Learning Plan

Lesson Title: Derby Cars

Content Statement(s):

- **Science:** Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.
- **Reading:** Informational Text-students ask and answer questions about key details in a text.
- **Math:** Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Teacher Name(s): [Teacher]
Grade Level: 1

Lesson Summary: The students will investigate that objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth. The students will design and build a derby car based on parameters that the class has decided on, i.e. how many wheels, what to test, etc. The students will collect and analyze data and communicate their results to others.

Enduring Understanding(s) taught using appropriate inquiry practices:
Objects can be moved and their positions are changed. Objects can move in a straight line (like a dropped coin falling to the ground) or a circle (like a pinwheel) or back and forth (like a swing) or even in a zigzag pattern. Objects near Earth fall to the ground unless something holds them up. Object motion can be faster, slower or change direction by pushing or pulling the object. Experimentation, testing and investigations of different ways to change the motion of different objects (such as a ball, a pinwheel or a kite) must be used to demonstrate movement. Forces are necessary to change the motion of objects

Student Learning Objectives/Performance Expectation(s)

Students should be able to or students that demonstrate an understanding can (see description/example below):

- Conduct an investigation on motion, design and build a derby car, collect data from the investigation, and graph the data to determine how objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) - ***Connections to the Nature of Science*** **Scientific Investigations Use a Variety of Methods** Scientists use different ways to study the world. (K-PS2-1)	**PS2.A: Forces and Motion** • Pushes and pulls can have different strengths and directions. (K-PS2-1),(K-PS2-2) • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K-PS2-1),(K-PS2-2) **PS2.B: Types of Interactions** • When objects touch or collide, they push on one another and can change motion. (K-PS2-1) **PS3.C: Relationship Between Energy and Forces** • A bigger push or pull makes things speed up or slow down more quickly. *(secondary to K-PS2-1)* **ETS1.A: Defining Engineering Problems** A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. *(secondary to K-PS2-2)*	**Cause and Effect** Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1)

Assessment(s): How will you know learning is occurring or has occurred?

***Pre-assessment**: Ask students what they know about motion.*

***Formative assessment**: teacher observation, teacher/student discourse, student/student discourse*

***Summative assessment**: In a group, students design, build, test, redesign, and re-test a derby car and share the results with the class.*

Discourse Plan [Talk to Talk]: Check the ways you will foster the learning conversations throughout the lesson to ensure that there is a

balance of teacher/student talk and students are discussing the topic of the lesson with each other?

- ☐ Probing-questions or prompts get students to make public more of their thinking
- ☐ Pressing-when a teacher must prompt students to reason further (out loud) about something they've just been discussing.
- ☐ Re-Voicing
- ☐ Peer-to-peer talk
- ☐ Putting ideas on hold

Learning Activity Plan

Parts of Lesson (time)	**Description**	**Teacher** (What are you doing)	**Student** (What are students doing?)	**Teacher** (What questions are you addressing?)

<u>Before Lesson 4 Days</u> (2 Days of investigating motion, 1 day for vocabulary, and 1 more day to investigate motion using vocabulary)	Throughout the whole lesson, the teacher and the students will use the classroom amplification system. Prior to teaching this lesson, the students will discuss what they think motion is. The students will have investigated motion though centers containing balls, cars, magnets, tops, and Kid K'nex Transportation. Students will have learned the following vocabulary: Motion-Something is moving Speed-How fast or slow something moves Force-Makes something move or stop moving Push-Move away Pull-Move it closer to you Gravity-A force that pulls things straight to the ground Magnet-Object that will attract or pull things made of iron Magnetic Force-A magnet's pull Poles-Places on a magnet where the pull is the strongest Repel-Push each other away Materials- balls, cars, magnets, tops, and Kid K'nex Transportation, white board, dry erase marker, eraser, Student Science Journals, pencils			

Before Lesson 1-2 Days	Before teaching the lesson, in a whole group, the students will have listened to and discussed Pull It, Push It and Gravity! Do You Feel It? By Buffy Silverman. The students will have watched and discussed the DVD Sid the Science Kid-Sid Engineers a Solution. The students will have watched and discussed a Pinewood Derby Car Race. www.youtube.com/watch?v=tC5qRw7QhLA Teacher will ask students how they would design and build a derby car if our class were to have a Pinewood Derby Car Race. The teacher will assign the students into groups of 3 or 4 based upon the individual needs of each student, such as academic strengths and weaknesses, behavior, and special needs, such as students with Autism may be in a group with students who are very tolerant and patient; ESL students may be placed with students who have a good command of the vocabulary. Special needs students may be given sensory breaks if needed. The students will have gotten into small groups and discussed their ideas for building a derby car. Materials- Pull It, Push It and Gravity! Do You Feel It? by Buffy Silverman, DVD Sid the Science Kid-Sid Engineers a Solution, www.youtube.com/watch?v=tC5qRw7QhLA			

Before Lesson 1-2 Days	Through discussion, talk moves, teacher questioning, and argumentation, students will come up with the perimeters for making a derby car, i.e. how many wheels, what we will test, where will we test, and how to make the ramp and the derby "track". (For this lesson, the students decided that the derby cars had to have 4 wheels and a body, we would test how far the cars went, the "track" would be the tiled floor with marks measured every 12 inches, and we would use a 3 x 2 foot dry erase board as the ramp and a table to hold up the ramp.) In their groups, the students will have designed their derby car on paper, written down the materials they might need, and gotten the materials they plan to use in building their derby cars. Students, who are unable to write the words for the materials, may draw pictures. Each student will make a prediction in their Science Journal on what they think their derby car will do and why they think that-"I think my derby car will _____ because _____." Students who are unable to write may use pictures. Materials- paper, pencils, Student Science Journals, large bins, a variety of recycled materials such as cans, round lids, cardboard tubes, boxes, plastic bottles, Pringles cans, cardboard, empty Scotch tape reels, straws, caps from dried out whiteboard markers, balls, washers, clay, small doll rods, duct tape, hot glue, drill, and decorations, such as decals and glitter.			

Parts of Lesson (time)	Description	Teacher (What are you doing)	Student (What are students doing?)	Teacher (What questions are you addressing?)
Body of Lesson 60 Minutes	In small groups, students will be building their derby cars using recycled materials based on their previously made designs. Once the derby cars are built, the students will test to see how far their car will travel on a tile floor after rolling down a 45 degree ramp. The students will record their data on the Derby Car Data Sheet. After the test, in small groups and as a whole class, students discuss what worked and why they think it worked and what did not work and why. Students discuss changes they may need to make. Materials-large bins (for holding supplies), a variety of recycled materials such as cans, round lids, cardboard tubes, boxes, plastic bottles, Pringles cans, cardboard, empty Scotch tape reels, straws, caps from dried out whiteboard markers, balls, washers, clay, small doll rods, duct tape, hot glue, knife or strong cutting instrument, drill, and decorations, such as decals and glitter, a ramp, painter's tape to mark 1 foot increments on the floor, ruler, Derby Car Data Sheet, clip boards, and a camera or iPad to record derby cars.	Prior to teaching lesson, the teacher will prepare "the track" by using painter's tape to mark 1 foot increments on the floor and setting up the ramp. The teacher will work with each group using Talk Moves and asking students probing questions about what they are doing, how they are doing something, and why they are doing it. If needed, the teacher will rephrase questions for students with special needs, have students show what they mean rather then using words, and redirect students who are easily off task. If possible, have a adult helper to assist the students with hot gluing, drilling holes, cutting, passing our duct tape, etc., while the teacher is interacting with each group. The teacher will photograph each group's derby car and video the test runs. Teacher will lead discussion on what worked, what didn't and what could be changed.	Using materials provided, the students will build a derby car in their group. The students will test their derby cars and record how far the derby car went on their data recording sheet. In a whole group and in small groups the students will discuss what worked and what needs to be redesigned.	Explain/tell me how it works. Tell me what you are thinking. How does that work? How did you decide ……..? How do you know that…..? I see….What's happening here….? Tell me why. What causes …. to happen? What do you think would happen if…..? What is the problem you are trying to solve? What evidence helped you to arrive at that answer? Would someone like to add on? Do you agree or disagree and why? Repeat what he said in your own words. What would you change? Why?

Group_____

Names_____

Derby Car Data Sheet

Test 1

Date	Distance
	feet

Test 2

Date	Distance
	feet

Test 3

Date	Distance
	Feet

After Teaching Lesson 45-60 Minutes	If necessary, the students will redesign and re-test their derby car 2 more times. Student will record the distance of each race on their Derby Car Data Sheet. In their small groups students, discuss what worked and why they think it worked and what did not work and why. The teacher will make a video of each groups' derby car using an app like Perfect Video. The video will show each derby car at the end of building and redesigning and a video of each test run. Using the hand held microphone through the classroom amplification system, each group explains the process they went though when designing, building, and testing their derby car, while the whole class is watching each groups' video. Students discuss what worked and why they think it worked and what did not work and why. Classmates are encouraged to ask each group questions about the derby cars. Student will receive trophies for their "Best Distance Traveled".			

Tools, Resources and/or Materials	Materials- balls, cars, magnets, tops, and Kid K'nex Transportation, white board, dry erase marker, eraser, Student Science Journals, pencils Pull It, Push It and Gravity! Do You Feel It? by Buffy Silverman, DVD Sid the Science Kid-Sid Engineers a Solution, www.youtube.com/watch?v=tC5qRw7QhLA paper, Student Science Journals, large bins (for holding supplies), a variety of recycled materials such as cans, round lids, cardboard tubes, boxes, plastic bottles, Pringles cans, cardboard, empty Scotch tape reels, straws, caps from dried out whiteboard markers, balls, washers, clay, small doll rods, duct tape, hot glue, knife or strong cutting instrument, drill, and decorations, such as decals and glitter, a ramp, painter's tape to mark 1 foot increments on the floor, ruler, Derby Car Data Sheet, clip boards, and a camera or iPad to record derby cars. Vocabulary: Motion-Something is moving Speed-How fast or slow something moves Force-Makes something move or stop moving Push-Move away Pull-Move it closer to you Gravity-A force that pulls things straight to the ground Magnet-Object that will attract or pull things made of iron Magnetic Force-A magnet's pull Poles-Places on a magnet where the pull is the strongest Repel-Push each other away
Any safety notes? ☐Yes ☐ No If yes, please elaborate: *The teacher or another adult will drill holes, hot glue, and cut the materials the students need.*	

*****I have addressed the following questions in my learning plan. Check all that apply.*****

Scientific Investigation Plan	*Engineering Design Process Plan*
☐What is the question for the investigation? (This should encourage students to predict or form a hypothesis.) ☐What investigation will the students be engaged in? ☐What data will students be collecting? ☐How will the students analyze the data? ☐How will you foster the development of explanations? (Revisit student hypotheses.) ☐How will you foster student discussion of their explanations? (Argumentation)	☐What is the problem you are trying to solve? ☐What are the specifications or the characteristics of the solution that your design should address? ☐How will you structure the design process? ☐What data will the students be collecting? ☐How will the students analyze this data? ☐How will you structure the re-design process? ☐How will you foster the articulation of the solution? ☐How will you foster student discussion of their solutions? (Argumentation)

REMEMBER TO BRING CLOSURE TO THE LESSON (TIME FOR STUDENT MEANING-MAKING)

Closure:

How will you bring closure to the learning activity?

- We will watch a video of each group's derby car and test and discuss how each group designed and built their derby car, and what was a success and what could have been done differently.
- We will hold an awards ceremony where the students will discuss how they made their derby cars and present each student with a trophy indicating their derby car's best distance.

What did the students learn or should have learned? (Discuss and Summarize)

Students should be able to:

- communicate that objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth
- investigate motion
- design, create, and test their own group derby car
- communicate their results to the rest of the class

How will you build linkages back to the crosscutting concepts, past science/engineering investigations and/or future investigations?

We will

- *make observations in the world around us*
- *read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world*
- *create drawings or physical models to communicate ideas for a problem's solutions to other people*
- *understand Cause and Effect*
- *understand that simple tests can be designed to gather evidence to support or refute student ideas about causes*

References:

- **Next Generation Science Standards**
- **Ohio Department of Education**
- **TPS Curriculum Map**
- **Amplification system**
- **iPad**
- **Perfect Video**
- **Pull It, Push It and Gravity! Do You Feel It? by Buffy Silverman**
- **DVD Sid the Science Kid-Sid Engineers a Solution**
- **www.youtube.com/watch?v=tC5qRw7QhLA**

Wiggins, G.& McTighe, J. (2011). The understanding by design guide to creating high quality units. Alexandria, VA; ASCD Publications.

Ohio Department of Education. (2013) Teacher Evaluations. Retreived from wwww.education.ohio.gov/Topics/Teaching/Educator-Evaluation-System.