Grade 8 Force and Motion Science

Canterbury Public Schools

Subject	Physical Science
Grade Level	8
Unit Title	Force and Motion
Unit Goals	• Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects • Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. • Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. • Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects • Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though objects are not in contact
Pacing (# of weeks)	12 weeks
Standards	• Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects • Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. • Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. • Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects • Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though objects are not in contact
Content/Conceptual Knowledge (know)	**Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2),(MS-PS2-4) **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3),(MS-PS2-5) **Systems and System Models** • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within

	systems. (MS-PS2-1),(MS-PS2-4) **Stability and Change** ● Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2) **Influence of Science, Engineering, and Technology on Society and the Natural World** ● The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-PS2-1)
Skills (be able to do)	● Ask questions that can be investigated within the scope of the classroom ● Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2) ● Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS-PS2-5) ● Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4)
Essential Questions	How are you able to determine if an object is in motion? How can motion be measured and manipulated? How do net forces affect the motion of an object? What are the factors that affect friction?
Enduring Understandings	**<u>PS2.A: Forces and Motion</u>** ● 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) ● 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) ● 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) **PS2.B: Types of Interactions** ● Electric and magnetic (electromagnetic) forces can be attractive or

	repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) ● Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4) ● Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, a magnet, or a ball, respectively). (MS-PS2-5)
Vocabulary	Motion, reference point, force, friction, speed, acceleration, meter, gram, inertia, momentum, velocity, newton, net force, mass, distance, time, static friction, kinetic friction.
Common Learning Experiences broken down by standard addressed in the unit	Discovery-based and/or Phenonema-based activities
Assessments	NGSS Performance Task: Force and Fan Carts NGSS Performance Task:
Resources	A Framework for K-12 Science Education Chromebooks/PC Explore Learning Gizmo's Desmos
Student Resources	Chromebooks/PC Investigation materials (such as popsicle sticks, sand paper, rubber bands, craft wheels)
Teacher Resources	Chromebooks/PC Investigation materials (such as popsicle sticks, sand paper, rubber bands, craft wheels) Metric measurement tools (Spring scales, metric ruler, triple beam balance, digital scale)
Strategies	Lab partners (strategically paired), small group discussion, engagement through competition, discover activities, mini-labs, Performance task STEM projects.
Behaviors that will lead to success	Laboratory safety practices, work effectively in partnerships, compromise, advocate for oneself, follow procedures independently.