Week 1

Grade level: 2

Driving Question for the unit: How can I get my wagon full of my toys to my friends house?

Specific Lesson Question: What is motion?

<table>
<tr><th colspan="3">Overview</th></tr>
<tr><td colspan="3">For lesson 1, what is the scenario/problem you are using to launch the unit?
● I am really nervous about going to my friends house for the first time. I am bringing a bunch of my favorite toys in my wagon. I want to be extra prepared, since I've never walked there before. How can I make sure my wagon is prepared so that I don't lose any of my toys?</td></tr>
<tr><td>Disciplinary Core Idea Addressed in lesson:

PS2.A: FORCES AND MOTION
How can one predict an object's continued motion, changes in motion, or stability?

All objects are moved via a push or a pull. How can one predict an object's ability to continue motion, how can an object's motion could be changed through a push or a pull, or an object's ability to be stable?</td><td>Science and Engineering Practices Addressed in Lesson:
1. Asking questions (for science) and defining problems (for engineering)
4. Analyzing and interpreting data
6. Constructing explanations (for science) and designing solutions (for engineering)</td><td>Cross-Cutting Concepts Addressed in Lesson:

Cause and Effect:
Students will explore the cause and effect relationships between pushing/pulling an object and motion.</td></tr>
</table>

	7. Engaging in argument from evidence **8. Obtaining, evaluating, and communicating information**	

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]
Yes
No

Students will use technologies from the materials list to analyze how objects will be manipulated by push and pull. They will use collaborative reasoning by participating in group work and discussing with one another.

*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

Learning objectives (outcomes):
What do you want students to be able to explain/state in response to the specific lesson question?
Students will be able to explain/state [USE KIDS' WORDS]:

- We move all objects by pushing or pulling them.

Learning Plan
(using the 5E model--Meredith will explain as needed)

In person	**Adaptations for Online** *(as needed by phase)*
ENGAGE ● We will start by sharing a version of the scenario above, grabbing the students attention by asking them what toys they would put in their wagon. From this discussion we will lead into the driving question ● The students will be asked what kind of things they could run into on their journey ● Have the students draw pictures of what hazards might be on the path. ● The teachers will make a list on the board of potential issues that may arise on the journey ● One teacher will ask students what would happen if something fell out of the wagon, demonstrating by dropping an object onto the floor	**ENGAGE** **EXPLORE** Students can elect to use materials from home to explore their movement and how they can be manipulated. We will have students print out a table prior to the lesson so that

EXPLORE ● We will move into an activity where students investigate the movement of several objects. Students will roll, bounce, blow and move objects ranging from balls to paper clips. ● Students will record on a t chart in pairs how many ways they can move an object ● We will come back together as a class to discuss all the ways the students could think of to move their objects ○ We will tell students that when they hear another group who shared a way to move the object to highlight that form of movement **EXPLAIN** ● We will have a class summary chart with starter phrases. This will give them opportunities to share their ideas and thoughts how objects are being pushed and pulled and that these will be called forces. **ELABORATING/EXTENDING Understanding** ***(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)*** ● We will start by discussing the scenario from the beginning and how it relates to the push and pull activity. ● Discuss how each object could play a role in how you get your wagon to your friend's house (In reference to the bouncy ball: "Would you bounce your wagon to your friends house? What would happen if you did that?") each student will share one object ● We will then add to our summary chart and write down ways we can move wagon (Push and pull) ● We will then lead into next week's topic which is friction by asking students to talk with their tables and come up with different ways that it might be difficult to move the wagon ● We will conclude by having the students complete an exit slip and a drawing.	they can record their results. If they do not have access to a printer, we can walk them through how to make a T chart so they can easily record and analyze. Students will work in breakout rooms with IU teachers and explore the movement of their objects. We will have a discussion with students as a large group after their exploration to discuss the terms they chose to describe the movement **EXPLAIN**
Formative Assessment Evidence	

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will have students come together and work on an exit slip asking them questions. One question will be "All objects can be moved by either _____ or _____." (Pushing or pulling) This question will have blanks that allow them to insert their answers. Additionally, students will draw their wagon and how they plan on pulling it. (Complete with arrows). Once students have completed their exit slip and drawing, we will ask if students want to share their drawing with their peers.
- We will also examine and discuss their T charts.

Individual Student Accomodations

Required Accommodations/Modifications:

- N/A

Additional Modifications for Individual Students:

- Scale-Up: Come up with examples of different real-world objects that require a push or pull.
- Scale-down: Giving visual guidance to help lead the students to the idea that motion is a push or a pull.

Materials

REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

In person (Items are per class)	Online (Will not need)
1. One bowl of water with a floating ping pong ball 2. 2 bouncy balls 3. 2 yo-yos 4. 2 slinkys 5. 2 toy cars 6. 4 small/ individual containers of playdough 7. Rolling chairs (Classroom) 8. Large paper for summary chart and markers 9. 6 copies of worksheet (provided by IU teachers) 10. Pencils for students 11. Plain Paper 6 pages 12. Colored pencils	1. 6 household items that can be rolled, dropped, blown on and played with (not breakable) 2. Paper for note taking 3. Pencils for recording data

Week 2

Grade level: 2

Driving Question for the unit: How can I get my wagon full of my toys to my friends house?

Specific Lesson Question: If my wagon is speeding down a hill, how can I slow it down?

Overview		
For lesson 2, how will you contribute to answering your overarching unit question? ●We will contribute by introducing the topic of friction which will help the students in solving our overarching scenario/ issue about getting the wagon to the friend's house.		
Disciplinary Core Idea Addressed in lesson: **PS2.A: FORCES AND MOTION** How can one predict an object's continued motion, changes in motion, or stability? All objects are moved via a push or a pull. How can one predict an object's ability to continue motion, how can an object's motion could be changed through a push or a pull, or an object's ability to be stable?	**Science and Engineering Practices Addressed in Lesson:** **1. Asking questions (for science) and defining problems (for engineering)** **4. Analyzing and interpreting data** **6. Constructing explanations (for science) and designing solutions (for engineering)** **7. Engaging in argument from evidence**	**Cross-Cutting Concepts Addressed in Lesson:** Students will explore the cause and effect relationships between different surfaces and how objects move on them.

Will another discipline of STEM (other than science) be included in this lesson?
[highlight your response]
Yes
No

Students will use technologies from the materials list (sandpaper, felt, tin foil, the ground, the desk) to analyze how objects move differently depending on the surface. They will use collaborative reasoning by participating in group work and discussing with one another.

*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

Learning objectives (outcomes):
What do you want students to be able to explain/state in response to the specific lesson question?
Students will be able to explain/state [USE KIDS' WORDS]:

Friction is a force, friction is when two objects move against each other in opposite ways, friction causes one object in motion to slow down

Learning Plan
(using the 5E model--Meredith will explain as needed)

In person	Adaptations for Online *(as needed by phase)*
ENGAGE (10 minutes 10:00-10:10) Izzy We will begin the lesson by re-introducing our driving question for the unit. We will then ask our students another question relating to our wagon: “One thing we talked about last week was some things that could happen on our trip to our friends house. We said there could be hills on the way to my friends house. I'm worried my wagon will go super fast down a really big hill. How would I stop my wagon if that happened?” **EXPLORE (35 minutes 10:10-10:45) Kayla explains** We will have students explore the way a car moves on a variety of surfaces. We will provide students with a worksheet in a table format. On one side of the worksheet, we will list a variety of materials on one column, a middle column for them to describe the texture and characteristics of the materials, and a third column for students to rank the difficulty of the movement across the materials. Students will push a toy car across surfaces and record their observations **EXPLAIN (15 minutes 10:45-11:00) Lauren** We will have a conversation about what surfaces were easy to move the car across and what surfaces were more difficult. Each student can share their rankings and we can record them on the board. We will ask students what they noticed about how the car moves across bump surfaces and how the car moves across smooth surfaces.	**ENGAGE** **EXPLORE** Teachers will share screen of the worksheet and fill it out with the students in breakout rooms **EXPLAIN** - We will record their thoughts on a google doc rather than a board - We will have a google doc for the summary chart - We will have them answer the exit slip question all together as a class

- "What are some of the things you guys notice are the same?" In reference to the recordings on the board.

ELABORATING/EXTENDING Understanding Jazz

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)

- **Discuss scenario of wagon going downhill and how it slows down; restate driving question and question for this lesson**
- **We will introduce the vocabulary, friction, and play a video about friction after talking about the idea of the 2 surfaces moving across one another and how that changes the movement**
- **"Do you guys have any questions about friction? Where did you guys see friction throughout the lesson today?"**
- **We will add to our summary chart of what we define friction to be**
- **We will provide an exit slip of a fill in the blank of " friction is" and have them complete the sentence with our class definition of friction and have them draw a picture of how a wagon is slowed down by friction and**
- **More on the exit slip, incorporate force and motion**

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will know the students understand the material when we have our ending classroom discussion during the “explain” portion of the learning plan.
- We will also be having the students complete an exit slip that asks them a simple question. The question will be centered around the learning objective. It will ask “Friction is _____”. They will complete it with their class definition.
- We will also have the students draw a picture of their wagon. They will be instructed to use arrows to demonstrate friction and how their wagon is slowed down by it.

Individual Student Accomodations

Required Accommodations/Modifications:

●We can scale up during the elaboration section by discussing the wagon would move if it was underwater.

- We can scale down by removing the middle ranking option (2) and making it (1) easier or (3) harder

Additional Modifications for Individual Students:

●N/A

Materials

REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

In person	**Online**
● **4 sheets of decent sized (8.5 by 11in?) Tin foil** ● **2 sheets of felt, same size as printer paper**	**- Carpet or towel instead of felt** **- Any toy with rolling wheels instead of car** **-**

• **2 Sand paper of different grains (fine and coarse 2 of each)** • **4 toy cars (hotwheels)**	

Week 3 and 4

Grade level: 2nd

Driving Question for the unit: How can I get my wagon full of my toys to my friends house?

Specific Lesson Question: How do gravity and slopes make it harder or easier to get my wagon to my friend's house?

Overview		
How does this lesson contribute to your overarching unit question? • **My wagon is really heavy, what do I have to do to stay in control of my wagon? (When going down a hill?)**		
Disciplinary Core Idea Addressed in lesson: **PS2.A: FORCES AND MOTION** How can one predict an object's continued motion, changes in motion, or stability?	**Science and Engineering Practices Addressed in Lesson:** **1. Asking questions (for science) and defining problems (for engineering)** **4. Analyzing and interpreting data**	**Cross-Cutting Concepts Addressed in Lesson:** Students will find patterns when exploring how different objects roll down a slope at different rates.

All objects are moved via a push or a pull. How can one predict an object's ability to continue motion, how can an object's motion could be changed through a push or a pull, or an object's ability to be stable?	**6. Constructing explanations (for science) and designing solutions (for engineering)** **7. Engaging in argument from evidence**	

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]

Yes

No

*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

During the explore section of the lesson, students will use technologies from the materials list (balls, paper clips, marbles, etc) to analyze how objects move differently depending on the size/ weight. They will use collaborative reasoning by participating in group work and discussing with one another.

Learning objectives (outcomes):

What do you want students to be able to explain/state in response to the specific lesson question?

Students will be able to explain/state [USE KIDS' WORDS]:

- **Heavier items are harder to control when going down a hill.**
- **Items roll down a hill faster the taller the hill is.**

Learning Plan
(using the 5E model--Meredith will explain as needed)

In person	Adaptations for Online *(as needed by phase)*
ENGAGE Izzie ● We will begin the lesson by re-introducing our driving questions for the unit. ● We will then ask our students another question relating to our wagon: ○ Since my wagon is super heavy from all my toys, what do I need to do to stay in control of my wagon? ○ When we pack our wagon with all the toys, what will happen when it rolls down the hill? ○ What will happen if we need to take the wagon back up the hill? **EXPLORE Kayla** ● We will have the students work through a handout that has different sized objects. ● The students will make predictions on how the objects will roll down each and why. ● The students will gently push their objects off their hand-made ramp and measure how fast their objects go(on worksheet) ● When an object goes down hill it will _____ _____ ○ What causes objects to change speed on slopes? ○ If an object moves along a flat surface, then uphill, then along a flat surface, how will its speed change? ● Students will explore using different ramp heights.	**ENGAGE** **EXPLORE** **EXPLAIN**

- We will then show slideshows of pictures and ask the students which objects would be the most difficult to push or pull and ask them why.

EXPLAIN Lauren

- We will ask the students if their predictions were right
  - If yes, how did they know
  - If no, why had they made those predictions
- In response to our exploration investigation, what result did we notice to be constant throughout our trials?
  - Why did some objects hit the ground before other objects? (Depending on the ramp size)
  - Did you notice any changes in the objects when you changed the height of the ramp?
- Did we notice anything different from person to person? Can you share how you got those results?

ELABORATING/EXTENDING Understanding Jazz

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)

- *Students will make connections with the scenario of how objects will get to the bottom of the ramp*
  - *How will it roll down (Dependent upon height of ramp)*

1. *We will ask the students how they can get their heavy wagon speeding down a hill under control.*
   a. *Push or pull?*
   b. *Ask the students if it would be easier to control the wagon if it is heavy or light?*
   c. *Is something already pulling or pushing the wagon down the hill?*

d. *If yes, what?* e. *If no, how is the wagon moving then?* 2. *If they have not already brought up the topic of gravity:* a. *How is it that humans do not just float into space?* b. *What is keeping us on the ground?* 3. *Ask the students to define gravity in their own words* 4. *We will then add to our summary chart and come up with a group answer for: "How do hills make it harder or easier to get my wagon to my friend's house?"* 5. *The students will then complete the exit slip, and draw a picture*	

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will know the students understand the material when we have our ending classroom discussion during the "explain" portion of the learning plan.
- We will also have the students draw a picture of their wagon on a hill. (Going upwards or downwards" They will be instructed to use arrows or labeling for their image. This will serve as our exit slip.

Individual Student Accomodations

Required Accommodations/Modifications:

- We can scale down by demo-ing the activity to our students so they get a better understanding of what we want them to do
- We can scale up by having the students use household items and demonstrate gravity to their peers.

Additional Modifications for Individual Students: ●	
Materials **REMEMBER to include Quantity. Also differentiate any materials for in person VS online.**	
In person: 3 Sets of each ● **Ping pong ball** ● **Marble** ● **Paper Clip** ● **2 pieces of paper7** ● **Coin** ● **Tennis ball** ● **Colored Pencils** ● **Ramps** ● **Hot wheels** ● **Playdough (small individual sizes)** ● **Dice (small size)**	**Online (Per person including teachers) 7 sets of supplies for 7 people** ● **Ping pong ball** ● **Marble** ● **Paper Clip** ● **2 pieces of paper7** ● **Coin** ● **Tennis ball** ● **Colored Pencils** ● **Ramps**

Week 5
Grade level: 2nd

Driving Question for the unit: How can I get my wagon full of my toys to my friends house?

Specific Lesson Question: How would strong winds affect the transportation of our wagon?

Overview		
For lesson 1, what is the scenario/problem you are using to launch the unit? ● When we're on our way to our friend's house, we might run into strong winds. How could we still make it to our friend's house with the strong winds?		
Disciplinary Core Idea Addressed in lesson: **PS2.A: FORCES AND MOTION** How can one predict an object's continued motion, changes in motion, or stability? All objects are moved via a push or a pull. How can one predict an object's ability to continue motion, how can an object's motion could be changed through a push or a pull, or an object's ability to be stable?	**Science and Engineering Practices Addressed in Lesson:** **1. Asking questions (for science) and defining problems (for engineering)** **4. Analyzing and interpreting data** **6. Constructing explanations (for science) and designing solutions (for engineering)** **7. Engaging in argument from evidence**	**Cross-Cutting Concepts Addressed in Lesson:** Systems and system models: A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
Will another discipline of STEM (other than science) be included in this lesson? [highlight your response] **Yes** **No** *If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*		

***Engineering and design**: students will identify the needs and constraints of their designs of their boats, they will imagine possible solutions for boat designs, they will create and build their boats from the supplies given, test their prototypes and then improve and redesign as needed.* During the explore section of the lesson, students will use **technologies** from the materials list (Tap, Fans, Foam boats...etc) to analyze how objects move differently depending on the size/ weight. They will use **collaborative reasoning** by participating in group work and discussing with one another.

Learning objectives (outcomes):
What do you want students to be able to explain/state in response to the specific lesson question?
Students will be able to explain/state [USE KIDS' WORDS]:

- **Wind is a force.**
  - **Wind could slow our wagon down by pushing on our wagon in the direction that we do not want to go in**
  - **Wind could help us move our wagon my pushing in the direction that we want to go in**

Learning Plan
(using the 5E model--Meredith will explain as needed)

In person

ENGAGE

- We will begin the lesson by re-introducing our driving questions for the unit.
- We will then ask our students another question relating to our wagon:
  - What is wind?
    - We anticipate that our students will say "its something that blows outside".

Adaptations for Online

(as needed by phase)

ENGAGE

EXPLORE

EXPLAIN

● If they say this, we will ask “well, can you see wind?” ○ We anticipate they will say no. ■ Then, we will ask, “If you cant see it, can you feel it? We anticipate they will say yes. ○ Has anyone experienced really strong winds before? ■ If yes, what did it feel like? Did it cause you to move or maybe fall over? ● We could see the students answering “yes, and it feels like someone is pushing you” ● If our students havent experienced strong winds before, we can ask “have you ever seen wind blow over trash cans, trees or anything else outside?” ○ We anticipate that our students will say yes. ○ Since we've never been to our friends house before, what will happen to our wagon if we experience strong winds? ■ We could see the students answering, “All of the toys would fly out” ● If the students say this we would say “yes, theres a possibility that our toys could fall out!” We would ask “what do you think could happen to the wagon?” ○ We anticipate that the students might say “it could flip or tip over” ■ If they do, we will ask “how could wind flip our wagon? And is there a way to stop wind?	

	● We anticipate that the students would say that wind can be really strong. ● We anticipate that the students would say "you can put something up to block wind" ○ If they are unsure, we can head straight into our explore part of the lesson.	
<u>EXPLORE</u> ● We will begin this section by telling students that they will be creating boats to test out what materials are best for a strong wind storm. We will inform them that they will be timed and we are looking for the boat that can get to the other side of the water tank the fastest in a windstorm ● We will then segway into a chat about how the materials we are for science and scientists do not play with their materials, even when they look like toys ○ These materials may look like toys and other things you may have played with at home but these materials are helping us with our investigation and answering our main		

question: how do strong winds affect the transportation of our wagon? ● We will first have students draw their boat design after introducing the material list. We will do this first so that they will not get distracted by the physical materials. ● Students will then have the opportunity to share their boat design with one online teacher and one-in person teacher. Teachers will ask the following questions about the designs ○ What materials did you choose to use? ○ Why did you choose those materials? ○ Were there any materials you chose to leave out? ■ We anticipate that they may neglect clay due to weight. ● To this, teachers might ask if clay could contribute to the sturdiness of the boat ■ We anticipate that they might not use tin foil on the bottom of the boat or not think about the friction between the boat and the water ● If they do not make the connection between the boat and water we will ask them about this possibility in the elaboration section ● We will then give students time to construct their boats ● As they construct their boats we will ask them “How are you designing your sail to make the boat go faster?” ○ We anticipate them saying that they are going to make their sail big so the wind pushes it ○ We anticipate them saying that they are making a small sail so the wind does not slow the boat down. ■ If they say this we will ask them “have you seen a sail boat before? Do they usually have big or small sails?	

- We anticipate them saying that they usually have really big sails.
- We also anticipate them saying that fast boats do not have sails.
    - If they say this, we will ask them, “Really fast boats have motors, but we do not have motors. How can we use the wind to make our boat go faster?”
        - We anticipate themsaying that the wind could push on the sail to make the boat go faster.

- After the construction is complete, students will put their boats to the test, timing how long it takes their boats to travel across the water tanks

EXPLAIN

- We will begin by asking the students if their boat went as fast as they thought it would
    - We anticipate the students may answer that their boats went slower than they thought they would
        - We will then ask them why that happened
            - We anticipate them stating that their sail may have slowed them down because it wasn't catching the air in the right direction.
            - We could also anticipate them answering that the weight of the boat slowed it down

	○ If this happens we will ask them what factors other than weight might have slowed their boats down? ■ We anticipate them answering that the wind not hitting the sail correctly is what made their boats slower than they predicted. ■ We also anticipate them saying that the water could slow them down. ● If they say this we will ask them “If water is rubbing against the bottom of the boat then what do we call that?” ○ We anticipate them saying friction ● We would then ask them “What is happening above the boat that could cause it to slow down?” ○ We anticipate them saying that the wind did not hit the sail and that caused the	

boat to not go as quickly.

- We will ask our students, “So how can the wind slow down our wagon?”
    - We anticipate them answering that objects in the wagon could be caught by the wind causing the wind to slow down their wagon.
    - We also anticipate them answering that the wind might be so strong that it stops the wagon from moving.
        - We will then ask them “why do you think the wind stops or slows down the wagon?”
            - We anticipate them answering that their the wind is a force pushing on the the wagon
                - We will then ask them “Could this be a good thing? Could the wind help us?”
                    - Based on our conversation from last week we anticipate them answering that the wind could help push the wagon in the direction that we want the wagon to go just like how last week gravity could help pull the wagon down a hill.
- We will then ask them, “What can we do when the wind is really strong and is pushing on our wagon to make sure that we still get our wagon and all of the toys to our friend’s house?”
    - We anticipate them answering that we will need to use more strength or force to push or pull it.

- We also anticipate them answering that we may need to put our wagon on a boat
    - We will ask “But what if there is not a boat? What if we are pulling it on a sidewalk and the wind is pushing on the wagon? What can we do?
        - We anticipate them answering that we will have to use more force and “Push back”
        - We also anticipate them answering that we might have to go a different way
            - We will ask “But this is the fastest route to my friend’s house and even if we go a different way it might still be windy. What do I need to do in order to still walk through the wind?”
                - We anticipate them answering that we will have to push or pull harder
                    - If they still are not making the connection we will ask them “Remember last week when we talked about hills and how we might have to pull harder on our wagon when going up a hill? Would that work for this and why?”

ELABORATING/EXTENDING Understanding (Jazz)

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)

- Students will make connections with how wind can affect objects that move.
    - We will ask, “How does wind move objects?”
        - We anticipate the students answering that the wind pushes on objects to make them move.
    - We will ask, “What are some examples of wind moving objects?”
        - We anticipate them to make connections to real life experiences, like a tree blowing in the wind or wind knocking over their trash bin at home.
- We will incorporate previous learned concepts to the boat activity and connect them to the driving question of the wagon. We will emphasis each learning concept since they will think of materials they want to build a track for next week(or we will provide examples of routes/track that they think would be fastest for getting to their friends house with the wagon)

    - Motion - How is motion pushing or pulling the boat? What is pushing the boat in this activity? Scale up (if needed): Does the force of motion change as the distance of the fan increases with the boat?
        - We anticipate that the students may not know if the force of the motion decreases as distance of the force is increasing.
            - We can then have the students feel the wind of the fan close to the fan and far away from the fan ask which one they felt more.

■ Connection to wagon: Reminding students how motion is enacted, push and pull. ○ Friction: How does friction play a part in our activity? ■ We anticipate them answering that they did not see how friction connected to the boat on the water. ● We would then ask, what two objects will be rubbing against each other in the activity? Would any materials cause less friction between the water? ○ If they do not think of anything, we could try quickly how foil makes for smoother, faster sailing. ○ Gravity: Why does our boat not float in the air? Why does our wagon again not float in the air? How is Mr.Gravity pushing or pulling on our wagon? ■ We anticipate the students may say that gravity is pushing or pulling on our wagon. ● We would then say what direction is gravity pulling on our wagon? ○ We anticipate the studentssaying the the force of gravity would be pulling downward towards the ground on our wagon. ○ Slope: How do the heights of hills affect our wagon? What if our route to our friends house has many hills to climb? What if it had many downhills? What would be faster? ■ When thinking of constructing hills for our next week activity, we anticipate the students may say	

that a too high of a hill would cause our toys to fall out or that we would lose control. ● We would agree with them and say, correcting a large hill could be dangerous for us and our wagons. ○ Air resistance: How is air resistance (Wind) working in the boat activity? ■ We anticipate them saying that the wind pushed on the boat andsail to make their boat move. ● We would then ask what would happen on a windy day if high winds were going with us (tailwind) to our friends house? ○ We anticipate them saying that the wind would push our wagon with us possibly speeding us up. ■ What if high winds were coming toward us (headwind) when we are pulling our wagon? ■ We anticipate them saying that the wind would push the wagon in the wrong direction which would slow us down ● We will then fill out the summary chart together answering, “How would strong winds affect the transportation of our wagon?” ● Students will brainstorm different materials for the following week of how they would like to design a route for the fastest way to get	

to their friend's house. They would consider motion, friction, gravity, slope and air resistance when brainstorming their ideas.	

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- From your sketch, how would you modify your boat to allow it to travel quicker? We will know that they have attained an understanding of air resistance if they include a list of materials, terms and ideas for their boat.

- We will know if our students attain the objection if our students create a design that makes their boat go faster during the exploration portion of our lesson.
- We will know if our students attained the objectives during the explain section if they are able to make connections between the wind on the boat and the wind that could affect our wagon.
- We will know if our students attained the objection during the elaborating portion of our lesson if they make connections to our previous lessons on slope, friction and gravity to our most current lesson on air resistance.

- For an exit slip, we will have the students write down some materials they would want to use for next week's lesson. We will explain to them that they will be building their own path to their friends house using many of the materials we have used previously. We will remind them of these materials such as sandpaper, tin foil and cardboard. They will make a list of materials that they want to use based off of their explorations in other weeks.

Individual Student Accomodations

Required Accommodations/Modifications:

- Scale up: Does the force of motion change as the distance of the fan increases with the boat? Discuss how with less wind force, will make the boat move slower.
    - Scale down: If the students are finding this project to be difficult, we could have them work together an compare boat designs from a distance.

Additional Modifications for Individual Students:

- When reminding our students of gravity, we will, as a brain break, have students do 10 jumps in the air and ask, why did we not float in the air after we have jumped? This would help keep focus for the rest of our time

Materials
REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

In person: 3 sets of each **Clay** **Straws** **Skewers** **Toothpicks** **Tape** **Fans** **Foam boats** **Tin Foil** **Wax paper** **Water trays (1 per student)** **Stopwatch** **Pencil** **Colored pencils** **White paper** **(Any other boat design materials)**	**Online**

Week 6

Grade level: 2nd

Driving Question for the unit: How can I get my wagon full of my toys to my friends house?

Specific Lesson Question: How can I create the safest and quickest path to our friends house?

Overview
For lesson 6, what is the scenario/problem you are using to launch the unit? **I am really nervous about going to my friends house for the first time. I am bringing a bunch of my favorite toys in my wagon. Now that I know what I could run into, how can I build the fastest route?**

Disciplinary Core Idea Addressed in lesson:	**Science and Engineering Practices Addressed in Lesson:**	**Cross-Cutting Concepts Addressed in Lesson:**
PS2.A: FORCES AND MOTION How can one predict an object's continued motion, changes in motion, or stability? All objects are moved via a push or a pull. How can one predict an object's ability to continue motion, how can an object's motion could be changed through a push or a pull, or an object's ability to be stable?	**1. Asking questions (for science) and defining problems (for engineering)** **4. Analyzing and interpreting data** **6. Constructing explanations (for science) and designing solutions (for engineering)** **7. Engaging in argument from evidence**	Systems and system models: A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]

Yes

No

*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

***Engineering and design**: students will identify the needs and constraints of their designs of their boats, they will imagine possible solutions for boat designs, they will create and build their boats from the supplies given, test their prototypes and then improve and redesign as needed.* During the explore section of the lesson, students will use **technologies** from the materials list (toy car, fan, sandpaper...etc) to analyze how objects move differently depending on the size/ weight. They will use **collaborative reasoning** by participating in group work and discussing with one another.

Learning objectives (outcomes):

What do you want students to be able to explain/state in response to the specific lesson question?

Students will be able to explain/state [USE KIDS' WORDS]:

Students will be able to explain how motion, friction, slopes and wind affect the movement of an object:

"Bumpy surfaces slow an object down"

"Smooth surfaces speed an object up"

"Something moving downhill will go faster than something going uphill"

"Wind can either slow an object down or speed it up depending on its shape"

Learning Plan

(using the 5E model--Meredith will explain as needed)

In person	Adaptations for Online *(as needed by phase)*
ENGAGE ● We will explain to students that today is the day they are bringing their wagon full of toys to their friends house and that they will have the opportunity to create their own path. Their path needs to be fast, since we don't want to keep our friend waiting, and safe. ○ We will ask the students to remind us what they might encounter on their journey ■ We anticipate that they will say things we have discussed in previous weeks such as rain, wind, hills, and bumpy or smooth surfaces ■ We also anticipate them listing things that we have not discussed liked hurricanes and tsunamis ● We would then ask them to think about things that we have learned about and investigated in the past 6 weeks.	**ENGAGE** **EXPLORE** **EXPLAIN**

● We will tell students that they need to keep their quarter on top of the car, representing their toys in the wagon. ● We will then explain to them that they have to include 3 things on their route: a hill, 2 different surfaces, and wind. We will have the students draw out their route with labels. Finally, we will have them explain why these chose their hill size and materials. ○ We anticipate that students will choose fine sandpaper as a material because they found in week 2 that it was one of the fastest surfaces ○ We anticipate that students will neglect to consider that hills have both positive and negative slopes, forgetting that their cars will have to go uphill if they also go downhill ○ We will ask students why they chose their materials ■ We anticipate that they will refrain from using crumpled tin foil because they decided it was the most rough and difficult surface to move across in week 2 but we assume that they will use smooth tin foil since one student used it to increase the speed of their boat last week	

EXPLORE

- We will begin the explore section by reintroducing the idea of being a serious scientist and not playing with the materials.
- We will then have the students construct their paths on their table tops
    - As they are constructing, we are going to ask the students, “Does it matter how big you make your hill? Why?”
        - We anticipate them saying, “yes, because the car might go faster down a bigger hill and the quarter (toys) could fall off”
        - We anticipate them saying no because you just have to be careful when going up and down it
            - If the students say this, we will ask them, “Remember when we rolled different objects down the big hill and the small hill? Did the objects

do anything different on the different sized hills?" ○ We anticipate them saying, "yes, the objects went faster on the bigger hill?" ■ We will then ask, "So does it matter how big the hill on your path is? Why?" ● We anticipate them saying, "yes, if the hill is really big the car will go faster and the quarter could fall off of it." ○ As they are constructing, we will ask them, "What do you think the wind will do to the car (wagon)?" ■ We anticipate them saying that the wind could slow down or speed up their car depending on the direction it is going.	

■ We anticipate them saying, “It will make the quarter (toys) fall off” ● If they say this we will ask, “What will happen to the actual car if the wind is blowing on it?” ○ We anticipate them saying that the wind will push against the car causing it to slow down or speed up ○ As they are constructing, we will ask them, “What could happen if the surface you are driving the car on is too bumpy?” ■ We anticipate them saying that the car might slow down ● We will ask them “What is that called when two surfaces rub against eachother causing one to slow down?” ○ We anticipate them saying friction ■ We anticipate them saying that the quarter will fall off of the car	

● We will then ask them “What might happen to the actual car?” ○ We anticipate them saying that the car will move around a lot because the surface is bumpy ■ We will ask them, “Will that slow the car down or speed it up?” ● We anticipate them saying that it could slow the car down due to there being a lot of friction. ● The students will then attach a string around the car and a quarter on top of the car to represent the toys in the wagon. ● The students will try to make it through their route as quickly as possible without their quarter falling off. ● The students will then get the chance to do a redesign of their route, but they can only change one thing because	

scientists only change one thing at a time when they are investigating.

- As the students are constructing we will ask, “What are you changing to make the route to your friend’s house faster and easier?”
    - We anticipate them saying that they are going to make their hill smaller
        - We will ask them, “How will this help?”
            - We anticipate them saying that the car will not go as fast down the hill if it is smaller
            - We anticipate saying that this will help their quarter not fall off
                - We will then ask them, “How will the hill being smaller help your quarter not fall off?”
                    - We anticipate them saying that the car will not go as fast down the hill and they will have more control

○ We anticipate them saying that they are going to change the surface that they are driving on ■ We will ask them, “How will changing the surface help?” ● We anticipate them saying that if they pick a smoother surface, their car will not be as slow. ● We anticipate them saying that their surface was too bumpy and they could not get their quarter to stay on. ○ We will ask, “do you think that a bumpy surface will help you get to your friend’s house quickly?” ■ We anticipate them saying no because more friction would slow the car down. ● The students will then test and time their final route with their car.	

- At the end of the explore section, we are going to have the students do a brain break (jumping, wiggling, etc.) so that the students are ready and focused for discussion.

EXPLAIN

- We will begin by asking the students what kind of surfaces they decided to use on their track
    - We expect for the students to use fine sandpaper because it will create less friction for their toy car.
    - We anticipate that the students will use fine sandpaper because of our previous lesson in week 2. During our explanation portion in week 2, the students all agreed that fine sandpaper was the smoothest surface for their toy car.
    - We anticipate that the students might pick aluminum foil because in week 5, Antonio put it on the bottom of his boat and it created a smooth surface. However, in week 2, the students crumpled the aluminum foil and it created a bumpy surface that caused more friction when used with the toy car.

We will ask the students why they decided to pick those surfaces for their track.

- We want the students to talk about friction, and how using surfaces that are smooth or less bumpy will result in our toy car going faster.
- We anticipate that they students will say that they wanted the surface with the least friction
    - We will ask them, “Why do you think that having a surface with less friction is important?”
        - We anticipate them saying that surfaces with less friction do not slow their car down as much
        - We anticipate them saying that it was less bumpy for their car
            - We will ask, “Are bumpy surfaces easy to pull our wagons on?”
                - We anticipate them to say no and that when there is more friction, their wagons slow down.

- We will ask the students what factors might have slowed down their toy car while they were on their route?

- We anticipate that the students will talk about the wind from the fan.
- We want them to bring up air resistance, and how wind pushes an object and can slow you down or cause you to put more force into an object. (pull harder on the string/wagon handle)
    - We will ask, “How did the fan slow you down?”
        - We anticipate them saying that the wind pushed on their car, slowing it down.

- Did the quarter fall off your toy car?
    - We anticipate that the students will say yes. It is likely that their coin will fall off their car multiple times due to the hills, surfaces and wind.
- We will ask the students why they think the coin kept falling off their toy car.
    - We anticipate that the students will say it's because of the route they created. They have to go up a hill and down a hill.
    - We anticipate that the students will say the wind from the fan caused the coin to fall off their toy car.

■ If they say this we will ask them, “What other factors made the coin fall off of the car?” ● We anticipate them saying that the hills caused the coin to fall off ● We anticipate saying that the surfaces caused the coin to fall off ● Would you have had to pick up all your toys if you were actually on the route to your friends house? ○ We anticipate that the students will say yes because they will compare the route they created to the story. ○ We anticipate that the students will say the toys will fall out of the wagon when they go up or down the hill. ○ We anticipate that the students will say the toys will fall out if they experience strong winds. ● What went well in your route? ○ We anticipate that the students will say the surfaces they choose were the highlight of their track. ■ We will ask, “How did those surfaces help you get to your friend’s house quickly?”	

- We anticipate them saying that they picked the surfaces with the least friction

- We anticipate that the students will say the hill they created caused the toy car to go fast.
  - We will ask, “Did you make a big hill or a small hil? Why?
    - We anticipate them saying that they made a small hill so that their quarter would not fall off.

- What did not go well during your route?

- We anticipate that the students will say the wind was an issue during their route.

- We anticipate the students will say the hill they created did not go well while their toy car went up it because their coin might have fallen off.
  - What could you have done to fix this?
    - We anticipate them saying that they could have made a smaller hill.

ELABORATING/EXTENDING Understanding

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline) ● Before students transition to elaboration and extending, students will participate in a short brain break to assure that they are focused and energized. Dance Party! ● Students will share how these concepts relate to how motion, friction, slopes, and wind are seen in the real world. ● What are some things that you would consider if you were to travel to your friends house? ● Motion: What do you need to consider when transporting your wagon up a hill? ○ Would you need more force to push or pull or wagon? Why? ■ How can we see motion? ● Can you show us motion? Ex: waving a hand, car moving, Earth	

	traveling around the sun. Is force and motion the same? ○ Anticipating Students Answers: Students may think that motion and force are the same but force causes an object to move through push or pull. Movement is the result of a force. This can be seen when we push the toy car, it has movement ● What is friction? ○ Why do some surfaces have less friction between them? ■ What are some of these surfaces? ● How does friction help us stay up? What type of shoes would you want when going hiking? How about when going ice skating? ○ Anticipating Student's Answers: Students may not know which surfaces would be hard to stay up therefore we will ask, would it be hard	

	to walk on ice all the time? Could you keep your balance if you run? These help to share that friction keeps people from falling. ● Would you take a route where you live with many hills? ○ Why do we not float in the air? ■ What is gravity? ● Anticipating student questions: Students may forget what gravity is or that it keeps us from floating. Through the use of our jumping in the air activity, we can not know that it is a force that pushes us downward. ● What is wind? (Air in motion) ○ What is a headwind? ■ What is a tailwind? ● How does wind affect travel? Is it easier to move our wagon when wind	

is coming at the wagon when we are trying to move forward? ○ Anticipating Student Answers: Students may not connect how if wind is coming towards them, it would be harder to move forward. ● The students will then finish the class by creating sketches of their route,adding in changes/ redesigns that they would have done if they had more chances for redesign. ● The students will share these sketches with the teachers.	
Formative Assessment Evidence	

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will gather their sketches from the engage section and look at what materials they chose to incorporate where to determine their understanding of how different slopes, winds and friction affect the movement of their wagons

    - We will know if the students obtained the information during the discussion portion (of explain) if they are able to explain why they decided to pick certain surfaces, what went well/went wrong with their route and what they would change if they had the chance to do it again. Alos, If students are talking about friction, air resistance and motion, then the students have obtained information from past lessons along with lesson 6.

    - We will know that students have obtained the learning outcomes through how students answer how motion, friction, slopes and wind is seen in the natural world. For instance, motion can be seen when someone waves their hand or sees a plane move in the sky.

    - We will know that the students met the objectives of the lesson during the explore section if they are able to pick the appropriate materials to create the fastest route for their wagon. We will also know that they have met the objectives if they are able to make a revision and explain why that would make their route even faster based on what they have learned about motion, friction, gravity, slopes, and air resistance.

    - We will have the students create a sketch showing how else they would have changed their route if they got more chances to redesign. Their sketches should include labels.

Individual Student Accomodations
Required Accommodations/Modifications: ● Scale Down: To scale down, the students could have a discussion with each other and talk through what decisions they are making and why as they construct their routes. ● Scale Up: To scale up, we could require the students to have 3 different surfaces and multiple hills throughout their course.
Additional Modifications for Individual Students: ● Continue to refocus students' attention through the use of brain breaks, 1-2 during Saturday Science
Materials **REMEMBER to include Quantity. Also differentiate any materials for in person VS online.**

In person	Online
● Tin foil (A roll) **● Fine sandpaper (4 Sheets)** **● Felt (4 Sheets)** **● Cardboard** **● Tape (2 rolls)** **● 3 toy cars** **● 3 pieces of string, 1 yard in length each** **● 2 stop watches** **● 2 medium to large containers of playdough** **● 1 box fan (2 if available)** **● Paper (4 sheets)** **● Colored pencils (2 packs)** **● Pencils (2)** **● 3 Quarters (Or something to put on the top of the car to**	**N/A**

represent the toys in the wagon) ● **Scissors**	