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| **Balance and Motion Timeline** |
| **Common Core State Standards –** • 1.P.1 Understand how forces (pushes or pulls) affect the motion of an object.• 1.P.1.1 Explain the importance of a push or pull to changing the motion of an object.• 1.P.1.2 Explain how some forces (pushes and pulls) can be used to make things move without touching them, such as magnets.• 1.P.1.3 Predict the effect of a given force on the motion of an object, including balanced forces. |  |
|  | **Goals and Lesson Development** | **Materials & Notes** |
| **Day** **1** | Introduction to Energy30 minutesGOAL: Students will be exposed to different types of energy. We will have conversations about energy and how it affects our lives. Students will be introduced to balance and motion, and will build their excitement for the future lessons.\* Foster discussion to help students understand energy as an abstract idea.Read: Energy Makes Things Happen by: Bradley(book from Ashley)* Explain to students that we are going to focus on balance and motion over the next few weeks.
* Introduce the types of activities we are going to be doing.
 | **Materials:** * Book: Energy Makes Things Happen by: Bradley
	+ Get from Ashley
* Smartboard file
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| **Day** **2** | Introduction to Balance and Motion – pushes and pulls30 minutesGOAL: Zoom in from the “big picture” of energy to smaller topic of balance and motion. Students will create a lotus on pushes and pulls. Students will be encouraged to think about cause and effect within balance and motion.Read: What are pushes and pulls?* Create a lotus on pushes and pulls

Focus on cause and effect: * What is the push? What caused the push? What is the pull? What caused the force of the pull?

Foster discussion to help students understand energy as an abstract idea. | **Materials:** * Book: Push and Pull by: Murphy
	+ Get from Ashley
* Lotus/KWL Chart
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| **Day** **3** | Marble Painting30 minutesGOAL: Students will explore different ways to push and pull a box with different types of marbles in it, without paint. They will observe the way that the marbles move. Not only will they see the objects in motion, but they will see the effect of the motion in the paint on the paper.Science Notebooks: Students will go through all of the motions of marble painting without the paint.* How did you make the marbles move?
* How did the marbles move?
 | **Materials:*** Paint
* Straws
* Marbles
* Ping Pong balls
* White Paper
* Newspaper to cover surfaces
* Plastic spoons
* Boxes
* Science Notebooks
	+ Attachment A
		- Record observations
	+ Answer questions under Day 3
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| **Day 4** | Marble Painting60 minutesGOAL: Students will write about the marble painting experience. They will investigate the different types of marbles. Cause and effect will be highly emphasized. Arts Integration: Marble Painting* Pass out boxes with white paper inside
* Different ways to explore (15-20 minutes):
	+ Put drops of paint on paper where you want. Drop in marbles where you want and move through the paint.
	+ Dip marble in paint and then place onto the paper with a plastic spoon.
	+ Use a straw and blow the marbles to make color streaks.
	+ Metal BB’s and magnet?
* Students will write about experience in their science journals, answering the following:
	+ How did you make the marbles move?
	+ How did the marbles move?
* Emphasize students to use new words and make sure they’re being used correctly

CONCLUSION/WRAP UP:Read: book that emphasizes cause and effect?* We will have conversations at the carpet about how everything has a cause and everything has an effect.

Partner discussions about what they noticed about their marbles during the marble activity. | **Materials:*** Paint
* Straws
* Marbles
* Ping Pong balls
* White Paper
* Newspaper to cover surfaces
* Plastic spoons
* Boxes
* Science Notebooks
* Cause and Effect book?

**Vocabulary*** Direction
* Fast
* Slow
* Up/Down
* Sideways
* Force
* Push
* Pull
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| **Day 5** | STEM: Introduction30 minutesGOAL: They will also learn about STEM. They will understand the differences between science, technology, engineering, and math. Students will participate in a technology brainstorm to understand that technology is anything humans create or use to solve a problem or meet a want/need.1. Introduce STEM. Tell students what it stands for
2. Talk about the differences between science, technology, engineering, and math.
3. Tech in a Bag Activity
	1. Students will work in partners and choose a piece of “technology” out of a bag and compose a list of its uses
4. Have discussion about difference between natural world and human world
	1. Where technology comes into play
	2. The natural world includes trees, plants, animals, rivers, oceans, and mountains. The human-made world includes buildings, airplanes, microwave ovens, refrigerators, and televisions.
5. Have discussion about technology and engineering
	1. Technologies are the results of engineered designs. Technology is anything that humans create to use or solve a problem or meet a need/want
	2. Technologists are related to engineers, but not the same thing
		1. SYNERGY!
6. Paper Plate Challenge!
	1. In table groups, list 10 things you can do with a paper plate
	2. Make a class list of all of the things
	3. Have discussion of how we are all engineers. We can all be creative and innovative.
 | **Materials:*** Examples of engineering (Smart file)
* Tech in a bag items
	+ Bag
	+ 12-15 items
* Paper plate
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| **Day 6** | Engineering Design Process: Introduction30 minutesGOAL:Students will learn the EDP. They will learn also review and learn more about why engineering is important. Students will help to brainstorm real-world engineering connections. They will apply what they’ve learned in a written reflection. They will act as engineers in a Lego build. * Go over the EDP
1. Ask: What are the problems? What are the constraints?
2. Imagine: Brainstorm the ideas. Choose the best one.
3. Plan: Draw a diagram. Gather needed materials.
4. Create: Follow the plan. Test it out!
5. Improve: Discuss what can work better. Repeat steps 1-5 to make changes.
* Discuss: Why is engineering important: Give many examples via Smart File
* Students get copies of blank diagram. They color and fill in the different steps of the EDP.

Why is engineering important?* Engineers know how to help!
* Making things better
* Helping humanity
* Expressing Creativity
* Solving problems
* Students write about why engineering is important.
* Lego build?
	+ Challenge: Build something that will move a marble from one point to another
 | **Materials:*** Smart file
* Blank EDP diagram
* Legos
* Marbles
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| **Day 7**  | Introduction to Rockets!30 minutes**\*Do not show students pictures of or books about rockets. That will come after the first rocket design. Focusing on PROCESS, not PRODUCT!*** Have carpet discussions about what you notice about the launcher.
* Show students the rocket launcher and show them how you will launch the rocket.
	+ Explain that you need some kind of cylinder to fit on the end. It may be necessary to guide conversation to include that in order for a rocket to move at all, it must have something blocking off the top of the cylinder.
		- Requirements: Rocket must have one end of cylinder blocked off and one open. This is the only way the rocket will launch.
* Students sketch ideas of rocket designs. They label each part.
* Students make predictions of how their sketches will perform.
 | **Materials:** * 2 liter plastic bottles
* Paper
* Scotch Tape
* Glue sticks
* Markers
* Scissors
* Stomp Rocket Launcher
* STEM notebooks

**Vocabulary*** Rocket vocabulary
	+ Nose
	+ Cone
	+ Fin
	+ Body
 |
| **Day 8** | Designing First Rocket Designs!30 minutesGOAL:Students continue designing the first rocket design. Students create their rockets in heterogeneous pairs.* Students can attach fins to their rocket. They can use different shapes.
 | **Materials:*** 2 liter plastic bottles
* Paper
* Scotch Tape
* Glue sticks
* Markers
* Scissors
* Stomp Rocket Launcher
* STEM notebooks
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| **Day 9** | Testing Rockets!30 minutesGOAL:Roles* Launcher (jumps on bottle)- TEACHER
	+ In order to keep tests consistent
* Time Keeper
* Measure Person

Launching Process\*Identify PUSH and PULLS* Each student will have their rocket tested.
* One student will time from the moment the launcher touches the bottle to the moment that the rocket touches the ground.
* One student will use measuring tape or yard sticks to measure how far each rocket goes.
* Each student is responsible for recording their own data: time and length of flight.

It’s important to have discussions about why some students’ rockets may not be launching. | **Materials:*** Rockets
* Stop Watch
* Measuring Stick
* Launcher
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| **Day 10** | Rockets Data #130 minutesGOAL:* In their STEM notebooks, each student will record their data. They will also write about the launching experience.
* As a class, record the data and create a data table.
* Interpret the results.
	+ Which rockets were the “best?”
	+ Did some stay in the air longer?
	+ Did some go further than others?
* Each student pastes a copy of the results into their STEM notebook.
* As a class and individually, make conclusions from the data and the discussion.
 | **Materials:*** STEM notebook
* Excel
	+ To input the data from test #1
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| **Day 11** | Learning about rockets and Redesigning!30 minutesGOAL:* Introduce students to pictures of rockets from around the world.
	+ What do you notice? Make observations about the shapes on the rockets and the placement of the shapes.
	+ Discussion about stability.
		- Rocket falling video
	+ Identify the nose cone, fins, and body.
* Students redesign their rockets.
	+ Students justify their modifications in their STEM notebooks.
		- What did you change and WHY?
 | **Materials:*** Reiterate vocabulary
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| **Day 12** | Creating Rocket Design #230 minutesGOAL:* Students create their improved rockets.
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| **Day 13** | Rocket Launching #230 minutesGOAL:\*Identify PUSH and PULLS* Test the rockets in the same way as before.
* Students reflect on rocket launching in their STEM notebooks.
 |  |
| **Day 14** | Rockets Data #230 minutesGOAL:* Record data. Create data table.
* Interpret the results.
* Make conclusions.
* Each student pastes a copy of the results into their STEM notebook.
* Students write about their experience. They include process and results.
	+ Engineering Design Process
* Compare results with first launching
* Compare results with Ms. Waldroup’s class
 |  |
| **Day 15** | Sails Introduction30 minutesGOAL:* What are things that are affected by the wind?
	+ Windmills, hair, kites, chimney smoke, leaves, etc.
* Explain to students that we are going to be building sails and engaging in the EDP like we did for the stomp rockets project.
	+ What is the purpose of a sail on a sailboat?
	+ How do you think the sail works?
	+ What properties of a sail affect how well it catches wind?
	+ What are some properties of a sail? Size, shape, material, stiffness, color, transparency, etc.
	+ Which properties do you predict are most important for catching the wind?
		- STEM notebook entry
* How do you think you could test your predictions?
	+ Show students the track and the raft that they will use when designing their sails. Highlight the “ask” part of the Engineering Design Process
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| **Day 16** | Sails Designs30 minutesGOAL:* Allow students to investigate the kinds of materials that can be used to make their sails.
* Students are broken into their small groups.
* Encourage students to investigate the different materials. Is it heavy or light? Stiff or floppy? Clear or opaque?
* Show students the raft, track, and fan. Demonstrate how to orient the craft stick with the widest part parallel to the short edge of the raft.
* Students design their sails.
 | **Materials:*** Rulers (meter sticks would be best)
* Large Box-style Fan
* Fishing Line (15-20 lb. gauge, 8’ to 10’ long pieces)
* Transparent Tape
* Tape, masking or duct
* 2 foam trays (at least 4” x 6”)
* 4 straws, plastic, drinking, non-flexible
* Craft sticks
* Coffee stirrers
* 3”x5” index cards
* 8.5” x 11” paper
* Tissue paper (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Aluminum foil (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Wax paper (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Stop watch

**New Vocabulary:*** Mast
* Speed
* Length
* Balance
* Sail
* Material
* Predict
* Property
* Test
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| **Day 17** | Creating SailsGOAL:Students create their sails. | **Materials:*** Rulers (meter sticks would be best)
* Large Box-style Fan
* Fishing Line (15-20 lb. gauge, 8’ to 10’ long pieces)
* Transparent Tape
* Tape, masking or duct
* 2 foam trays (at least 4” x 6”)
* 4 straws, plastic, drinking, non-flexible
* Craft sticks
* Coffee stirrers
* 3”x5” index cards
* 8.5” x 11” paper
* Tissue paper (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Aluminum foil (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Wax paper (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Stop watch
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| **Day 18** | Testing Sails30 minutesGOAL:Roles* Sail attacher- TEACHER
* Timer
* Fan Operator

\*Identify PUSH and PULLS* Each student records their data.
* In their STEM notebooks, students record their data and add any information about the sailing experience.
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| **Day 19** | Sails Data Day #1GOAL:* As a class, record data. Create a data table.
* Interpret the table. Make conclusions.
	+ Which sails were the “best?”
	+ What caused your sail to react the way it did?
		- Push was too strong…need a cross brace
	+ Which materials made the “best” sails? What properties do those materials have in common?
	+ Which shapes worked best for the sail? How do you know?
	+ Is the biggest sail always the best? Why or why not?
	+ For flawed designs: Do these sails share any properties? Why did they not work as well? Is it a material issue?
* Each student pastes a copy of the results into their STEM notebook.
 | **Materials:*** Excel
 |
| **Day 20** | Learning about sails and Redesigning30 minutes* Show students examples of sails in different parts of the world and throughout history.
	+ Chinese junks have a very particular shape
	+ What do you notice that’s different?
		- Braces
		- Shapes
* Students reflect upon their own designs in a STEM notebook entry.
	+ How floppy was your sail?
	+ What could improve the stability of your sail?
		- Geer students towards using a cross-brace (use real-life examples above!)
* Students redesign their sails.
	+ Students justify their modifications in their STEM notebooks.
 | **Materials:*** Smart file with real-world examples
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| **Day 21** | Sails Creation #230 minutesGOAL:Students create their second design for their sails. | **Materials:*** Rulers (meter sticks would be best)
* Large Box-style Fan
* Fishing Line (15-20 lb. gauge, 8’ to 10’ long pieces)
* Transparent Tape
* Tape, masking or duct
* 2 foam trays (at least 4” x 6”)
* 4 straws, plastic, drinking, non-flexible
* Craft sticks
* Coffee stirrers
* 3”x5” index cards
* 8.5” x 11” paper
* Tissue paper (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Aluminum foil (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Wax paper (cut into squares, rectangles, trapezoids, triangles, half circles, and quarter circles)
* Stop watch
 |
| **Day 22** | Sails Testing #230 minutesGOAL:\*Identify PUSH and PULLSTest the sails.Students record data and reflect on launching experience in their STEM notebooks. |  |
| **Day 23** | Sails Data Day #230 minutesGOAL:* Record data. Create a data table.
	+ Order the data tables together
* Interpret the results and make conclusions.
	+ Which shape of sail looks like it performed the best? Why?
	+ How do we define the word best?
		- How far
		- How fast: How much more time did this one take than that one? It is incorrect to say “faster.”
	+ Compare data with the data from Rachel’s class?
* Each student pastes a copy of the results in their STEM notebook.
* Students write about their experience. They include process and results.
* Compare these results with test 1
* Compare these results with Ms. Waldroup’s class?
 | **Materials:*** Excel
 |
| **Day 24** | How Air Affects Objects30 minutesGOAL: Students will reflect on the rocket and sails experiences. They will identify and apply concepts of cause and effect. * Note: The students should use these concepts during the performance assessment.
* Discuss the rockets experience.
* Discuss the sails experience.
* Compare the two experiences?
* What did we learn about cause and effect with rockets and sails?
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| **Day 25** | Performance Task Assessment:Wind MillsRubric:* Students use of vocabulary
	+ Accurate and appropriately
* Students make connections to both the rockets and sails lessons
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NCSU Lesson Plan Write Ups:

* STEM & EDP
* Marble painting
* Rockets
* Sails
* Performance assessment (windmills?)