Unit 1: Matter, Motion, Forces

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **45 days**
Status: **Published**

Summary

Introduction: In this unit, students will work to explore the world around them, focusing on matter and force and motion while utilizing the scientific method and problem solving. Students will explore Newton's Laws of Motion as well the properties of matter.Students will also be able to construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.Students will explore laboratory fundamentals while highlighting the concepts of physics through a paper airplane lab, sticky shoes lab, and others. Students will gain experience in communicating results, scientific writing, and data representation and analysis through a unit project. The crosscutting concepts of scale, proportion, and quantity and structure and function provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in planning and carrying out investigations, analyzing and interpreting data, and developing and using models, Students are also expected to use these to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.Also students will demoonstrate the cause and effect relationships may be used to predict phenomena in natural or designed systems.

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SCI.MS-PS1	Matter and its Interactions
MA.K-12.1	Make sense of problems and persevere in solving them.
SCI.MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures.
LA.RL.8.1	Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
	Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.
LA.RL.8.2	Determine a theme or central idea of a text and analyze its development over the course of the text, including its relationship to the characters, setting, and plot; provide an objective summary of the text.
	Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.
MA.8.EE.A	Work with radicals and integer exponents.
MA.8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
MA.K-12.5	Use appropriate tools strategically.

	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
SCI.MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
MA.8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
	Analyzing and Interpreting Data
	Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
	Analyze and interpret data to determine similarities and differences in findings.
MA.8.EE.C.7	Solve linear equations in one variable.
SCI.MS.PS1.A	Structure and Properties of Matter
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
SCI.MS.PS1.B	Chemical Reactions
SCI.MS-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
LA.RI.8.7	Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.
LA.RI.8.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
	Obtaining, Evaluating, and Communicating Information
	Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.
MA.8.F.A	Define, evaluate, and compare functions.
MA.8.F.A.1	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
	Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.
SCI.MS.PS1.A	Structure and Properties of Matter
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

LA.W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.W.8.1.A	Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.8.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
	Structure and Function
LA.W.8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
SCI.MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
MA.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
LA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
MA.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
	Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.
MA.8.G.A	Understand congruence and similarity using physical models, transparencies, or geometry software.
MA.8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations:
SCI.MS.PS1.A	Structure and Properties of Matter
LA.W.8.2.C	Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
LA.W.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
	Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
SCI.MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
LA.W.8.3.E	Provide a conclusion that follows from and reflects on the narrated experiences or events.
LA.W.8.4	Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
LA.W.8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
MA.8.SP.A	Investigate patterns of association in bivariate data.
LA.W.8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
SCI.MS.PS1.B	Chemical Reactions

LA.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
MA.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
MA.8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
LA.W.8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.W.8.9.A	Apply grade 8 Reading standards to literature (e.g., “Analyze how a modern work of fiction draws on themes, patterns of events, or character types from myths, traditional stories, or religious works such as the Bible, including describing how the material is rendered new”).
SCI.MS-PS2	Motion and Stability: Forces and Interactions
SCI.MS-PS2-1	Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.
SCI.MS-PS2-2	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.
SCI.MS.PS2.A	Forces and Motion
SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
SCI.MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
SCI.MS-PS3	Energy
SCI.MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate’s hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems. Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. Systems and System Models
SCI.MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.
SCI.MS-PS4	Waves and Their Applications in Technologies for Information Transfer
SCI.MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

	Patterns
	Patterns can be used to identify cause-and-effect relationships.
	Modeling in in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
	Develop and use a model to describe phenomena.
SCI.MS-ESS2-3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
	Analyzing and Interpreting Data
	Analyzing data in in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
	Cause and Effect
	Cause and effect relationships may be used to predict phenomena in natural or designed systems.
CS.6-8.8.1.8.DA.5	Test, analyze, and refine computational models.
CS.6-8.8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
CS.6-8.8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
CS.6-8.DA	Data & Analysis
CS.6-8.ED	Engineering Design
6-8.MS-PS4-1.5.1	Use mathematical representations to describe and/or support scientific conclusions and design solutions.
6-8.MS-PS4-3.6.1	Structures can be designed to serve particular functions.
6-8.MS-PS3-5.7.1	Construct, use, 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.
6-8.MS-PS4-3.8	Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to

	apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
WRK.9.2.8.CAP	Career Awareness and Planning
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
TECH.8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
TECH.8.1.8.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.8.D.2	Demonstrate the application of appropriate citations to digital content.
TECH.8.1.8.D.4	Assess the credibility and accuracy of digital content.
TECH.8.1.8.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.8.D.CS3	Exhibit leadership for digital citizenship.
TECH.8.1.8.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.1.8.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.8.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.2.8.C.3	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
TECH.8.2.8.D.CS1	Apply the design process.
TECH.9.4.8.CI	Creativity and Innovation
TECH.9.4.8.CT	Critical Thinking and Problem-solving
TECH.9.4.8.TL	Technology Literacy

Essential Questions/Enduring Understandings

Essential Questions

How do scientists communicate?
How do you know if something is moving?
How can we use the scientific method to solve real-world problems?

Enduring Understanding

Understand how to carry out proper lab safety techniques, create a testable hypothesis and utilize the scientific method.

Understand that anything that is not energy, is matter.

Understand Newton's Laws of Motion and describe basic qualities of each.

Objectives

Students will be skilled at using SI measurements including units and symbols for length, volume, mass, density, time, and temperature.
Students will be skilled at converting between metric units.
Students will be skilled at communicating their data using graphs.
Students will be skilled at classifying matter based on its characteristics.
Students will be skilled at considering the effects of forces on objects including motion, speed, velocity, and acceleration.
Students will be skilled at explaining the change in motion of an object using Newton's First Law of Motion.
Students will be skilled at using Newton's Second Law of Motion to mathematically relate force, mass, and acceleration.
Students will be skilled at explaining how the motion of certain objects is due to action reaction forces according to Newton's Third Law of Motion.
Students will be skilled at addressing the Law of Conservation of Momentum when calculating the momentum of an object.
Students will be skilled at comparing and contrasting weight and mass.
Students will be skilled at understanding that gravity, friction, and air resistance are net forces that can overcome the effects of inertia and cause a change in motion of an object.

Learning Plan

Review lab safety procedures and lab equipment.

Review Scientific Method.

Introduce unit conversions in the metric system and practice metric to metric conversions.

Metric Measurement Labs

Students design and develop a class lab with a "testable hypothesis".

Develop well written lab report.

Define and discuss the three phases of matter and the physical and chemical properties associated with each.

Define and discuss speed and velocity.

Calculate basic speed=distance/time word problems and graph various speed/time relationships.

Paper Airplane Lab

Define and discuss balanced and unbalanced forces and the motion of an object when acted upon by external forces.

Calculate the relationship between forces, mass, and acceleration.

Newton's Laws of Motion

"Egg-stra" Safe Car Design Lab

Inertia Stations Lab

Friction lab

Discuss the Law of Conservation of Momentum and lab

Define and discuss free fall, air resistance, terminal velocity and gravity.

Calculate the acceleration of different objects during free fall.

Calculate the effects of air resistance on free fall by completing word problems.

Assessment

Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

Formative Assessments:

Worksheets

Exit Tickets

Class Discussion

Quizzes

***Some Suggested Options**:*

Calculating Density

Calculating Velocity

Calculating Acceleration

Calculating Momentum

Calculating Efficiency

Calculating Force

Newton's 3rd Law

States of Matter

Bench Marks:

Formal Lab Reports/Lab Write-ups

Some Suggested Options

Density Cubed

Inclined to Roll

Can You Power

The Water Games

Laboratory Techniques

Summative:

Quizzes

Some Suggested Options*:*

Calculating Density

Calculating Velocity

Calculating Acceleration

Calculating Momentum

Calculating Efficiency

Calculating Force

Newton's 3rd Law

States of Matter

Unit Tests

Matter

Motion

Forces

Alternative:

Long-Term Projects

Amusement Park Physics

Saving Eggbert

Crash Test Cars

Laboratory Practical

Materials

General lab equipment

General lab kits

General classroom supplies

Safety Equipment

Science Textbook

Physical Science McGraw Hill

Science Explorer Modules Physical Science Prentice Hall

Computer(s)

Smartboard

Access to Internet

Powerpoints

Relevant worksheets/notes

Relevant videos

Relevant virtual activities

Relevant interactive programs

Various size and weight balls

Feathers

Eggs

Coins

Cups
String
Rubber bands

Shoes