\_\_5th\_\_ Grade \_\_Physical\_\_\_ Science Unit

**Grade level:** 5 **Unit:** Physical **Time Frame:** Dec-Mar

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| **Unit Essential Questions:*** **How can we observe and measure the effects of forces on the motion of objects?**

**Big ideas:*** **Forces that are all around us and how they are both helpful and harmful to what we want to occur; examine how they are overcome and used to do work for us.**
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| **Essential Concepts/Skills/****GLCE’s:****Force Interactions - Some forces between objects act when the objects are in direct contact (touching), such as friction and air resistance, or when they are not in direct contact (not touching), such as magnetic force, electrical force, and gravitational force**.P.FM.05.21 Distinguish between contact forces and non-contact forces.P.FM.05.22 Demonstrate contact and non-contact forces to change the motion of an object**P.FM.M.3 Force – Forces have a magnitude and direction. Forces can be added. The net force on an object is the sum of all of the forces acting on the object. The speed and/or direction of motion of an object changes when a non-zero net force is applied to it. A balanced force on an object does not change the motion of the object (the object either remains at rest or continues to move at a constant speed in a straight line).** P.FM.05.31Describe what happens when two forces act on an object in the same or opposing directions.P.FM.05.32 Describe how constant motion is the result of balanced (zero net) forces.P.FM.05.33 Describe how changes in the motion of objects are caused by a non-zero net (unbalanced) force.P.FM.05.34 Relate the size of change in motion to the strength of unbalanced forces and the mass of the object.**P.FM.M.4 Speed – Motion can be described by a change in position relative to a point of reference. The motion of an object can be described by its speed and the direction it is moving. The position and speed of an object can be measured and graphed as a function of time.**P.FM.05.41 Explain the motion of an object relative to a point of reference.P.FM.05.42 Describe the motion of an object in terms of distance, time and direction, as the object moves, and in relationship to other objects.P.FM.05.43 Demonstrate how motion can be measured and represented on a graph. **S.IP.05.13 Use tools and equipment (spring scales, stop watches, meter sticks and tapes, models, hand lens) appropriate to scientific investigations.****NGSS:****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. [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.] **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)[PS2.A: Forces and Motion](http://www.nap.edu/openbook.php?record_id=13165&page=114)* [For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton’s third law). (MS-PS2-1)](http://www.nap.edu/openbook.php?record_id=13165&page=114)
* [The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)](http://www.nap.edu/openbook.php?record_id=13165&page=114)
* [All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)](http://www.nap.edu/openbook.php?record_id=13165&page=114)

**MS-PS2-1**.[**Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.\***](http://www.nap.edu/openbook.php?record_id=13165&page=114) [[Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and](http://www.nap.edu/openbook.php?record_id=13165&page=114) [between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]](http://www.nap.edu/openbook.php?record_id=13165&page=114)  |
|  ***PRE-PLANNING CONSIDERATIONS*** |
| **Misconceptions that need to be addressed:****Mass and weight are the same thing.****Larger objects will fall faster than smaller ones.** **Friction is caused by surface roughness.****A moving object has no force acting on it.****Good tool for many misconceptions with explanations. NEISD San Antonio, TX**[**http://www.neisd.net/curriculum/SchImprov/sci/program/misconceptions\_inter.htm#gravity**](http://www.neisd.net/curriculum/SchImprov/sci/program/misconceptions_inter.htm#gravity) |
| **Vocabulary** |
|  **Critically Important Vocabulary Instructionally Useful**

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| **force****balanced force****change of direction****change of motion****change of speed****force strength****friction****graph****magnetic attraction****magnetic repulsion****mass** | **relative position****constant speed****direction of motion****gravitational force****speed****unbalanced force****zero net force****non-zero net force** | **acceleration****applied force****kinetic energy****mechanical motion****Newton’s laws of motion****pulley****deceleration****inertia** **velocity****magnitude****lever** **inclined plane****simple machines****spring scales****newtons** |

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| **Supplies to gather or things that need to be done:** |
| * **journal for each student**
* **technology for making movies**
* **video camera(s)**
* **cups**
* **index cards**
* **pennies 3-4 rolls**
* **masking tape**
* **measuring tape/meter sticks**
* **calculators**
* **marbles**
* **glass/plastic bowls with curved bottoms**
* **markers**
* **bean bags/ tennis balls**
* **hi-lighters**
* **sports images (magazine, computer printed, student generated)**
* **crayons/colored pencils**
* **glass jars**
* **large bucket**
* **empty cup/glass**
* **long pieces of plastic (thin trash bag strips-for static demo)**
* **wool sock**
* **thick rubber band**
* **masses of different values with hooks**
* **two liter bottle**
* **cloth**
* **carpet**
* **string**
* **drinking straws**
* **poster paper/white boards**
* **bricks (2)**
* **spring scales**
* **different types of shoes**
* **fillers (marbles etc. to double mass of the shoes)**
* **stop watches**
* **balloon round and long (clear preferably)**
* **hex nuts**
* **heavy weight Styrofoam cup**
* **washers**
* **raw eggs**
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| **Additional Resources** |
| Videos that Explain science topics “Make Me a Genius” Younger Style<https://www.youtube.com/channel/UCEA-kbwNlY3YTmp4nVjkUjQ> various games with science topics to include force and friction <http://www.sciencekids.co.nz/gamesactivities.html> topics like gravity, force and motion, Newton’s Laws<http://www.physics4kids.com/files/motion_force.html> Idaho TV site- simply put text etc.<http://idahoptv.org/dialogue4kids/season12/force_and_motion/facts.cfm> NASA Dynamics of Flight <http://www.grc.nasa.gov/WWW/K-12/UEET/StudentSite/dynamicsofflight.html#lawofmotion> Newton’s Life text<http://www.newton.ac.uk/newtlife.html> Galileo and Inertia-Newton’s 1st Law <http://zonalandeducation.com/mstm/physics/mechanics/forces/galileo/galileoInertia.html> Clear explanations for teachers-just in case<http://zonalandeducation.com/mstm/physics/mechanics/forces/forces.html>**Physclips Galileo and Newton’s 1st Law short videos that explain**[**http://www.animations.physics.unsw.edu.au/mechanics/chapter5\_Newton.html**](http://www.animations.physics.unsw.edu.au/mechanics/chapter5_Newton.html)**Physclips short videos that explain** [**http://www.animations.physics.unsw.edu.au/mechanics/**](http://www.animations.physics.unsw.edu.au/mechanics/)**\*\* iPad apps** various topics to include friction, graph speed/distance, gravitation, etc<http://www.exploriments.com/index.htm>**Bill Nye** Force and Motion (full video)<https://www.youtube.com/watch?v=HXtNwLGxu78>  |

**Notes:**

**The Engineering Task is embedded in this unit as the egg drop activity.**