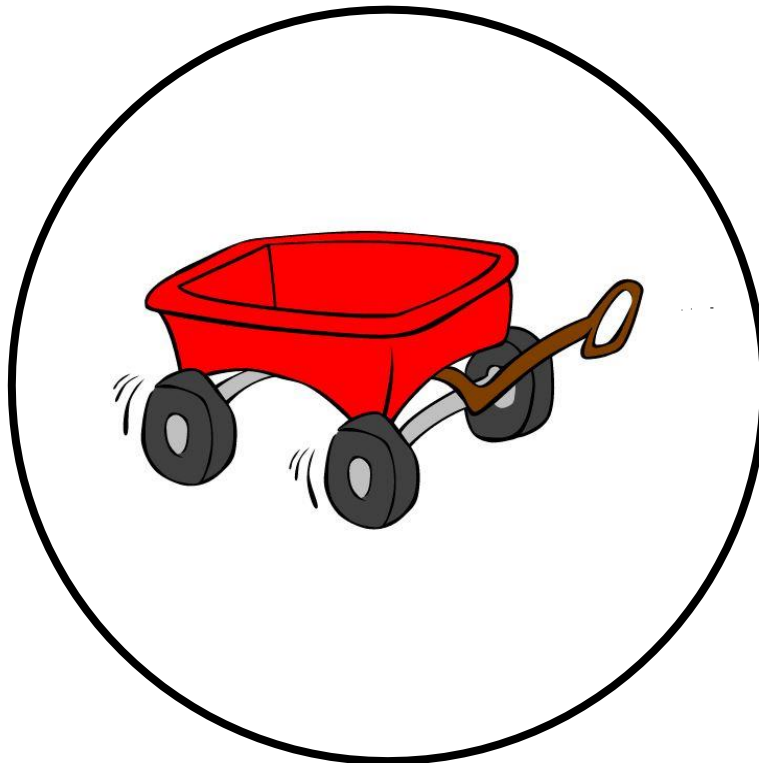


# It's a Matter of Pushing or Pulling: How Objects Move

Scientist's Notebook



Scientist: \_\_\_\_\_

2017 by Cattaraugus-Allegany-Erie-Wyoming BOCES  
&  
Erie 2 Chautauqua Cattaraugus BOCES

All rights reserved.

No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written consent of the publishers.

For permission, please visit: [www.advancingSTEM.com](http://www.advancingSTEM.com)

---

Major support for and work on this project has been provided by the Cattaraugus-Allegany-Erie-Wyoming BOCES and Erie 2 Chautauqua Cattaraugus BOCES Region school districts. Extended thanks and appreciation to the teachers involved in the curriculum writing process.

**Cattaraugus-Allegany-Erie-Wyoming  
BOCES Participating Districts**

Allegany-Limestone Central School  
Andover Central School  
Belfast Central School  
Bolivar-Richburg Central School  
Cattaraugus-Little Valley Central School  
Cuba-Rushford Central School  
Franklinville Central School  
Friendship Central School  
Genesee Valley Central School  
Hinsdale Central School  
Pioneer Central School  
Randolph Central School  
Scio Central School  
Wellsville Central School  
West Valley Central School  
Whitesville Central School

**Erie 2 Chautauqua Cattaraugus BOCES  
Participating Districts**

Bemus Point Central School  
Brocton Central School  
Cassadaga Valley Central School  
Chautauqua Lake Central School  
Clymer Central School  
East Aurora Union Free School  
Forestville Central School  
Holland Central School  
Jamestown Public School  
Lake Shore Central School  
Panama Central School  
Sherman Central School  
Silver Creek Central School  
Springville-Griffith Institute Central School

---

Dear Families,

Learning about our natural world is an exciting part of the elementary school curriculum. As we explore, we will come back time and again to elements of STEM: Science, Technology, Engineering, and Math.

Shortly, we will begin our next topic of study, which will focus on Forces and Interactions: Pushes and Pulls, a domain of Physical Sciences.

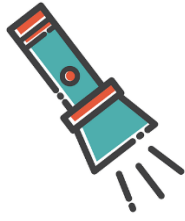
As we explore this topic, essential understandings will include:

- pushing an object can change its speed and direction
- pulling an object can change its speed and direction

Our final assessment for this unit will consist of an Engineering Design Challenge where students will analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or pull. For this assessment, students will construct a ramp and collect data on the number of blocks different size marbles will knock down from various heights. Additionally, students will explore how changing the direction of the marble impacts the data.

As always, please don't hesitate to contact me with any questions.

Thanks!



Dear Scientist,

Have you ever seen a train and wondered, “How does one engine pull all of the other cars along the track?” Or have you ever been swinging and had someone push you so you can go higher and higher? Those actions—push and pull—are called “forces” and we’re going to learn all about them!

During this unit, we’re going to better understand how pushes and pulls make objects move. We will also investigate the force needed to push over wooden blocks. We are going to conduct an experiment to see what effect a ramp has on a marble travelling down it, and how to design a solution to a problem that has many possible solutions.

The answer to all of these questions are what scientists seek to understand and explain. So, as we study pushes and pulls, be sure to ask your teacher lots of questions!

Have fun!

Force and Motion Song

# **Force *and* Motion**

To the tune of “Mary had a Little Lamb”

**A force can be a push or pull,  
push or pull,  
push or pull**

**A force can be a push or pull,  
It moves it to and away from me.**

**Motion is the way things move  
Way things move  
Way things move**

**Motion is the way things move  
It moves things many ways!**

## Push Investigation



1. How far does the empty wagon travel when pushed?
2. How far does the wagon travel when weight is added, with the same amount of push?

<b>Wagon with Weight</b>					
<b>Empty Wagon</b>					
	<b>0-2 feet</b>	<b>2-4 feet</b>	<b>4-6 feet</b>	<b>6-8 feet</b>	<b>8-10 feet</b>

Evaluation Chart

Push

Pull

Both







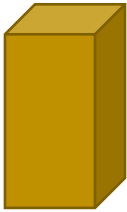


## Evaluation Cards



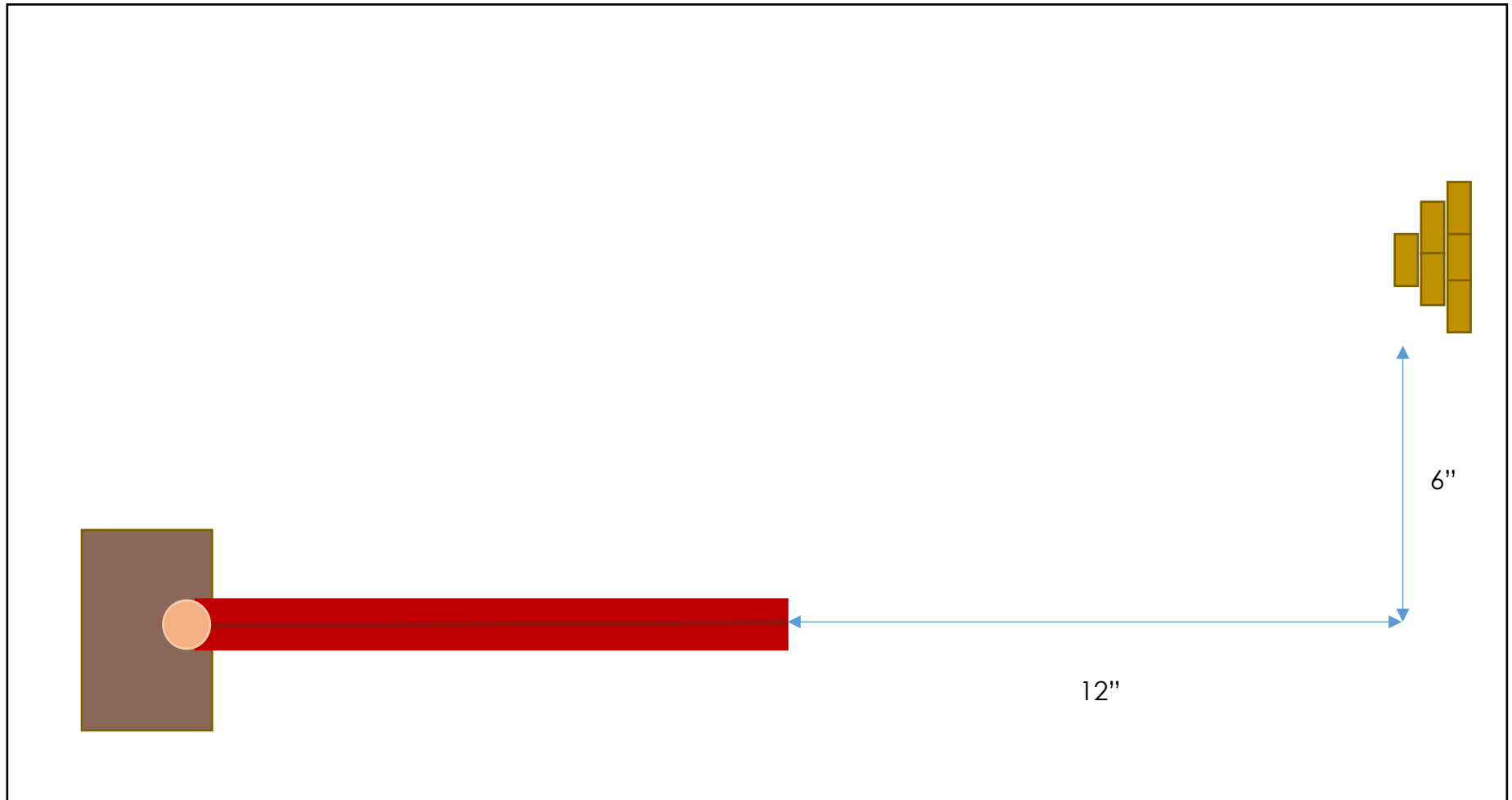


## Engineering Design Process: Ask

*How Many Blocks Were Pushed Over?*

Trial		First	Second	Third	Fourth
					
					
					
					
					
					

## Engineering Design Process: Imagine



## Engineering Design Process: Plan



## Engineering Design Process: Plan



## Engineering Design Process: Create

Did the marble hit the wooden blocks?

Yes

No

How many blocks were pushed over?

1

2

3

4

5

6

Do you need to improve your solution?

Yes

No

## Engineering Design Process: Create

Did the marble hit the wooden blocks?

Yes

No

How many blocks were pushed over?

1

2

3

4

5

6

Do you need to improve your solution?

Yes

No

## Engineering Design Challenge Rubric: Student Friendly

Student will be able to...	Novice 1	Apprentice 2	Proficient 3	Distinguished 4
<b>Engineering Design Process</b>	Engineering Design Process (Ask, Imagine, Plan, Create, Improve) was not followed.	Some of the Engineering Design Process was followed.	All five steps of the Engineering Design Process were followed.	The Engineering Design Process was used many times and was flexible.
<b>Session Knowledge</b>	Knowledge from sessions was not used to create the design.	Little knowledge from sessions was used or was incorrect to create the design.	Knowledge from sessions was used correctly to create the design.	Knowledge from sessions was used correctly and further research was done to create the design.
<b>Criteria and Improvements</b>	Design does not follow criteria or a form of improvement.	Design does not follow all of the criteria, or the improvements are very small.	Design follows all criteria and shows improvement.	Design follows all criteria and shows many forms of improvement.
<b>Collaboration</b>	Team members did not work well together. The presentation is missing some of the information.	Team members needed reminded to stay on task. Most of the information is included with the presentation.	Team members shared working together. Little reminding was needed to stay on task. Presentation is complete.	Team members shared working together without teacher reminders. Presentation is complete with added material.

## Glossary

force	what makes something move
motion	the direction of movement
pull	to bring toward
push	to move away