2024-2025 Physical Science (In Motion) - Richards

Grades: 5-8	Overview: Students are introduced to physical science, especially physics concepts involving motion, forces, energy, sound, and light.
Length: Two Semesters	
Prerequisites: None	

Year Outline

Main Units	Standards (NGSS)	Sub-Units	Notes & Resources
Introduction to Physical Science **Scientific Measurement (review as needed with B, C class)** **Introduction to Matter** **Introduction to Motion and Stability** **Fresh Eyes on Ice**	**Matter and Its Interactions:** Develop models to describe the atomic composition of simple molecules and extended structures. MS-PS1-1 **Motion and Stability:** 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	Introduction / Review of Physical Science (Physics, Chemistry) Major concepts in Physics, Chemistry and why they are different disciplines Introduction / Review of Scientific Measurement The Metric System and base 10 calculations (multiplying and dividing by 10, scientific notation) Length (with calculations / activity) Mass (with calculations / activity) Volume (with calculations / activity) Density (with calculations / activity) Matter Introduction and/or Review States of matter (liquid, solid, gas) and explanations of energy in each	Notes: • Class structure will follow 5-E model, an inquiry-focused approach to teaching and learning. • Introduce grading structure and portfolio system in Google Classroom in first weeks and reinforce continually with portfolio checks every time summative assessments are given. Students will need

(first quarter)	the object. MS-PS2-2	system States of Matter Model Construction Lab Introduction to Motion & Stability Forces UAA Bridge Building Competition (two-three weeks; focus on forces, stability, and introduction to engineering) Newton's First Law (object in motion will stay in motion, object at rest will stay at rest, unless acted upon by unbalanced force). Speed, motion, inertia, friction Inertia Lab (creating a "wall" of index cards to stop a "wrecking ball") Newton's Second Law (acceleration = net force on object / object's mass, or a = f/m) Acceleration Acceleration Lab Fresh Eyes on Ice Project / data collection (this will be interspersed between other units)	training on Google Docs / Forms / Google Classroom. • The composition of matter is explained briefly, but atomic composition and other major topics of chemistry are covered in "Foundational Changes" year at ACSA • Laboratory activities will occur once weekly, but more important labs are listed here
Newton's Third Law **Work and Simple Machines** **Inventions and Invention Convention** **Science Fair Project** **Energy** **(second quarter)**	**Newton's Third Law:** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. MS-PS2-1 **Modeling Potential Energy:** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. MS-PS3-1	Newton's Third Law (equal and opposite reactions) Soda Can Rocket Lab Work and Simple Machines Work Inclined Plane Wedge Screw Lever Wheel and Axle Pulley Compound Machines Hydraulics	

		Engineering, Inventions, and Invention Convention Inventions in early American history (will cover some from this list, with focus on those employing simple machines in their designs: https://www.pbs.org/wgbh/americanexperience/features/telephone-technology-timeline/) Engineering and “inventing” using the Engineering Design Process Arctic Innovation Competition (using inventions already created) Science Fair Project Starters Fresh Eyes on Ice Project / data collection	
Earth and Space Science **Science Fair** **(third quarter)**	**Earth and Space Sciences:** Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. MS-ESS1-1 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. MS-ESS1-2 Analyze and interpret data to determine scale properties of objects	Earth and Space Science The Solar System, seasons, and lunar phases Planets and objects in our solar system Why Visit? - Planet / Moon Presentations (students “sell” the idea that their planet/moon should be explored by people) Gravity and motion of objects in space Science Fair Waves, Sound, Light introduction (if time)	

	in the solar system. MS-ESS1-3		
Waves, Sound, and the Electromagnetic Spectrum **Thermal Energy** **(fourth quarter)**	**MSPS4-1:** 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. **MSPS4-2:** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. **MSPS4-3:** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	Waves Waves as energy transferred through a material Waves in water and connections to coastal erosion Properties of waves Amplitude, Frequency, Wavelength Sound Speed of sound waves in different materials Electromagnetic Spectrum Range of EMS Role of EMS radiation in modern communication Thermal Energy Heat, specific heat, and temperature Principles of heat conservation and dissipation	

Resources:

CK-12 Online Middle School Physical Science Textbook

Semester 1 Learning Goals

Differentiation Statement: Class A, B, and C will all focus on similar learning goals and the same overall content. Here, text in black refers to learning goals that apply directly to all three classes. Differentiation will take the place of modified content and assessment. For example, the types of careers and details covered for "I can describe a career in the physical sciences…." will range from discussing career paths and basic types of major career pathways with class A, to calculating wage earnings and other details of specific careers in the sciences with class C.

For other learning targets, text in red refers to those learning targets for class A, text in pink refers to learning targets for class B, and text in blue refers to learning targets for class C. These learning targets are the basis for differentiation, but content and assessments will also differ from the three classes.

Importantly, students in any one class will also receive extension options if they finish work at a class level but are ready to move to the next level (for

example, if a student in class B is ahead of the group and can easily calculate metric values up to 1000 times greater or smaller using the principles of scientific notation, they will be given extensions at the class C level for that activity). Likewise, every attempt will be made to meet students who are struggling with content at their level. The learning targets will remain the same, but time and resources will be granted to those students (even if it will require work outside of school) who need it. However, the same assessments will always be given for every student and every student will be held to the same learning goal.

Units of Instruction	Sub-Units	Learning Goals	Notes & Activities
Introduction to Physical Science **Scientific Measurement (review as needed with B, C class)**	Introduction / Review of Physical Science (Physics, Chemistry) Major concepts in Physics, Chemistry and why they are different disciplines Introduction / Review of Scientific Measurement The Metric System and base 10 calculations (multiplying and dividing by 10, scientific notation) Length (with calculations / activity) Mass (with calculations / activity) Volume (with calculations / activity) Density (with calculations / activity)	*I can describe a career in the physical sciences and the type of education and/or training required for it.* *I can describe the steps of the scientific process / give examples for the steps of the scientific process / connect the scientific process to a real-world research process happening today.* *I can choose the appropriate (accurate and efficient) metric tool for measuring length, volume, and mass.* *I can accurately measure length in metric units to the mm, volume to the ml, and mass to the mg.* *I can design an experiment to find an irregular object's volume using water displacement (differentiation depends on type of object, and types of tools available to calculate volume).* *I can calculate the density of objects after measuring their mass and being given their volume / I can calculate the density of objects after measuring their mass and calculating their volume using water displacement / I can calculate the density of objects using a process I choose depending on the size and shape of the object (eg, choose to calculate a cylinder's volume using math, but choose to calculate an irregular object's volume using water displacement)* *I can use principles of base 10 to convert values in the metric*	*Note: this section will be filled in as the semester progresses with exact activities and notes about the curriculum.

Introduction to Matter **Introduction to Motion and Stability** **Fresh Eyes on Ice** **SECOND QUARTER** **Newton's First Law**	Matter Introduction and/or Review States of matter (liquid, solid, gas) and explanations of energy in each system States of Matter Model Construction Lab Introduction to Motion & Stability Forces UAA Bridge Building Competition (two-three weeks; focus on forces, stability, and introduction to engineering) **SECOND QUARTER** Newton's First Law (object in motion will stay in motion, object at rest will stay at rest, unless acted upon by unbalanced force). Speed,	*system up to 100 times less / greater / up to 1000 times less / greater / as large or as small as standard units of metric measurement.* *I can create models that show the difference between atoms in a solid, atoms in a liquid, and atoms in gasses / I can create models that show the difference between atoms in a solid, atoms in a liquid, and atoms in gasses and provide real-life examples for each / I can create models that show the difference between atoms in a solid, atoms in a liquid, and atoms in gasses, provide real-life examples for each, and explain how a molecule (eg, water) can exist in all three states given different conditions.* *I can use vector force arrows to diagram at least two forces on an object given a real-world example; I can create a diagram showing at least three vector forces on an object given a real-world example; I can create a diagram showing at least three vector forces on an object given a real-world example, and when given a vector force diagram, translate that into at least two real-world representations for that diagram.* *I can apply my knowledge of vector forces to build a model bridge using limited resources that will hold at least 11kg / at least 18kg / at least 30kg.* *I can create and perform an experiment showing that the motion (or lack thereof) of an object is determined by the sum of forces acting on it; I can create and perform an*	

Newton's Second Law Newton's Third Law	motion, inertia, friction Inertia Lab (creating a "wall" of index cards to stop a "wrecking ball") Newton's Second Law (acceleration = net force on object / object's mass, or a = f/m) Acceleration Acceleration Lab Fresh Eyes on Ice Project / data collection (this will be interspersed between other units) Newton's Third Law (equal and opposite reactions) Soda Can Rocket Lab Work and Simple Machines Work	*experiment comparing how the motion of a more or less massive object is related to the forces acting upon it; I can create and perform an experiment showing how mass, the forces acting on an object, and motion are interrelated, and apply that to a real-world example.* *Interpret a dataset to show how net force and mass are related to the acceleration of an object* *Collect and interpret real-world data and connect that data to changes in climate.* *I can use principles in Newton's Third Law to improve a "rocket" nozzle for a soda can rocket; I can use principles in Newton's Third Law to improve a "rocket" nozzle for a soda can rocket and connect Newton's Third Law to other real-world physical phenomena; I can use principles in Newton's*	

Work and Simple Machines	Inclined Plane Wedge Screw Lever Wheel and Axle Pulley Compound Machines Hydraulics	*Third Law to improve a "rocket" nozzle for a soda can rocket and transfer learnings from that project to theorizing how to make helmets and/or seat belts safer.* *I can identify the various types of simple machines and describe how they have been used in history by humans to accomplish tasks otherwise impossible without them.*	
Inventions and Invention Convention	Engineering, Inventions, and Invention Convention Inventions in early American history (will cover some from this list, with focus on those employing simple machines in their designs: https://www.pbs.org/wgbh/americanexperience/features/telephone-technology-timeline/) Engineering and "inventing" using the Engineering Design Process Arctic Innovation Competition (using inventions already created) Science Fair Project Starters Fresh Eyes on Ice Project / data collection	*I can describe at least five inventions from American history and provide evidence and argument for how they transformed ways of living.* *I can describe the steps of the Engineering Design Process and give real-world examples for how the process is used to create technologies.* *I can use the Engineering Design Process to design a new technology that solves a real-world problem in Alaska.*	

Science Fair Project **Energy** **(second quarter)**			
Semester 2 Learning Goals			
Earth and Space Science **Science Fair** **(third quarter)**	Earth and Space Science The Solar System, seasons, and lunar phases Planets and objects in our solar system Why Visit? - Planet / Moon Presentations (students "sell" the idea that their planet/moon should be explored by people) Gravity and motion of objects in space Science Fair	*I can list all of the major bodies in our solar system, order them, and describe their major characteristics.* *I can describe one solar system body in detail, and give convincing arguments for why it should be explored by humans.* *I can create a model that shows how gravity results in the balance of our solar system, and also how gravity can result in impacts and captures between bodies in the solar system.* *I can design and conduct an original science fair project following the steps of the scientific process. [separate individual learning targets will be broken down within this process, to reflect the amount of time and effort students will need to put into their science fair project and give weight to the science fair for grading in PowerSchool.]*	Students might create solar system mobiles with the sun at the center for this learning target.

Waves, Sound, and the Electromagnetic Spectrum **Thermal Energy** **(fourth quarter)**	Waves Waves as energy transferred through a material Waves in water and connections to coastal erosion Properties of waves Amplitude, Frequency, Wavelength Sound Hearing Speed and properties of sound waves in different materials Electromagnetic Spectrum Range of EMS	*I can use a slinky to demonstrate different types of waves and correctly identify each; I can use a slinky to demonstrate different types of waves and describe a real-world example of each type of wave; I can use a slinky to demonstrate different types of waves and describe how that wave is used in a technology that helps humans.* *I can develop and use a model that describes how waves are reflected, absorbed, or transmitted through different kinds of materials.* *I can describe how ocean waves of certain types (ie tides, storm surges, tsunamis) can impact landscapes and/or communities.* *I can use drawings to illustrate the different properties of waves and how energy increases or decreases within the wave depending on these properties; I can use drawings to illustrate the different properties of waves and how energy increases or decreases within the wave depending on these properties, and give real-world examples for changes within a waveform; I can use drawings to illustrate the different properties of waves and how energy increases or decreases within the wave depending on these properties, and argue which waveforms work best to communicate through different mediums and which properties could be altered to communicate signals.* *I can design an improved "ear" for humans based on an understanding of how hearing works.* *I can list and order the types of radiation within the EMS by energy level; I can list and order the types of radiation within the EMS by energy level and describe real-world*	

	Role of EMS radiation in modern communication Thermal Energy Heat, specific heat, and temperature Principles of heat conservation and dissipation	*examples of each type of radiation; I can list and order the types of radiation within the EMS by energy level and describe real-world examples of each type of radiation and their use in modern technology.* *I can describe the difference between digital and analog signals and provide evidence for why digital signals are more reliable; I can compare and contrast technologies that communicate in digital and analog signals and argue which signals are more reliable; I can compare and contrast technologies that communicate in digital and analog signals and argue which signals are more reliable, describing situations where both technologies are assets.* *I can design and build a technology to decrease thermal heat transfer.*	