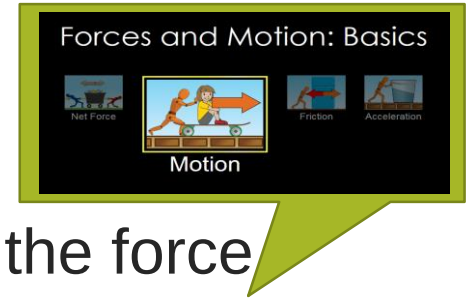
1 WARM UP
Warm-Up

# FM: 1.4.1 WARM-UP

How would you finish the last sentence? What would you say to Sherman so he understands that *velocity* and *force* are different? Write a response and be prepared to share it with a partner.

Actually, Sherman, *velocity* and *force* are different because force is something that happens to an object—a hit, a push, or a pull— that can make the object change how it moves. Velocity is the way something moves—how fast it is going and in which direction.

- A force is a push or pull that is required to change an object's velocity.
- Velocity describes how an object is moving.
- Force and velocity have a cause-and-effect relationship because the force between two objects is a *cause* that can result in the *effect* of a change in velocity for one or both objects.



2 STUDENT TO STUDENT DISCUSSION
Word Relationships

# FM: 1.4.2 DISCUSSION
# WORD RELATIONSHIPS

Students work together to write sentences that use key vocabulary words and explain why a moving baseball changes direction after it is hit by a bat. 20 min

**Brief overview of the activity.**

You will work in pairs to discuss and create sentences that will explain what you have been learning, using specific science words.

Word Bank

- cause
- effect
- force
- velocity

## Word Relationships Routine

1. Imagine this scene:

   - Mary used a bat to swing at a baseball that was moving toward her. She hit the baseball and it traveled in the opposite direction, right out of the park!

2. Work with a partner and use the words on the cards to create sentences that describe what actually happened to the baseball when Mary hit it with the bat. Do this aloud or use scratch paper.

2 **STUDENT TO STUDENT DISCUSSION**
Word Relationships

# FM: 1.4.2 DISCUSSION
# WORD RELATIONSHIPS

The Word Relationships routine will help you explain why the baseball moves in the opposite direction when it is hit by a bat.

The most important part of the activity is discussing your ideas with a partner.

**Word Bank**

- cause
- effect
- force
- velocity

## Word Relationships Routine

3. Use at least two words from the word bank in each sentence. You don't have to use all the words.

4. Create as many sentences as you can. You are not limited to a one-sentence description. In fact, try to use more than one sentence to express your ideas.

5. When you are finished creating sentences, join another pair and share your sentences.

2 **STUDENT TO STUDENT DISCUSSION**
Word Relationships

# FM: 1.4.2 DISCUSSION
# WORD RELATIONSHIPS

Take turns speaking and listening as you create sentences with the Word Relationships cards that address the prompt (describing what happened to the baseball when Mary hit it with the bat).

Let's review and clarify the meaning of the words on the Word Relationships cards prior to starting.

**Word Bank**

- cause
- effect
- force
- velocity

## Word Relationships Routine

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2 **STUDENT TO STUDENT DISCUSSION**
Word Relationships

# FM: 1.4.2 DISCUSSION
# WORD RELATIONSHIPS

Jot down your ideas as well as first drafts of sentences; use scratch paper for this purpose.

**Join another pair to form a group of four and share responses.** One student says the sentences aloud, while the other partner holds up the cards that were used in that sentence.

Let's hear those sentences

**Word Bank**

- cause
- effect
- force
- velocity

## Word Relationships Routine

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2 STUDENT TO STUDENT DISCUSSION
Word Relationships

# FM: 1.4.2 DISCUSSION
# WORD RELATIONSHIPS

## Word Relationships Routine

1. Imagine this scene:

   - Mary used a bat to swing at a baseball that was moving toward her. She hit the baseball and it traveled in the opposite direction, right out of the park!

Example Sentences:

- The baseball changed **velocity** because the **force** the baseball exerted on it caused it to go in the opposite direction when Mary swung the bat.

- A **force** exerted by the bat hitting the ball **caused** the baseball to change **velocity** and go in the opposite direction.

2 STUDENT TO STUDENT DISCUSSION
Word Relationships

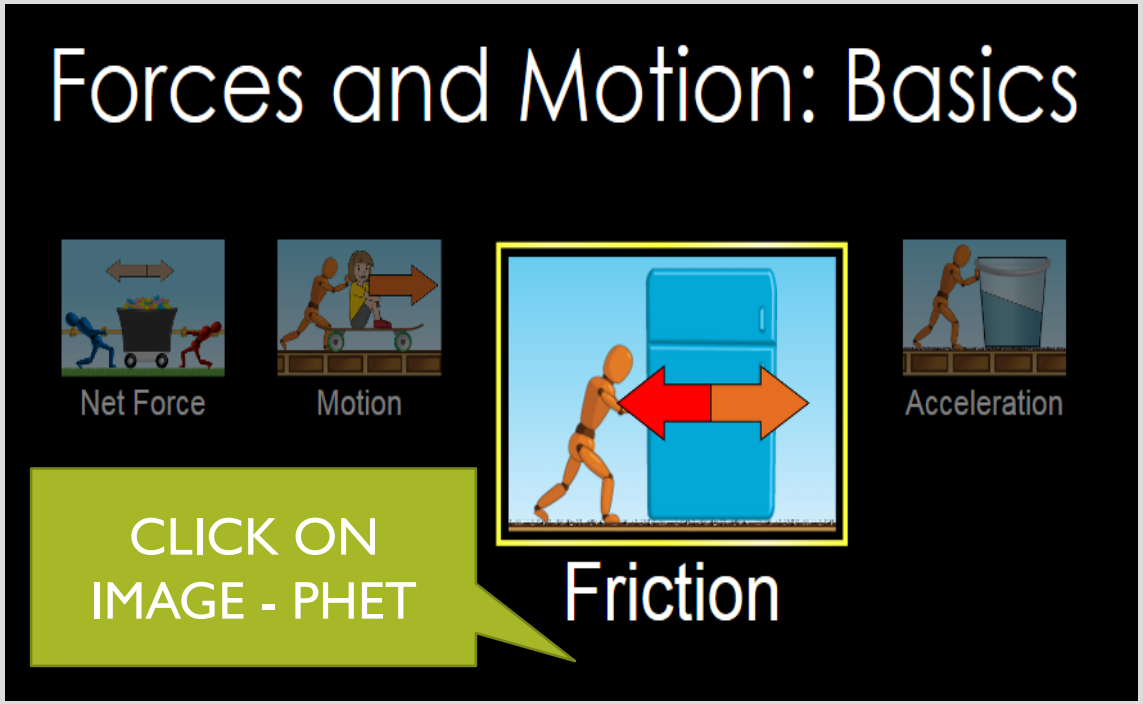
# FM: 1.4.2 DISCUSSION
# WORD RELATIONSHIPS

**Let's review how same- and opposite-direction forces can change an object's velocity—speed and direction.**

In the sentences that you created with your partners, you explained how force and velocity have a cause-and-effect relationship because it was the force of the bat hitting the baseball that caused the ball to change direction.

When a force is exerted in the direction opposite to an object's motion, as with the bat and baseball, the force can cause the object to slow down, stop moving, or move in the opposite direction.

You have also seen examples in both hands-on activities and in the Sim that show when a force is exerted in the same direction as an object's motion, it can cause the object to speed up.



3 **HANDS ON**
Exploring Strong and Weak Forces

# FM 1.4.3 HANDS ON EXPLORING STRONG AND WEAK FORCES

Students use stronger and weaker forces to launch various objects and compare how different strength forces affect the velocities of identical objects. (15 min)

**Investigation Question 1:** What makes an object's motion change?

**Investigation Question 2:** What causes some velocity changes to be greater than others?

Previously you determined what causes an object to change velocity, and now you will consider what causes a *greater* change in velocity.

The strength of the force could be the answer.

What are some everyday examples of moving objects that may illustrate how a greater push or pull could result in a greater change in velocity?

**WHAT DO YOU THINK? DISCUSS YOUR THOUGHTS!**

**Let's share your ideas.**

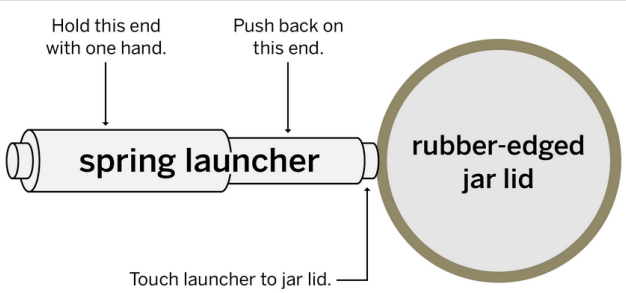
3 **HANDS ON**
Exploring Strong and Weak Forces

# FM 1.4.3 HANDS ON EXPLORING STRONG AND WEAK FORCES

**Investigation Question 2:** What causes some velocity changes to be greater than others?

**Hands-on activity.**

You will look for an answer to this new Investigation Question by exerting different forces on jar bands that are initially at rest and observing their changes in velocity.




## Exploring Strong and Weak Forces

Use the launcher to exert different strength forces on the jar bands. Observe how the velocity changes in response to different strength forces.

1. Lay a meter stick on the floor or table.
2. Place two jar bands on the floor or table, one on each side of the meter stick at the end, or 0 cm.
3. Exert a different force on each jar band, but release the launchers at the same time.
   - Have one partner press the launcher to the *2* mark.
   - Have the other partner press the launcher to the *3* mark.
4. Observe which jar band is the first to reach the opposite end of the meter stick.
5. Record your observations in the data table.
6. Repeat this process twice so you have data for three trials, and then answer the questions.

3 **HANDS ON**
Exploring Strong and Weak Forces

# FM 1.4.3 HANDS ON EXPLORING STRONG AND WEAK FORCES

**Investigation Question 2:** What causes some velocity changes to be greater than others?

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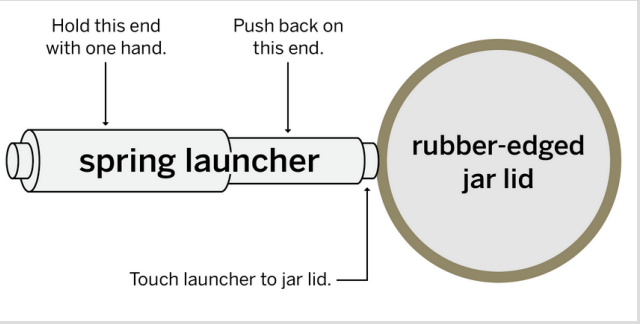
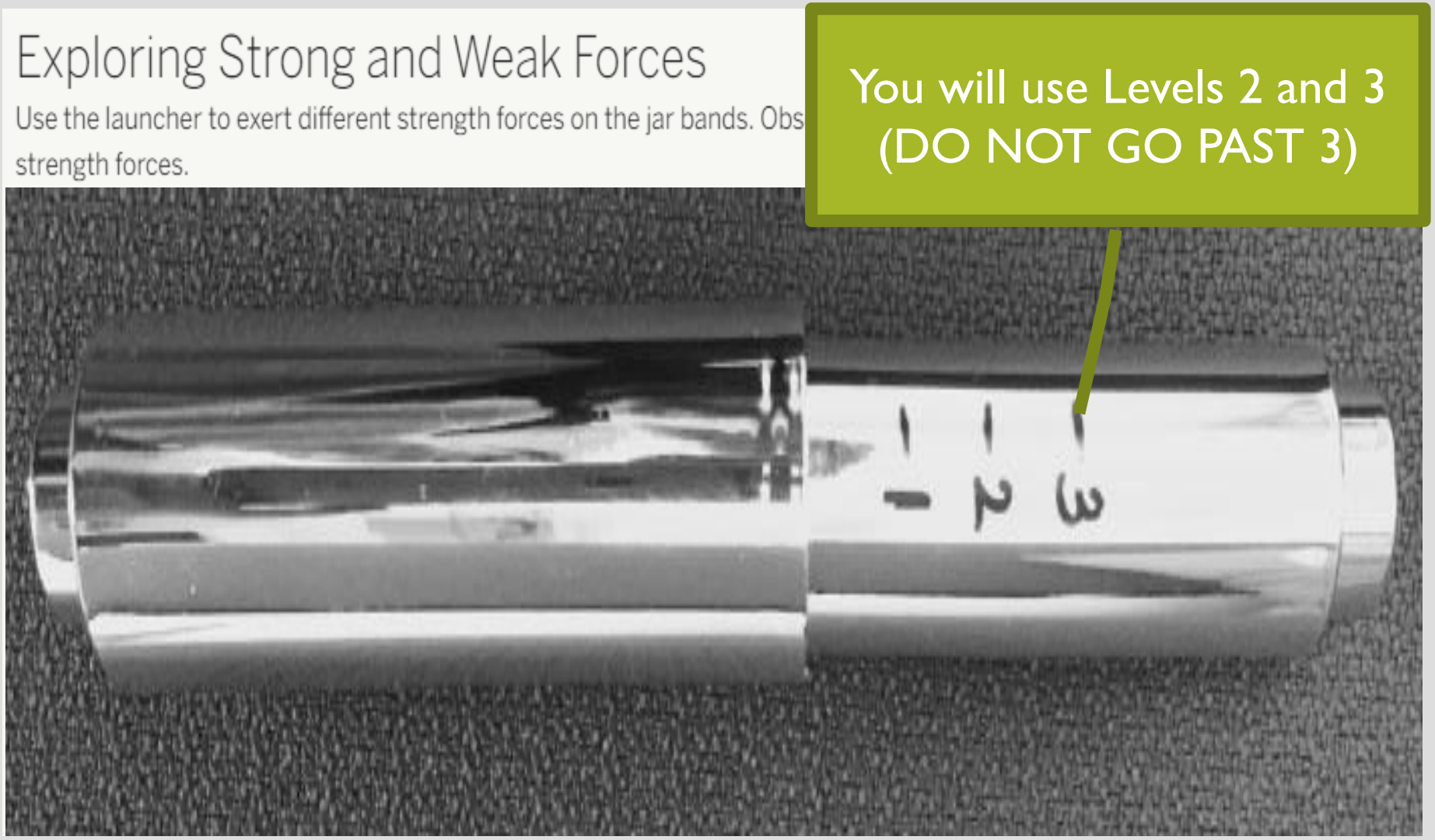


3 **HANDS ON**
Exploring Strong and Weak Forces

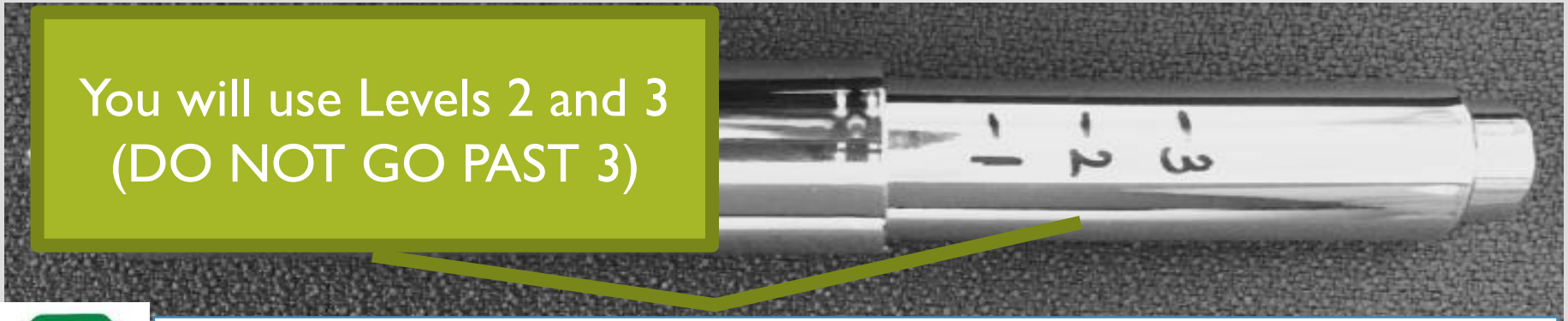
# FM 1.4.3 HANDS ON EXPLORING STRONG AND WEAK FORCES

**Investigation Question 2:** What causes some velocity changes to be greater than others?

## Hands-on activity.

Two students will launch the lids at the same time.

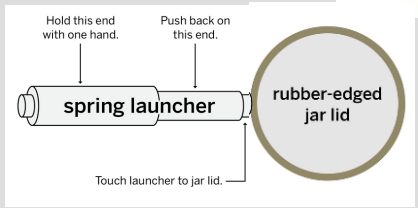
- Student 1: Level 2
- Student 2: Level 3



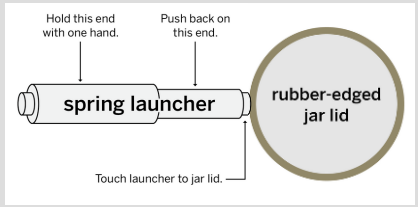


The meterstick is used to mark the starting and ending locations of the jar bands.

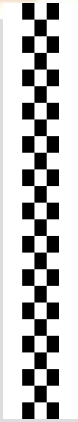
LEVEL 2




LEVEL 3







3 **HANDS ON**
Exploring Strong and Weak Forces

# FM 1.4.3 HANDS ON EXPLORING STRONG AND WEAK FORCES

## Conduct tests.

Remember…you should launch the jar bands at the same time and make them run parallel to the meterstick.

Conduct a few practice tests before the actual trials where you record data.

| Trial number | Which jar band reached the end of the meterstick first? (force #2 or #3) |
|---|---|
| Trial 1 | |
| Trial 2 | |
| Trial 3 | |

**RECORD YOUR DATA FOR EACH TRIAL HERE**

**PLACE ALL MATERIALS BACK WHEN FINISHED YOUR TRIALS**

**Discuss results after you finished your tests, recorded your trials and placed your materials back. Then answer the 3 reflection questions.**

Wait to answer these questions until you have completed all three trials.

1. Which mark exerted the stronger force?

a force 2

b force 3

c both exerted the same strength force

2. Which force caused the jar band to travel faster and arrive at the end of the meterstick first?

a the weaker force

b the stronger force

c both forces had the same effect

3. Using your data, complete the following sentence:

When you exert a stronger force on an object, you will see ▾ change in velocity as compared to exerting a weaker force on the same object.

3 **HANDS ON**
Exploring Strong and Weak Forces

# FM 1.4.3 HANDS ON EXPLORING STRONG AND WEAK FORCES

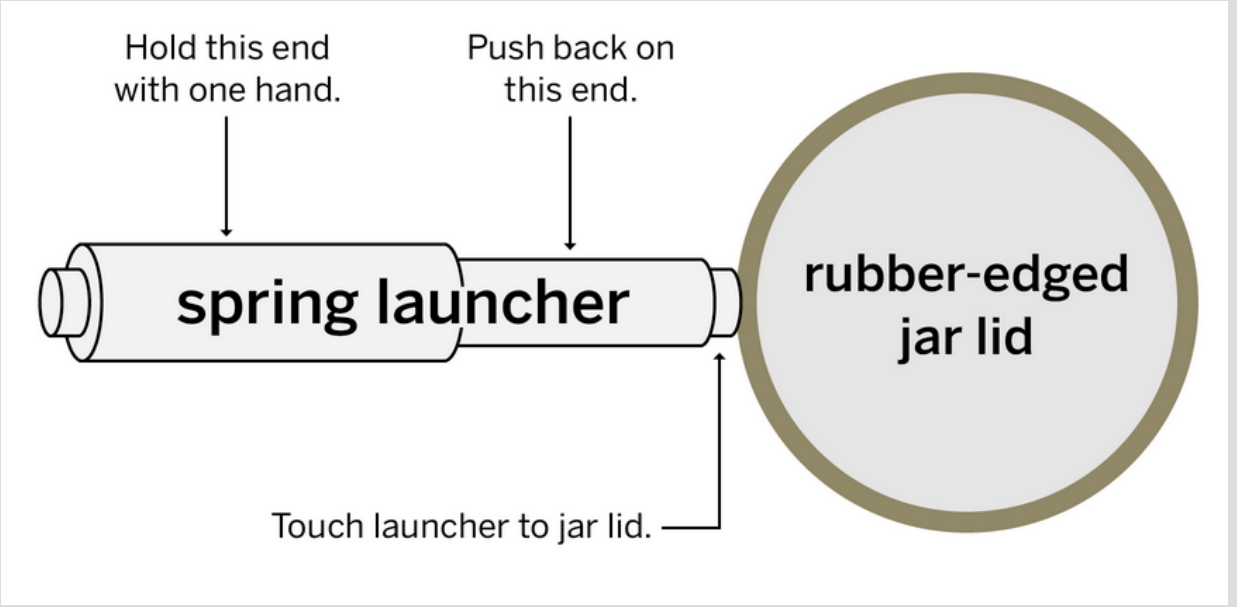
**Investigation Question 2:** What causes some velocity changes to be greater than others?

**Let's discuss the Investigation Question.**

Turn to your partners and share what you think now that you have conducted the investigation.

**Class discussion.**

Let's share your results and answers with the class.

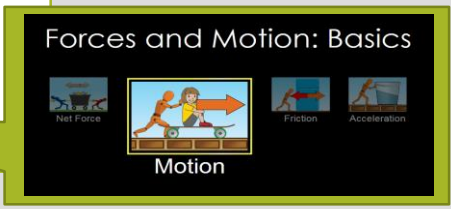



Which lid traveled faster?

The lid that had a stronger force exerted on it.

Speaking about the jar band that traveled faster, what can you say about its velocity?

It had a greater change in velocity.



4 **HOMEWORK**
Homework

# FM 1.4.4 HOMEWORK

Students identify ideas that will help them answer some focus questions as they read a text about friction and velocity.

The hands-on activity had limitations because the lids were slowed down by another force.

What caused the lids to slow and stop.

**FRICTION**

You will read about this force for homework.

On ice, a hockey puck can travel a long way with just one push. gilaxia/E+/Getty Images

4 **HOMEWORK**
Homework

# FM 1.4.4 HOMEWORK

Students identify ideas that will help them answer some focus questions as they read a text about friction and velocity.

**HAND IN**

## Reading "Friction"

1. Review the focus questions before you read the article.
2. Keep the questions in mind while you read, and highlight or annotate any information that might help you answer those questions.
3. After you are finished reading, answer the questions.

ANSWER 2 QUESTIONS

READ / ANNOTATE ARTICLE

### Friction: Why Hockey Rinks Are Not Carpeted

On ice, a hockey puck can travel a long way with just one push. gilaxia/E+/Getty Images

**Focus Questions:**

1. Why does an object that is sliding across carpet slow down?

2. Compare an object sliding across carpet and that same object sliding across a bare floor. Why is the object quicker to slow down on carpet than on the bare floor?

Mentimeter

## LEARNING TARGETS

- Forces vary in strength.
- The strength of a force affects how the velocity of the object changes.

Go to **www.menti.com** and use the code **41 97 91**

## LET'S REVIEW

- The difference between Force and Velocity
- The relationship that exists between Force and Velocity