3rd Grade
Force Affects Motion

Teaching the Science and Engineering Education (SEEd) Standards

UVU College of ENGINEERING & TECHNOLOGY
UTAH VALLEY UNIVERSITY

UVU CREATIVE LEARNING STUDIO

UVU School of EDUCATION
UTAH VALLEY UNIVERSITY

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SEEd Strand 3.3: Force Affects Motion

Forces act on objects and have both a strength and a direction. An object at rest typically has multiple forces acting on it, but they are balanced, resulting in a zero net force on the object. Forces that are unbalanced can cause changes in an object's speed or direction of motion. The patterns of an object's motion in various situations can be observed, measured, and used to predict future motion. Forces are exerted when objects come in contact with each other; how-ever, some forces can act on objects that are not in contact. The gravitational force of Earth,acting on an object near Earth's surface, pulls that object toward the planet's center. Electric and magnetic forces between a pair of objects can act at a distance. The strength of these non-contact forces depends on the properties of the objects and the distance between the objects.

Standard 3.3.1 Plan and carry out investigations that provide evidence of the effects of balanced and unbalanced forces on the motion of an object. Emphasize investigations where only one variable is tested at a time. Examples could include an unbalanced force on one side of a ball causing it to move and balanced forces pushing on a box from both sides producing no movement. (PS2.A, PS2.B)

Standard 3.3.2 Analyze and interpret data from observations and measurements of an object's motion to identify patterns in its motion that can be used to predict future motion. Examples of motion with a predictable pattern could include a child swinging on a swing or a ball rolling down a ramp. (PS2.A, PS2.C)

Standard 3.3.3 Construct an explanation that the gravitational force exerted by Earth causes objects to be directed downward, toward the center of the spherical Earth. Emphasize that "downward" is a local description depending on one's position on Earth. (PS2.B)

Standard 3.3.4 Ask questions to **plan and carry out an investigation** to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. Emphasize how static electricity and magnets can cause objects to move without touching. Examples could include the force an electrically charged balloon has on hair, how magnet orientation affects the direction of a force, or how distance between objects affects the strength of a

force. Electrical charges and magnetic fields will be taught in Grades 6 through 8. (PS2.B)

Standard 3.3.5 Design a solution to a problem in which a device functions by using scientific ideas about magnets. *Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data from testing solutions, and propose modifications for optimizing a solution.* Examples could include a latch or lock used to keep a door shut or a device to keep two moving objects from touching each other. (PS2.B, ETS1.A, ETS1.B, ETS1.C)

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3.3.1 - Ramps and Cars

Grade: 3rd

Lesson Topic: Balanced and Unbalanced Forces

Utah SEEd Standard:

Standard 3.3.1 Plan and carry out investigations that provide evidence of the effects of balanced and unbalanced forces on the motion of an object. Emphasize investigations where only one variable is tested at a time. Examples could include an unbalanced force on one side of a ball causing it to move and balanced forces pushing on a box from both sides producing no movement. (PS2.A, PS2.B)

Other standards:

Standard 3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot where the horizontal scale is marked off in appropriate units-whole numbers, halves, or quarters.

Lesson Performance Expectations:

- Students will discover the variables involved in the forces of car collisions on ramps of different heights.
- Students will be able to explain what creates a collision with the most force.

Phenomenon: Cars on a steeper ramp will create a bigger collision.

Gather

1. Students ask questions in preparation for an investigation to observe the patterns in forces in car collisions at different ramp heights
2. Students will plan and carry out an investigation to observe the patterns in forces of car collisions at different ramp heights.

Reason

3. Students will analyze and interpret their data in order to explain the cause and effect of the phenomenon.

Class Discussion:
Questions to initiate Discussion:
Q: How does the force of the car affect the intensity of the collision at the bottom of the ramp?
Q: What caused changes in the force of the collisions?

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Q: Why does the input of energy cause greater force in the collision?
Q: Could anything be done to create a greater force collision at a lower ramp height?

(Teaching Suggestions: Base the discussion on the students' findings and help them think of creative ways that they could change the results or do further testing on the subject.)

Communicate Reasoning

4. Students will write an explanation for the cause and effect as to why higher ramps create a stronger force in collisions.

Science and Engineering Practices Ask questions Plan and carry out an investigation analyze and interpret data Create an explanation	Ask questions regarding a given phenomenon in order to prepare to carry out an investigation. Plan and carry out an investigation in order to delve further into the phenomenon. Analyze and interpret data from the investigation in order to explain the phenomenon. Create an explanation for the phenomenon.
Crosscutting Concepts Patterns Cause and effect	Observe patterns in order to explain the phenomenon. Analyze the cause and effect of the phenomenon in order to better understand it.
Disciplinary Core Ideas Force and motion, balanced and unbalanced forces	The greater the motion of an object the greater the force; unbalanced forces will cause greater motion as gravity acts on it.

Appendix A - Student Prompts for the Lesson

Phenomenon: *Cars on a steeper ramp will create a bigger collision.*

Group Performances:

1. Students ask questions in preparation for an investigation to observe the patterns in forces in car collisions at different ramp heights.
2. Students will plan and carry out an investigation to observe the patterns in forces of car collisions at different ramp heights.

Class Discussion

3. Students will analyze and interpret their data in order to explain the cause and effect of the phenomenon.

Individual Performances:

4. Students will write an explanation for the cause and effect as to why higher ramps create more forceful collisions.

Lesson Steps:

1. *Introduce force and vocabulary words. Watch video and go over vocabulary words as a class.*
    a. *Force- Any interaction that, when unopposed, will change the motion of an object.*
    b. *Balanced forces- don't move*
    c. *Unbalanced forces- moves*
    d. *Emphasize that engineers experiment and use force*
2. *Divide students into groups(5-6 students) to conduct their investigation.*
    a. *As students conduct their investigation, have them fill out their graphic organizer. It may be helpful to have group jobs so everyone participates. Such as recorders, car captain, measurer, and observers. They should decide before their investigation who will start with what job and how they will rotate throughout the trials.*
    b. *They will have small cars such as hot wheels and be provided a wooden ramp and books to stack the ramp on. They should place a wall of keva blocks at the bottom of the ramp. While the ramp is placed at different recorded heights, they will observe the force of the collision with the barrier at each height. Model for students how to conduct their investigation.*
    c. *They should start with the ramp flat on the floor to represent balanced force and record what happens. Then they should gradually increase the slope to test unbalanced force several more times. Students can decide these heights or the teacher can assign what heights to observe and record. (Use the green felt side of the ramps as these are easiest for the cars to go down straight).*
3. When students have completed the investigation they will participate in a class discussion in which they will discuss what they observed and how it shows balanced and unbalanced forces. Questions for the discussion are found above in the "Reason" section.

4. Finally, students will write an explanation for the cause and effect as to why higher ramps create a stronger force in collisions. Have students start a science journal to record and collect their investigation.

Appendix B -

Ramps and Cars Observation Sheet- PLEASE MAKE A COPY IF YOU NEED TO MAKE CHANGES

Materials:

Provided Materials:

- *Hot wheels cars*
- *Wooden ramps*
- *Keva blocks*

Classroom Materials:

- *Science journals*
- *Rulers for measuring height*
- *Books to stack and create a steeper ramp, or they can be leaned on a wall*

https://eschooltoday.com/science/forces/unbalanced-forces.html this link talks about balanced and unbalanced forces.

UVU SEEdPods: 3rd Grade

3.3.2 - Roller Coaster Construction

Grade: 3rd **Time:** 30-40 minutes

Lesson Topic: Motion

Utah SEEd Standard:

Standard 3.3.2 Analyze and interpret data from observations and measurements of an object's motion to identify patterns in its motion that can be used to predict future motion. Examples of motion with a predictable pattern could include a child swinging on a swing or a ball rolling down a ramp.(PS2.A, PS2.C)

Lesson Performance Expectations:

- Students will be able to experiment with roller coasters and how different designs affect the speed and distance of the car.
- Students will be able to explain why steeper tracks cause the cars to go faster and vice versa.

Phenomenon: *Steeper tracks will cause objects to go faster down them, shallower tracks will cause objects to go slower down them.*

Gather

1. Students ask questions about the patterns that motion and gravity cause when they act together.
2. Students plan and carry out an investigation by building roller coasters and observing the cause and effect the steepness has on the car.

Reason

3. Students analyze and interpret the gathered data to determine the effect that gravity plays in motion (steepness of the coaster on how fast the car goes).
4. Students develop and use a model to show how gravity affects motion on an object (using the coasters to develop their model).

Class Discussion:

Questions to initiate Discussion

Q: Why do roller coasters have to start out tall? What happens if they are too short?

Q: What did you have to change to get the car to complete the track? What adjustments were made?

Q: How did the steeper track affect the car? Why did it make the car go faster?

Q: Will the car act the same if it's put on another steep track?

Sentence Framers/Starters after Investigation:

1. *When the top of the roller coaster is shorter than the loop, the car _____.*
2. *When the top of the roller coaster is the same height as the loop, the car _____.*
3. *When the top of the roller coaster is taller than the loop, the car _____.*

4. *The car goes faster when _____.*
5. *The car goes slower when _____.*
6. *Because of the investigation, I have learned _____.*

Communicate Reasoning

5. Students construct an explanation to explain the common patterns of the roller coasters they created.

Science and Engineering Practices Ask questions plan and carry out an investigation Analyze and interpret data Design and use a model Construct an explanation	Ask questions about a phenomenon in order to plan and carry out an investigation. Use findings from the investigation to analyze and interpret data and be able to construct a logical explanation. Design and use a model to explain findings from the investigation.
Crosscutting Concepts Patterns Cause and Effect	Identify and describe the causes of phenomena (effect). Use patterns to make predictions.
Disciplinary Core Ideas Physical Science-objects and motion	Objects go faster when they go down a steeper slope than they do when they go down a shallower slope because of the pull gravity has on them.

Appendix A - Student Prompts for the Lesson

Phenomenon: *Steeper tracks will cause objects to go faster down them, shallower tracks will cause objects to go slower down them.*

Group Performances:

1. Students ask questions about the patterns that motion and gravity cause when they act together.
2. Students plan and carry out an investigation by building roller coasters and observing the cause and effect the steepness has on the car.

Class Discussion

3. Students analyze and interpret the gathered data to determine the effect that gravity plays in motion (steepness of the coaster on how fast the car goes).

4. Students develop and use a model to show how gravity affects motion on an object (using the coasters to develop their model).

Individual Performances:

5. Students construct an explanation to explain the observations of the roller coasters they created.

Lesson Steps:

This lesson could be done over two days if time allows. The first day would be covering vocab, figuring out how to assemble tracks, playing with the material, and practicing with the material. The second day would be gathering data from their roller coasters.

1. *Introduce the lesson by showing this roller coaster video and then talking about the phenomenon. Go over needed vocabulary (force, motion, gravity). Also mention that engineers build roller coasters.*
2. *Split students into small groups.*
    a. *Start with a group planning session, have the students discuss and draw out what they want their track(s) to look like.*
    b. *Have students fill out their graphic organizer and assign group roles before they begin experimenting with the tracks. Such as recorder, time keeper, car captain, observers, and loop holder if necessary*
    c. *They will adjust the initial steepness of the starting hill and record and observe the time it took for the car to get through the roller coaster track. Students should focus on creating hills, and then try making a simple loop if they finish early. (loops usually need to be held up by someone). To create hills use stacks of textbooks, chairs, backpacks, desks...etc. or other materials they can find around the classroomStudents will record their observations on the observation sheet, which can go in their science journals after.*
3. *Students will participate in a group discussion and will share what they learned about how the height and steepness of the first hill affects the car for the rest of the coaster. Discussion questions are found above in the reason section.*
4. *Students will then provide a written explanation of the observations, specifying what worked and what did not and why. They should use their science journals or observation sheets.*

Alternate idea - give groups 10 min to build a coaster, then each group watches and observes each other while tracking the data of each observation. This way each group would build one really good coaster and still be able to observe multiple tracks.

Appendix B -

Roller Coaster Observation Sheet PLEASE MAKE A COPY OF THIS DOCUMENT TO MODIFY RATHER THAN MODIFYING THE ORIGINAL.

Hot Wheels Procedure Card

Materials:

Provided Materials:

- Hot wheels tracks
- Hot wheels cars
- Timers

Classroom Materials:

- observation logs
- Pencils
- Books or other materials to build hills

https://www.youtube.com/watch?v=ZmMLSUbRuoM Roller Coaster Video Example

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3.3.3 - Ball Drop Experiment

Grade: 3rd

Lesson Topic: The force of Gravity

Utah SEEd Standard:

Standard 3.3.3 Construct an explanation that the gravitational force exerted by Earth causes objects to be directed downward, toward the center of the spherical Earth. Emphasize that "downward" is a local description depending on one's position on Earth. (PS2.B)

Lesson Performance Expectations:

- Students will conduct an experiment to observe the force of gravity on different types of balls
- Students will explain the force of gravity on objects when we drop them.

Phenomenon: *Gravity pulls objects towards the center of the earth.*

Gather

1. Students ask questions to prepare for the investigation in order to observe patterns of gravity and objects.
2. Students plan and carry out an investigation to observe the patterns of gravity by rolling balls on a blanket with a weight in the center to represent the Earth's gravity.

Reason

3. Students will analyze and interpret data from their investigation in order to observe the patterns of gravity on objects.

Class Discussion:

Questions to initiate Discussion:

Q: Does the weight of the center of the sheet affect the speed of the balls? Explain.
Q: Does the weight of each ball affect the speed that it rolls at? Explain.
Q: Why do you think the balls rolled at different speeds or similar speeds?
Q: Did anything surprise you from this experiment?
Q: How did each type of ball act similarly and differently?
Q: How does this investigation represent Earth's gravity?

Communicate Reasoning

4. Students will construct an explanation as to why the patterns they observed in the experiment were the way they were.

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Science and Engineering Practices Ask questions Plan and carry out an investigation analyze and interpret data construct an explanation	Ask questions to prepare for the investigation. Plan and carry out an investigation in order to gather information on the phenomenon. Analyze and interpret data to learn more about the phenomenon. Construct an explanation for the causes of the phenomenon.
Crosscutting Concepts Patterns	Observe patterns to make predictions.
Disciplinary Core Ideas Gravity and Motion	Gravity is the force that pulls objects towards the center of the earth.

Appendix A - Student Prompts for the Lesson

Phenomenon: *Gravity pulls objects towards the center of the earth.*

Group Performances:

1. Students ask questions to prepare for the investigation in order to observe patterns of gravity and objects.
2. Students plan and carry out an investigation to observe the patterns of gravity by rolling balls on a blanket with a weight in the center to represent the Earth's gravity.

Class Discussion

3. Students will analyze and interpret data from their investigation in order to observe the patterns of gravity on objects.

Individual Performances:

4. Students will construct an explanation as to why the patterns they observed in the experiment were the way they were.

UVU SEEdPods: 3rd Grade

Lesson steps:

1. *Start by watching the Kids Crash Course on Gravity and discussing observations and a-ha moments with the class. Introduce vocab words with definitions (force, motion, gravity). Mention that engineers experiment with force, motion and gravity.*
2. *Students will complete an investigation to observe how gravity affects different sized objects. They will be split into groups of 5-6 to do this investigation.*
    a. *Students should decide prior to starting the investigation who starts with which role, and if they rotate how they will rotate. The investigation jobs include, one timer/recorder, one student who rolls the balls, and 4 students to hold the sheet tight at each corner.*
    b. *Students will have a piece of fabric that 4 of them will hold from the corners as tight as they can make it. They will place the 1 lb. weighted ball in the center of the sheet. This will act as Earth's gravity for the experiment.*
    c. *Using the different sized balls one at a time, one student will roll the ball from the outside of the sheet and they will observe how long it takes the ball to get to the center. They also can start at an outside corner and let the ball go and see how long it takes the ball to roll to the center. A student should be recording the time it takes with a stopwatch.*
    d. *Students will do this with each of the balls and continue to test with different weights in the center to represent the earth's gravity. They will record the results of the speeds on a worksheet or in their science notebooks.*
3. *Hold a class discussion about the students observations and what they learned. Questions can be found above in the "Reason" section.*
4. *Students will complete an exit ticket to draw or write an explanation of how objects are affected by the earth's gravity (e.g. the heavier the object, the faster it's pulled by gravity).*

Appendix B -

Materials:

Provided Materials:

- *Marbles*
- *Beach balls*
- *Plastic bouncy playground balls*
- *Golf balls*
- *Small plastic balls*
- *Stop Watches*
- *Fabric*

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- *Weighted balls*

Classroom Materials:

- *Science Journals*
- *Other types of balls- students can bring in their own to try*

https://www.youtube.com/watch?v=ljRlB6TuMOU What is Gravity?

UVU SEEdPods: 3rd Grade

3.3.4 - Can you use the force? Investigation

Grade: 3rd

Lesson Topic: Magnetic Force

Utah SEEd Standard:

Standard 3.3.4 Ask questions to **plan and carry out an investigation** to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. Emphasize how static electricity and magnets can cause objects to move without touching. Examples could include the force an electrically charged balloon has on hair, how magnet orientation affects the direction of a force, or how distance between objects affects the strength of a force. Electrical charges and magnetic fields will be taught in Grades 6 through 8. (PS2.B)

Lesson Performance Expectations:

- Students will investigate magnetic forces and determine cause and effect of force strength.
- Students will create a hypothesis to explain why magnets are stronger the closer they are to each other.

Phenomenon: *Magnets exert a stronger force the closer they are to each other.*

Gather

1. Students will ask questions about magnets in order to determine the causes of magnetic force.
2. Students will plan and carry out an investigation about magnetic force and fill out a t-chart to observe the patterns and causes of magnetic force, attraction, and repelling.

Reason

3. Students will analyze and interpret data in order to discern the causes of magnetic force.

Class Discussion:
Questions to initiate Discussion:
Q: What happened when you held the magnets closer on opposite poles? What happened when they were the same poles?
Q: What caused the magnets to move together? What caused the magnets to push apart?
Q: Why do the magnets move on their own?
Q: Why does the force change on the magnets depending on how close they are together?

Communicate Reasoning

4. Students will construct an explanation to communicate the causes and effects of magnets.

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Science and Engineering Practices Ask questions Plan and carry out an investigation Analyze and interpret data Construct an explanation	Develop questions to obtain information. Plan and carry out an investigation to find an explanation. Analyze and interpret data in order to construct an explanation. Engage in an argument from evidence to prove an explanation is based on evidence.
Crosscutting Concepts Cause and effect patterns	Identify patterns and make predictions. Use cause and effect to explain results.
Disciplinary Core Ideas Magnetic force	Magnets develop a stronger force when they are closer together. Magnetic force is weaker the further apart they are held.

Appendix A - Student Prompts for the Lesson

Phenomenon: *Magnets exert a stronger force the closer they are to each other.*

Group Performances:

1. Students will ask questions about magnets in order to determine the causes of magnetic force.
2. Students will plan and carry out an investigation about magnetic force and fill out a t-chart to observe the patterns and causes of magnetic force, attraction, and repelling.

Class Discussion

3. Students will analyze and interpret data in order to discern the causes of magnetic force.

Individual Performances:

4. Students will construct an explanation to communicate the causes and effects of magnets.

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Lesson steps:

1. *Show video in appendix B from 3:18-5:00 to introduce the investigation. Share phenomenon statement. Review vocab. Words from previous lessons and introduce new vocab. (Force, repel, attract, N pole, S pole). Mention that engineers use magnets and engineers experiment and explore to develop deeper meaning.*
2. *The investigation should answer the following questions: How close do the magnets have to be in order for them to pull towards each other? Why do they have to be close to pull together? What happens to the force of the magnets on each other as you put them closer together?*
    a. *These questions should guide their investigation. Write them down on the board for them to refer to.*
3. *Students will be given various kinds of magnets (between 4-8) along with a couple of paper clips and mini iron rods. They can work individually or in groups to experiment freely with the magnets, have "play time" to explore the questions and make their own observations. It will then be students' jobs for the investigation period to explore the magnets and find answers to the questions,*
4. *When students have had sufficient time to explore with the magnets, hold a class discussion. Questions are found above in the reason section. Feel free to revisit any special observations you saw the students make along with discussion about it with the class.*
5. *Students will then answer the following investigation question in their science journals individually.*

Appendix B -

https://www.youtube.com/watch?v=h5oXWtSMHzw (3:18-5:00) this shows how magnetic force gets stronger the closer the magnets are to each other. Great hook video to show students at the beginning of class.

Materials:

Provided Materials:

- *Magnet kits provided (magnets of different shapes, paper clips, and metal rods)*

Appendix C -

After the activity show students this video and discuss what they saw in comparison with their personal observations: https://www.youtube.com/watch?v=Mp0Bu75MSj8

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Questions to initiate discussion:
Q: What happened to the metallic ball when it went down the ramp? What caused this?
Q: What causes the magnets to move by themselves?
Q: Do these investigations match up with our investigations?
Q: Do these investigations support your hypothesis? Why or why not?
Q: After watching this video would you adjust your hypothesis?

UVU SEEdPods: 3rd Grade

3.3.5 - Solving Problems with Magnets

Grade: 3rd

Lesson Topic: Magnets

Utah SEEd Standard:

Standard 3.3.5 Design a solution to a problem in which a device functions by using scientific ideas about magnets. *Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data from testing solutions, and propose modifications for optimizing a solution.* Examples could include a latch or lock used to keep a door shut or a device to keep two moving objects from touching each other. (PS2.B, ETS1.A, ETS1.B, ETS1.C)

Lesson Performance Expectations:

- Students will identify a common problem within the classroom and be able to create a solution using magnets.
- Students will test their solution and evaluate and modify the given solution.

Phenomenon: Magnets can be used in many different ways to solve common problems.

Gather

1. Students will define a common problem within the classroom and identify its causes.
2. Students will gather information about the problem in order to learn how its cause can be solved.
3. Students will develop and use a model to show how the system can be solved with magnets.

Reason

4. Students will analyze and interpret data from the system to learn how the solution can be modified.
5. Students will design a final solution in order to best solve the problem and correct the system.

Class Discussion:
Questions to initiate Discussion:
Q: How does a magnet work?
Q: How do magnets attract and repel each other?
Q: Could magnets be used to solve a problem?
Q: In what ways could we use a magnet to solve a problem?
Q: What causes magnets to stay stuck to each other? Does their strength affect this?

Communicate Reasoning

6. Students will explain why the given solution best solves the problem in the given system.

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Science and Engineering Practices Define a problem Gather information Develop and use a model Analyze and interpret data Design a solution Develop an explanation	Define a problem and design a solution through developing and using a model. Gather information in order to solve a problem. Analyze and interpret data to make appropriate modifications to the given solution. Create an explanation to prove how the solution appropriately solves the problem.
Crosscutting Concepts Cause and Effect Systems and System Models	Use cause and effect to define the given problem. Identify how the systems work and what can help them function better.
Disciplinary Core Ideas Magnets	"A magnet is a material or object that produces a magnetic field. This magnetic field is invisible but is responsible for the most notable property of a magnet: a force that pulls on other ferromagnetic materials, such as iron, and attracts or repels other magnets."

Appendix A - Student Prompts for the Lesson

Phenomenon: *Magnets can be used in many different ways to solve common problems.*

Group Performances:

1. Students will define a common problem within the classroom and identify its causes.
2. Students will gather information about the problem in order to learn how its cause can be solved.
3. Students will develop and use a model to show how the system can be solved with magnets.

Class Discussion

4. Students will analyze and interpret data from the system to learn how the solution can be modified.

5. Students will design a final solution in order to best solve the problem and correct the system.

Individual Performances:

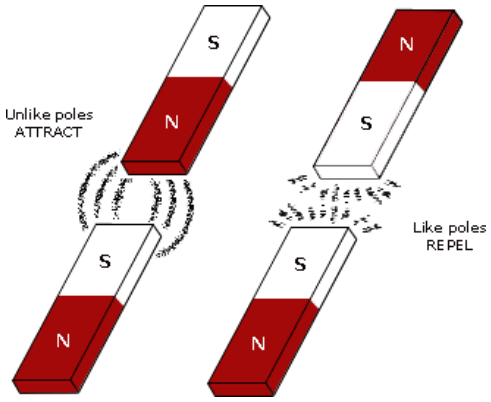
6. Develop an argument for how the evidence you collected supports or refutes your explanation for the causes of the phenomenon.

Lesson Steps:

1. *Read the timeforkids article to the class to introduce the phenomenon. Go over vocabulary for what a problem is. Also Mention that engineers use magnets, and that big magnets can be used to power roller coasters.*
2. *Hold a class discussion as you introduce the investigation. Talk about what a problem is and give some examples of problems in the classroom that need to be solved. Ask for more problems that they see and brainstorm ways students could solve these problems with magnets. This should be a segway into the investigation to help students begin thinking about how magnets can be used to solve common problems and what they might like to experiment with. Questions for the discussion can be found above in the "Reason" section.*
3. *Students will be tasked to design a solution to a common classroom problem using magnets as the main solution. They can work in small groups, pairs, or individually, and can be given a list of common problems to get them brainstorming. These problems may include, but are not limited to:*
    a. *Picking up a pencil or piece of paper that has fallen on the floor*
    b. *Keeping a classroom door, window, or drawer shut that will not close all the way*
    c. *A Covid friendly way to pick up student papers without touching them*
    d. *A way to hold an item down that won't stay up properly*
    e. *How to use magnets to get something to move*
    f. *How to use magnets to get something to not move (keeping a pencil on a desk, keeping a playground ball from rolling on the floor, etc.)*
4. *Students should plan, design, and create their solutions. Give them sufficient time to decide on their problem and solution, think of and plan a design, and create their design. This may take more than one class period. After solutions have been built students should test out their solutions to see how well they worked. They can revise if necessary and if time allows.*
5. *Students can then present their solutions to the class and explain how magnets are used to solve the problem.*

Appendix B -

What are Magnets? https://www.timeforkids.com/g34/what-are-magnets-2/ (Use as a read aloud as this would be too complex to make independent work.)



Materials:

Provided Materials:

- Magnets
- Keva Blocks
- String/Yarn
- Rubber bands

Classroom Materials:

- Books
- Rulers
- Paper
- Paper clips
- Other needed materials

Appendix C -

https://sciencing.com/5-uses-magnets-kids-12016642.html

Things to Do With Rare Earth Magnets

Updated March 13, 2018

By Charong Chow

Kids can have fun while learning about the varied and important uses of magnets in the world around them. Common uses of magnets include the compass, vending machines, refrigerator magnets and electric motors. Some types of trains even levitate above magnetized rails! Without magnets, the world would be a very different place.

UVU SEEdPods: 3rd Grade

Compass

A compass uses a magnet to direct its needle to the north pole. This is why magnets are said to have a north and south pole. The side that is attracted and points to the north is called the north pole, while the other end is the south pole. Children can easily learn about magnets in a compass by crafting one with a needle, cork and a bowl of water. Magnetize the needle by rubbing it with a strong magnet. Then, place the needle on top of a cork floating in water. It will point to the north.

Mag-Lev Trains

Magnetically levitated trains, known as mag-lev trains, use magnets under the cars to float above the magnetic tracks because the magnets are repelling each other. These types of trains use superconducting magnets and can travel up to 300 miles per hour. Mag-lev trains are used in countries such as Japan. The United States government is working on bringing the technology to America.

Vending Machines

Coins are separated and sorted inside vending machines with magnets. These magnets sort out metal disks or slugs from the real coin money. Also, paper money and checks have magnetic dust in their ink. Vending machines and currency counters check the money for its magnetism to ensure the money is genuine.

Holding Things

One of the most common uses of magnets is to hold things together. Paper shopping lists and your book report can be held up on refrigerator doors with fridge magnets. The magnets stick the paper to the door with its attraction to the metal in the door. Also, the actual refrigerator doors stay closed because of magnets in the door frames.

Electric Motors

Magnets are responsible for making electric motors and generators work. Moving a metal wire near a magnet produces electricity. Electric generators use steam, flowing water or another source of energy to spin wires through a magnetic field and create electricity. Every time you turn on a light or watch television, you can thank magnets for helping produce electricity.

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Questions to Initiate Discussion:

Q: Do you feel magnets are important in the world we live in? Why or why not?

Q: Can you think of any other objects or machines that might use magnets?

Q: What might you use magnets for in the future?

Materials List by Lesson:

3.3.1- Ramps and Cars

Provided Materials:

- *Hot wheels cars (1 bag with 27 cars)*
- *Wooden ramps (22)*

Classroom Materials:

- *Rulers for measuring height*
- *Wall/obstacle such as a book standing up*
- *Books to stack and create a steeper ramp*
- *Observation sheet*

3.3.2- Roller Coaster Construction

Provided Materials:

- Marbles (2 bags, 134 total, 67 in each)
- Hot Wheel Kits (2)
- Hot Wheel Tracks (3 bags)
- Stop watch (1 bag with 19)

Classroom Materials:

- Observation sheets

3.3.3- Ball Drop Experiment

Provided Materials:

- *Golf Balls (15)*
- *Beach balls (9)*
- *Stop Watches (1 bag with 19)*
- *Fabric (8)*
- *Plastic play balls (200)*
- *Weighted balls (12)*
- *Air pumps (2)*
- *Tape measure (1)*

Classroom Materials:

- *Science Journals*
- *Provided in classroom: other types of balls, students can bring in their own to try*

3.3.4- Can you use the Force? Investigation

Provided Materials:

- *Magnets (13 sets)*
- *Ceramic Magnets (45)*

Classroom Materials:

- *Objects around classroom both magnetic and nonmagnetic*

3.3.5- solving Problems with Magnets

Provided Materials:

- Magnets (13 sets)
- Popsicle sticks
- String/Yarn
- Rubber bands

Classroom Materials:

- Books
- Rulers
- Paper
- Paper clips

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Classroom Procedures

Hot Wheels Tracks

1. To start building your track, grab a blue connector, and two orange track pieces.
2. Placing the blue connector with the holes up. Slide it into the groves on the bottom of the orange track, until the small blue dot clicks in place.
3. Grab your other orange piece and place it on the other side. Connecting two pieces.
4. Repeat the process to build a track.
5. To disconnect the pieces simply push down on the big blue circle that divides the two orange track pieces, and pull apart.