Unit Overview	
Content Area: Physical Science	
Unit Title: Forces & Motion	**Unit: 1**
Target Course/Grade Level: 3	**Timeline: 20 Days**
Unit Summary: **Forces & Motion:** In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of *patterns and cause and effect* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations*. Students are also expected to use these practices to demonstrate an understanding of the core ideas. This unit is based on 3-PS2-3, 2-PS2-4 and 3-5-ERS1-1 **Forces & Motion:** In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of *patterns and cause and effect* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations*. Students are also expected to use these practices to demonstrate an understanding of the core ideas. This unit is based on 3-PS2-1 and 3-PS2-2	
Learning Targets	
NJSLS-Science	
3-PS2-1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
3-PS2-2	Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion
3-PS2-3	Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
3-PS-2-4	Define a simple design problem that can be solved by applying scientific ideas about magnets.
3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
Disciplinary Core Ideas	

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4)

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

Science and Engineering Practices

Planning and Carrying Out Investigations

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1)
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)

Analyzing and Interpreting Data

- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)

Asking Questions and Defining Problems

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on

materials, time, or cost. (3-5-ETS1-1)

NJSLS Connections

Primary Interdisciplinary Connections:

English Language Arts/Literacy:

- *Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. RI.3.1*
- Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. RI.3.3
- *Conduct short research projects that build knowledge about a topic. W.3.7*
- *Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. W.3.8*
- Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. SL.3.3

Mathematics:

- Reason abstractly and quantitatively. MP.2
- Use appropriate tools strategically. MP.5
- Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. 3.MD.A.2

Unit Essential Questions	**Unit Understandings**

Unit Learning Targets (Outcomes) – Formative Assessment
Students who understand the concepts are able to …

· Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

· Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion

· Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

· Define a simple design problem that can be solved by applying scientific ideas about magnets.

· Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Cross Cutting Concepts:

Cause and Effect
Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Patterns
Patterns of change can be used to make predictions. (3-PS2-2)

Science Knowledge is Based on Empirical Evidence
Science findings are based on recognizing patterns. (3-PS2-2)

Scientific Investigations Use a Variety of Methods
Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

Interdependence of Science, Engineering, and Technology
Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)

Integration of Technology: Interactive Whiteboard, Videos

Technology Resources:

Opportunities for Differentiation: Differentiation and support tips, which includes suggestions for ELL, struggling students, and accelerated students, are available below the instructional practice section of each model lesson.

Teacher Notes:

Career Ready Practices: *In this unit the following career ready practices are addressed*
CRP1: Act as a reasonable and contributing citizen and employee
CRP2: Apply appropriate academic and technical skills
CRP3: Attend to personal health and financial well-being
CRP4: Communicate clearly and effectively and with reason
CRP5: Consider the environmental, social and economic impacts of decisions
CRP6: Demonstrate creativity and innovation
CRP7: Employ valid and reliable research strategies
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them
CRP9: Model integrity, ethical leadership and effective management
CRP10: Plan education and career paths aligned to personal goals
CRP11: Use technology to enhance productivity
CRP12: Work productively in teams while using cultural global competence

Prior Learning- by the end of Grade ___ , students understand that:

Kindergarten Unit 1: Pushes and Pulls

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of the object's motion and can start or stop it.
- When objects touch or collide, they push on one another and can change motion.
- A bigger push or pull causes things speed up or slow down more quickly.

Grade 1 Unit 1: Patterns of Change in the Sky

Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

Evidence of Learning
Summative Assessment
Project Based Learning: Mag-Lev Train Construction and Exploration End of Unit Physical Science Test
Equipment needed: Whiteboard, laptops, headphones, and hands-on materials for lessons
Teacher Instructional Resources (Hyperlinks):

Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

· Restructure lesson using UDL principles
(http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)

ACTIVITIES	**MATERIALS**
1.1 Measure That! — A Review of Linear Measurement This review can be done before or after lesson 1.2 Session 1 Session Goal: Review Means of Measurement	Materials (per group): 5 books, 5 pencils, ruler, measuring tape, yard stick, standard and non standard units table
1.2 Measuring Distance and Motion Session 1 Session Goal: Define and measure distance. Explain the importance of initial and final positions when measuring distance traveled	Remote control car (with batteries installed), tape measure, stop watch, small dot stickers, rulers, Activity Sheet 1: "Distance Traveled"
1.2 Measuring Distance and Motion Session 2 Session Goal: Use time to measure how long it takes an object to move. Demonstrate an understanding that the faster something moves, the less time it takes to cover the same distance.	Pendulum (optional) to demonstrate/explain time, Activity Sheet 2: "Speed", Lap Time Table, Stop Watch, Remote Control Car *Hallway or large space
1.2 Measuring Distance and Motion Session 2 Pendulum activity Session Goal: Use time to measure how long it takes an object to move. Measure the time for ten oscillation changing the length of the pendulum rope and the mass attached Organize races with multiple linear tracks. Students will be able to compare how fast cars went on each track and the total time to find who was overall the fastest.	Continued From 1.2 Session 1 to 1.2 session 2: 3-4 days
1.3 Let's Move! Session 1 Activity 1 Session Goal: Explain that a push or a pull causes an object at rest to move.	Materials: Masking tape, string, scoring table, smoothie straws, Activity Sheet 1: "Forces and Motion", 5 sets of balls, cups, 5 small cones, 10 ping pong balls, cartoon

Explain that a force can cause a moving object to stop or change direction. Explain that it requires more force to move a heavier object than a lighter one.	*2 days including next session 2 activities: split class in half 10 kids do act. 1, 10 do act 2, then switch on day 2
1.3 Let's Move! Session 1 Activity 2 Session Goal: Explain that a push or a pull causes an object at rest to move. Explain that a force can cause a moving object to stop or change direction. Explain that it requires more force to move a heavier object than a lighter one	Masking tape, string, scoring table, smoothie straws, Activity Sheet 1: "Forces and Motion", 5 sets of balls, cups, 5 small cones, 10 ping pong balls, cartoon *2 days including previous
1.3 Let's Move! Session 2 Session Goal: Practice that a force can cause a moving object to stop or change direction.	Materials: Activity Sheet 2 "Curling", squash balls, masking tape, string, large straws, rulers *2 days
1.4 Balanced and Unbalanced Forces Session 1 Session Goal: Explain that balanced forces will not cause an object to stay at rest or will not change its motion. Explain that unbalanced forces will cause an object to change its motion.	Laminated Arrows, Jump rope, pole, weight set up *1 day
1.4 Balanced and Unbalanced Forces Session 2 Session Goal: Practice and measure balanced forces.	Tug of war cone kit, spring scale, string, masking tape, Activity sheet 1: "Balancing Forces" *1day
1.5 Contact and Non-contact Forces Session 1 Session Goal: Introduce contact/noncontact forces.	Materials: Dictionary, Magnets, Movie Clip, 1 pc. paper, Newton's Cradle *1 day
1.5 Contact and Non-contact Forces Session 2	5 Friction Rods, Silk pad, 25 styrofoam peanuts, 5 pairs of

Session Goal: Explore noncontact forces excluding magnetism.	bar magnets, inclined plane kit, phillips head screw driver, water, 2 cups or buckets, Activity Sheet 1: "Non-Contact Forces"
1.6 Magnets Make Things Move Session 1 Session Goal: Explain what kinds of materials magnets attract. Demonstrate that like poles of two magnets repel each other. Demonstrate that opposite poles of two magnets attract each other.	Materials: Magnet Kit, 5 boxes with small random objects (gather yourself: safety pins, rubber bands, tacks, pins, clips, pennies), 2-3 metal paper clips
1.6 Magnets Make Things Move Session 2 Session Goal: Project a toy train that incorporates magnetic levitation. Build a toy train that incorporates magnetic levitation.	Materials: Activity Sheet 1: "Mag-Lev Train", Markers