

Second Grade- Forces and Motion

Standards

Physical Sciences 1- Forces change the motion of an object.

W.2.3- Write narratives to recount a well- elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.

Objectives

Students will....

Build a toy car

Explain what 'push' and 'pull' mean

Describe what happens when you push/pull on an object in the classroom, in the pool, and in outer space

Form a hypothesis and revise their thinking

Vocabulary

Force

Motion

Push

Pull

Materials

Access to YouTube videos

Paper

Pencils

For the paper car:

Cardboard/paper

Tape

Bottle caps

Wooden skewers

Straws

Session One

1) Hook:

- a) Watch this video “Treibball Demo at Bogart Park” with the class:
<https://www.youtube.com/watch?v=wREWKq8izyg>. Treibball is a sport for dogs in which the dogs push eight big bouncy balls with their noses; it is basically soccer for dogs. Before watching, tell the class to pay attention to how the dog is moving the ball. Once you watch the video, ask the students to raise their hands if they know how the dog moves the ball. Students will likely answer that the dog ‘pushed the ball with its nose.’ Highlight this word ‘push’ and ask students what it means to ‘push’ something. What happens when you push an object? Have a conversation about this word’s meaning.
- b) Next, watch the video “Watch Siberian Huskies in Sled Dog Racing:”
<https://www.youtube.com/watch?v=pgxKGM30S48>. Have a similar conversation with the class about the word ‘pull.’
- c) The class should arrive at the conclusion that when you push something, it moves away from you; when you pull something, it moves toward you.

(10 minutes)

2) Mini lesson

- a) Explain that a force is a push or a pull that happens between two (or more) objects/people. (Note: a force is not a type of energy. An agent needs energy in order to exert a force). Demonstrate this with a small object like a water bottle or pencil by pushing the object away from you and then pulling it back toward you. Explain that both of those were forces- just in different directions. We call one a push and one a pull.
- b) Ask students to give examples of times when you push and pull in everyday life.
 - i) Opening a door, pushing a shopping cart, pulling a sled up a hill, etc

(15 minutes)

3) Fun craft: make a toy car!

- a) Making a toy car is incredibly easy. A basic toy car requires just 4 bottle caps, 2 straws, and 2 skewers, as well as a piece of cardboard for the body of the car, and scissors and glue, of course. Here is a fun version of the toy car craft from the Pink Stripecy Socks blog:
<http://www.pinkstripecysocks.com/2014/05/build-toy-car-that-moves.html>. You can find countless tutorials and renditions of this craft online.
- b) Once the cars are finished, ask the students to show you ‘push.’ Then ask them to show you ‘pull.’

4) Finish out the day with some free play to give students a chance to experiment with their new creations.

(40 minutes)

Session Two

5) Mini lesson

- a) Summarize from last class: so, a force can be a push or a pull. A push moves something away, and a pull moves something toward you. But what if you're pushing or pulling something super heavy? Will you still move it away? (Super strength is not an option for the purposes of this conversation).
- b) Find a very heavy object in the classroom or outside and have the students try to push it or pull it. (A wall or tree might work, but the students might be a bit confused by these examples because you are inside the building pushing on the wall, and a tree is rooted to the ground. A large, heavy object would be best to demonstrate this concept, if possible).
- c) Ask the students, "what happens when you push on the [object]?" Answer: it doesn't move! Ask, "why doesn't it move?" Answer: it's too heavy!
- d) Restate: So, when you push on something really heavy, it doesn't move. How about you? Do you move? Answer: no, you don't move (but your hand might hurt a little!)
- e) Now, try pushing on a wall. Show the students that nothing moves. Now ask them to raise their hands if they have ever gone swimming and pushed themselves off from the pool's wall. Watch this video, "Swim Faster, Push Off the Wall Better," to demonstrate the concept: <https://www.youtube.com/watch?v=MCOxTIUqnPY>.
- f) So when you push a wall in a pool, you move backward! Why doesn't that work in the classroom? Because in water, you float! (This is because of buoyancy and it is different from the zero gravity in space, but you won't get into that with second graders).
- g) Explain that when you push on something, it actually pushes back on you. On land, you don't move from this push because you aren't floating. But in water, you are floating, so when you push on the wall, the wall pushes you, and you float backward.
- h) Recap: push and pull are forces. When you push something, it moves away from you. When you pull something, it moves toward you. What if you try pushing or pulling something really heavy? It pushes back on you. It's hard to tell that this happens when you're just standing on land, but if you're floating in the pool and you push on the wall, you'll float backward. That's because when you push on something, it pushes back on you. The same goes for pulling something.
- i) Tell the students that astronauts actually practice in pools before they go to space. Watch this video: <https://www.youtube.com/watch?v=4514z--Zbfk>. The students do not need to worry about what 'neutral buoyancy' means. If they ask, you might explain something like, "underwater is a lot like space, but there are still a few differences. The water helps them float, but to be just like space, their space suits have some extra weights that makes swimming feel more like the zero gravity in space." You might mute the video and talk over it if you'd like.

(30 minutes)

- 6) Time for a game! Have another teacher help you with this. You're going to have a tug-o-war to demonstrate push and pull. Make sure that in the beginning, you both pull with the same force so that neither of you moves. Explain this to the class. Then, finally, one of you should pull the other forward and win. Have a conversation with the class about what happened. Drawing a diagram of the board to recap the tug-o-war might help.

(5 minutes)

- 7) Pass out some paper and pencils. Ask the students: what do you think would happen if we had a tug-o-war in space? Give them a hint: remember, astronauts practice in pools. What happens when you push on a wall in a pool? It pushes back, so you move backward! The same thing happens in space. If an astronaut is outside the spacecraft and they push themselves off of the wall, they will float backward. That's part of why space is dangerous- the astronauts could get lost if they keep floating. So if you push on a pool wall, you float backward. If you push on a spacecraft wall in space, you move backward. What do you think would happen if you pulled in a tug-o-war? Have the students write their hypotheses on the paper.

(5-10 minutes)

- 8) Lead a class discussion so that the students can share their hypotheses and support their reasoning, as well as respond to their classmates' ideas and revise their thinking.

(5-10 minutes)

- 9) The big reveal! Watch the video "What Would Happen If You Played Tug-o-War in Outer Space?" : <https://www.livescience.com/60857-tug-of-war-in-space.html>, where two astronauts actually try this out at the International Space Station.
- 10) Talk about the video with the students: what happened, and why did this happen?
- 11) Closing: Ask students to touch their ear if their reasoning changed, and touch their nose if their reasoning stayed the same.

Session Three

- 1) Review from the last two sessions. What have we learned about push and pull? What is it like on land? What is it like in the pool? How about in space?

(5 minutes)

- 2) Formative assessment: students will write a short story about a tug-o-war in space. It could be between aliens, space pirates, astronauts, the space Olympics- they can use their imagination and creativity to design their own story.
 - a) There are story templates for three levels of students. Below level learners will use the template with the blue astronaut; grade level learners will use the template with the green astronaut; and above level learners will use the template with the purple astronaut. See the templates and rubric below. Notice that the expectations for the students are the same regardless of where the student is in their learning, but the templates are designed to support three different levels of learners.

- 3) Discuss the two-point checklist with the students so that everyone is clear on the story's structure and the two details they need to include about the tug-o-war. Take time to answer questions and check comprehension.
- 4) Allow students to disperse around the classroom to begin writing. Circulate the room to check in on students. Help with brainstorming and focusing the students' ideas.
- 5) Story writing might take a few class sessions. Encourage the revision and proofreading processes as fits your curriculum.
- 6) Once the stories are finished, invite students to share their work with their peers and pull out the toy cars for some more fun!
- 7) Potential extension: have the students formulate new questions to ask while playing with their toy cars. "What will happen if...?"
- 8) After reviewing students' work with the help of the rubric, conference with individual students to discuss their progress. You will talk about what they did well and what they will continue working on in the next unit. Draft a clear plan of steps the student will take to pursue their learning and what the teacher will do to support them.

The Tug o War Space Adventure!

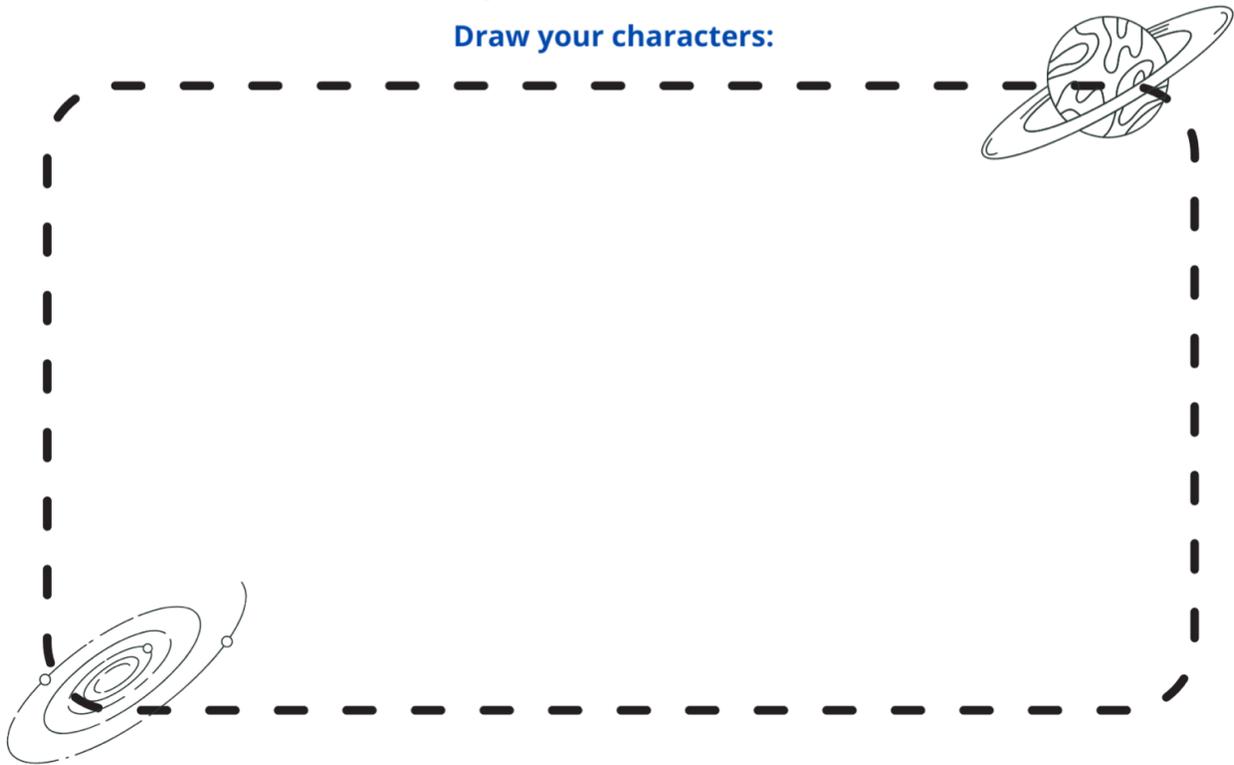


Write a story about a tug o war that happens in outer space.
Your story should have:

1. A beginning, a middle, and an ending
2. 1 sentence telling us what happens with the tug o war!

- Do the characters **push** or **pull** during the tug o war?
- Do they move **forward, backward, or stay** in the same place?
- Who **wins** the tug o war?

Draw your characters:



What are the characters doing at the beginning of the story?



Once upon a time, there was _____

in outer space. One day, they were _____

_____ when all of a sudden,

_____. So they _____

Draw the tug o war that happens in the middle of the story.



_____ and _____ started to pull

on the _____. At first, _____

_____.

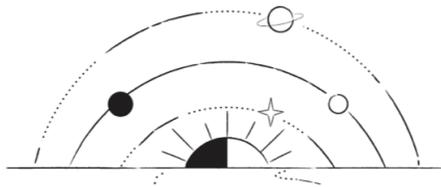
But then, _____

How does the story end?



So in the end, _____ and _____

The end!



The Tug o War Space Adventure!

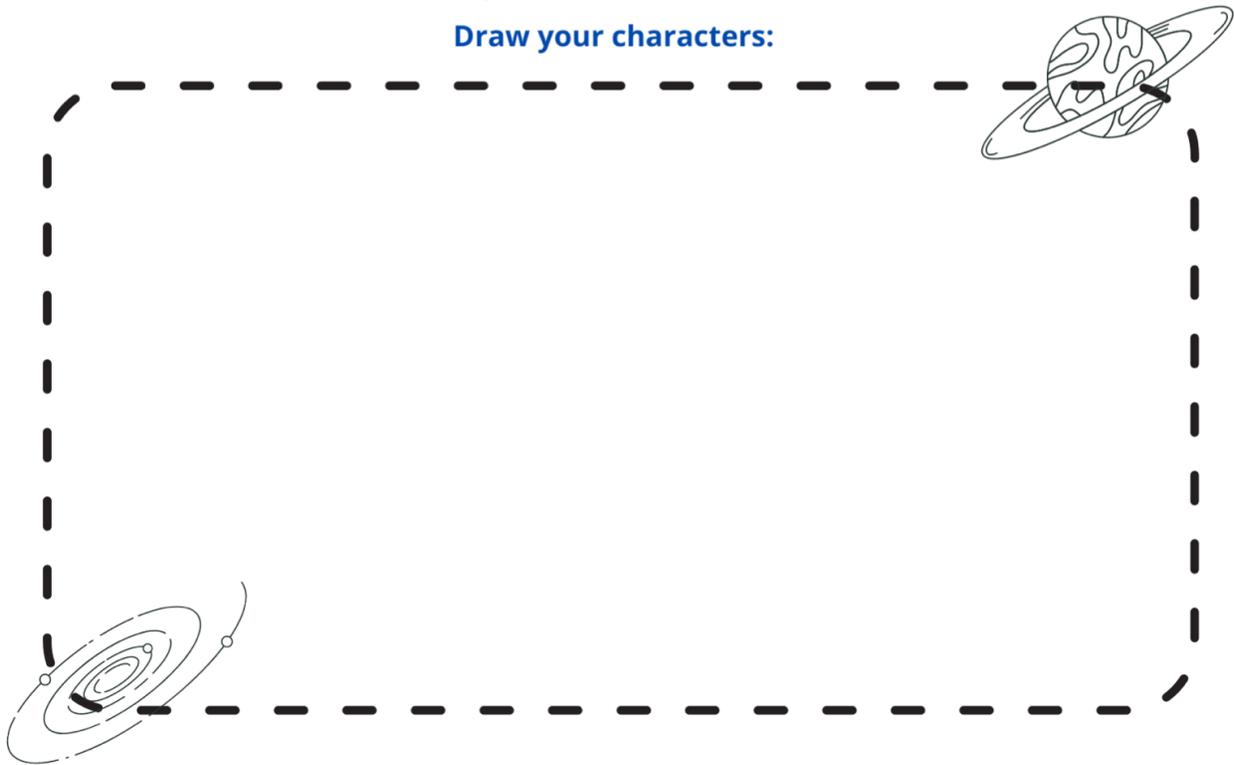


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_____ and _____ started to

(push/pull) on the _____ .

At first, _____ moved _____ and

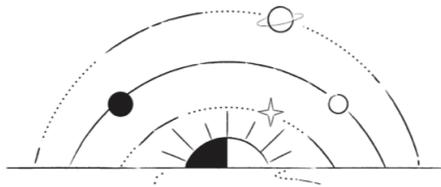
_____ moved _____ .

But then, _____

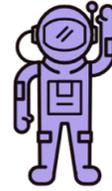
How does the story end?



The end!



The Tug o War Space Adventure!

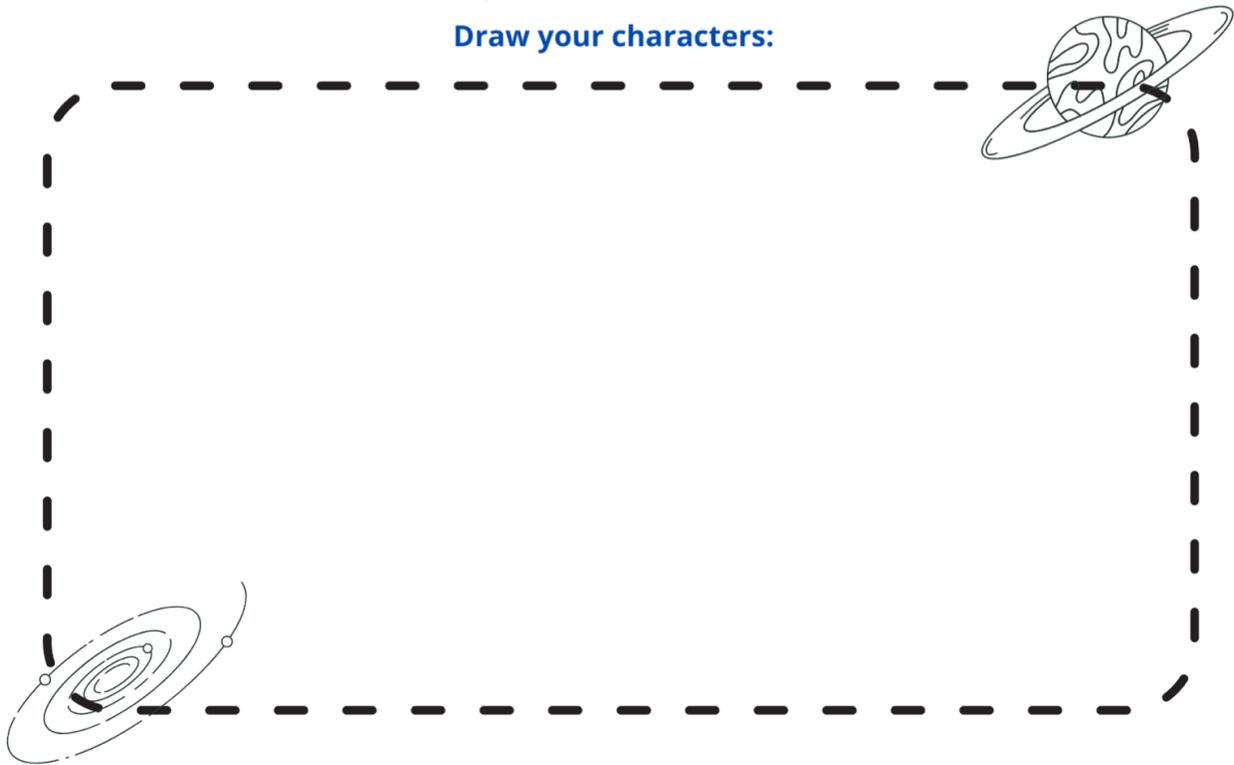


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- Do they move **forward, backward, or stay** in the same place?
- Who **wins** the tug o war?

Draw your characters:



What are the characters doing at the **beginning** of the story?

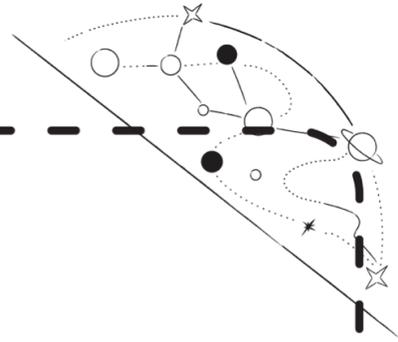


Draw what happens in the **middle** of the story.



So the characters had a tug o war. What happened?

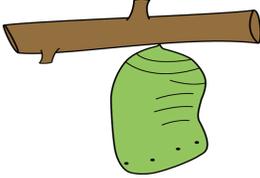
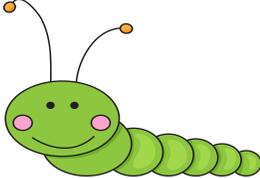
How does the story end?



So in the end, they decided to _____

and they never _____

_____ again. **The end!**

<p>How did I do?</p>			
<p>Beginning</p>	<p>In the beginning of the story, the characters are introduced. The writer tells us who they are and why they are in space.</p>	<p>In the beginning of the story, the characters are introduced, but we do not know what they are doing in space.</p>	<p>In the beginning of the story, the writer jumps right in without telling us who the characters are and what they are doing in space.</p>
<p>Middle</p>	<p>In the middle of the story, the characters have a problem. A tug of war happens.</p>	<p>In the middle of the story, a tug of war happens. The problem that is going on might be a little unclear.</p>	<p>In the middle of the story, the problem that the characters have is unclear. There may or may not be a tug of war.</p>
<p>End</p>	<p>In the end of the story, the problem is solved.</p>	<p>In the end of the story, the problem might still be a bit unclear.</p>	<p>In the end of the story, there is not a problem that has been solved.</p>
<p>Push/pull vocabulary</p>	<p>The writer has clearly stated whether the tug of war involves pushing or pulling.</p>	<p>The writer alludes to push/pull but does not explicitly state this vocabulary.</p>	<p>The writer does not mention push/pull.</p>
<p>Movement vocabulary</p>	<p>The writer clearly states which character moves forward/backwards, falls, etc.</p>	<p>The writer mentions what one character does, but not the other.</p>	<p>The writer does not describe how the characters are moving.</p>