



Constant Velocity

Draft Date 06-07-2024	Course HS H/CP/GEN Principles of Science	Duration 3 Week(s)	Grades 9	Subjects Science	Team Allison Zmuda, Casey Banh, Marshall Edens
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Focus

This topic of constant velocity starts off our journey of objects in motion. Constant velocity isn't just about moving steadily—it is the exhilarating essence of unbroken motion in physics, where objects move with speed and flawless consistency, and embodying the thrill of seamless progression towards infinite horizons.

We will continue to use our graphical skills to represent and predict an object's motion.

Stage 1: Learning Goals

Established Goals	Transfer			
Standards	Long-Term Transfer Goals			
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision. Clarifying Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions. (Innovative Problem Solver) (T1) ■ Participate in respectful discourse with peers, teachers, and experts in the field to share ideas, perspectives, and findings. (Collaborator, Communicator) (T2)			
	Meaning			
	<table> <tr> <th>Understandings</th><th>Essential Questions</th></tr> <tr> <td> What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ All forces between objects arise from a few types of interactions: gravity, </td><td> What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering... ■ How can one predict an object's continued motion, changes in motion, </td></tr> </table>	Understandings	Essential Questions	What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ All forces between objects arise from a few types of interactions: gravity,
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football helmet or a parachute.	electromagnetism, and the strong and weak nuclear interactions. (U1)	or stability? (Q1)
Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations. (3.2.9-12.K)	Acquisition of Knowledge & Skill	
	Knowledge	Skills
	What facts and basic concepts should students know and be able to recall? Students will know... ■ Velocity is speed AND direction. (K1) ■ Speed is slope on a position vs time graph. (K2) ■ Position v time graphs represent the motion of an object. (K3)	What discrete skills and processes should students be able to use? Students can... ■ I can use the appropriate equation to predict constant velocity motion. (S1) ■ I can determine where along a position vs time graph the object is fastest/ slowest/not moving. (S2) ■ I can calculate speed based from a position vs time graph. (S3) ■ I can determine direction the object is moving. (S4) ■ I can identify the reference point. (S5)
Profile of a CV Learner ■ Collaboration: Students will be able to independently engage and meaningfully contribute to a team to reach a common goal, through mutual reflection, feedback, and shared responsibility. (PCVL.CO) ■ Innovative Problem Solving: Students will be able to independently use their learning to approach new problems with curiosity and creativity while consistently seeking growth through self-reflection and a willingness to accept constructive feedback. (PCVL.IPS)		



Forces

Draft Date 06-07-2024	Course HS H/CP/GEN Principles of Science	Duration 2 Week(s)	Grades 9	Subjects Science	Team Allison Zmuda, Casey Banh, Marshall Edens
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Focus

Some objects accelerate, as we saw in the previous unit. But the underlying reason for this has been unexplained. Forces are the invisible superheroes of the physical world. They're the dynamic agents that push, pull, and twist all objects in the universe. From the gentle touch of gravity holding us to Earth to the explosive power of engines propelling us forward.

We will learn that forces are the drivers behind acceleration. Newton's 1st and 3rd Laws will be explored.

Stage 1: Learning Goals

Established Goals	Transfer	
Standards	Long-Term Transfer Goals	
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision. Clarifying Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions. (Innovative Problem Solver) (T1) ■ Participate in respectful discourse with peers, teachers, and experts in the field to share ideas, perspectives, and findings. (Collaborator, Communicator) (T2)	
	Meaning	
	Understandings	Essential Questions
	What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ All forces between objects arise from a few types of interactions: gravity,	What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering... ■ What underlying forces explain the variety of interactions observed? (Q1)

football helmet or a parachute.

Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations. (3.2.9-12.K)

electromagnetism, and the strong and weak nuclear interactions. (U1)

Acquisition of Knowledge & Skill

Knowledge

Skills

Profile of a CV Learner

- Collaboration: Students will be able to independently engage and meaningfully contribute to a team to reach a common goal, through mutual reflection, feedback, and shared responsibility. (PCVL.CO)
- Innovative Problem Solving: Students will be able to independently use their learning to approach new problems with curiosity and creativity while consistently seeking growth through self-reflection and a willingness to accept constructive feedback. (PCVL.IPS)

What facts and basic concepts should students know and be able to recall?

Students will know...

- Newton's 1st law states that an object at rest or in motion will remain so until acted on by unbalanced forces. Also known as the law of inertia. Inertia is the tendency of an object to obey Newton's 1st law. Objects with greater mass or greater velocity are said to have more inertia. (K1)
 - Free body diagrams (FBDs) are representations of all the forces on an object. Arrows (ie vectors) represent the forces. A box or dot represents the object on which the forces act. (K2)
 - Forces are pushes or pulls acting by contact or action-at-a-distance.
 - Gravitational force
 - Electromagnetic force
 - Applied force
 - Buoyancy force
 - Frictional force
 - Drag force
 - Tension force
- (K3)

What discrete skills and processes should students be able to use? Students can...

- I can demonstrate how Newton's 1st law governs mechanical motion. (S1)
- I can demonstrate how Newton's 3rd law governs mechanical motion. (S2)
- I can create free body diagrams to represent any object in various types of motion (constant or accelerating). (S3)



Matter

Draft Date 06-07-2024	Course HS H/CP/GEN Principles of Science	Duration 3 Week(s)	Grades 9	Subjects Science	Team Allison Zmuda, Casey Banh, Marshall Edens
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Focus

At this point in our story, we must depart from the physics of motion and energy at a macro scale, and instead direct our attention to the ultra small; the particles of a substance itself. If we zoom in to any object or substance in our world we would see a frenzy of activity! Billions of tiny particles feverishly in motion. Particles and their behavior are the reason why ships float, but a skipping stone eventually sinks.

We will learn how to describe matter as particles and how those particles are conserved.

Stage 1: Learning Goals

Established Goals	Transfer	
Standards	Long-Term Transfer Goals	
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. Clarifying Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions. (Innovative Problem Solver) (T1) ■ Make and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions. (Communicator) (T2)	
	Meaning	
	Understandings	Essential Questions
	What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ Matter can be understood in terms of the types of atoms present and the	What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering... ■ How do substances combine or change (react) to make new substances? (Q1)

the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.

Assessment Boundary: Assessment does not include complex chemical reactions. (3.2.9-12.G)

Profile of a CV Learner

- Communication: Students will be able to independently and confidently adapt their writing and speaking in relation to audience, task, and purpose, as well as practice active listening to understand other perspectives, viewpoints, and cultures. (PCVL.CM)
- Innovative Problem Solving: Students will be able to independently use their learning to approach new problems with curiosity and creativity while consistently seeking growth through self-reflection and a willingness to accept constructive feedback. (PCVL.IPS)

interactions both between and within atoms. (U1)

- How does one characterize and explain these reactions and make predictions about them? (Q2)

Acquisition of Knowledge & Skill

Knowledge

What facts and basic concepts should students know and be able to recall?
Students will know...

- All substances are made of particles. (K1)
- The mass of a system is conserved. (K2)
- Mass changes only when particles are added or removed. (K3)
- 1 milliliter (mL) is equal to 1 cubic centimeter (cm³). (K4)
- Slope on a volume vs mass graph represents the density of a substance. (K5)
- Density is a characteristic property of matter and can be useful in identifying unknown substances. (K6)
- Density = mass / volume (K7)
- Common units of density are grams per milliliter (g/mL) and grams per cubic centimeter (g/cm³). (K8)
- Density of a substance is determined by three variables of its particles; mass of particles, size of particles, and arrangement of particles. (K9)

Skills

What discrete skills and processes should students be able to use? Students can...

- I can explain mass change in a system as a result of particles entering or leaving a system. (S1)
- I can predict properties of matter based on the arrangement and behavior of its particles. (S2)
- I can describe density at the particle level. (S3)



Nuclear Reactions

Draft Date 06-07-2024	Course HS H/CP/GEN Principles of Science	Duration 2 Week(s)	Grades 9	Subjects Science	Team Allison Zmuda, Casey Banh, Marshall Edens
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Focus

To end our story, we would like to view atoms at their best and at their worst. No topic is as interesting (or concerning) as nuclear radiation. From nuclear bombs to nuclear medicine, from the food you eat to the ground beneath your feet.

We will learn that atoms give rise to radioactivity. We will also examine the history of radiation and the impact it has to our neck-of-the-woods, here in Pennsylvania.

Stage 1: Learning Goals

Established Goals	Transfer	
Standards	Long-Term Transfer Goals	
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. Clarifying Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Approach science as a reliable and testable way of knowing and explaining the natural world and designed world. (Life-Long Learner) (T1) ■ Explain how the natural and designed worlds are interrelated and the application of scientific knowledge and technology can have beneficial, detrimental, or unintended consequences. (Global Citizen, Communicator) (T2)	
	Meaning	
	Understandings	
	What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ Matter can be understood in terms of the types of atoms present and the	

Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays. (3.2.9-12.H)	interactions both between and within atoms. (U1)	<table><tr><th colspan="2">Essential Questions</th></tr><tr><td colspan="2">What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering...</td></tr><tr><td colspan="2"> ■ What forces hold nuclei together and mediate nuclear processes? (Q1) </td></tr></table>	Essential Questions		What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering...		■ What forces hold nuclei together and mediate nuclear processes? (Q1)			
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| | <ul style="list-style-type: none">■ Radon gas can create hazardous conditions in the basement of homes. (K11)■ People install radon gas removal systems in homes. (K12) | |
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Particles in Motion

Draft Date	Course	Duration	Grades	Subjects	Team
06-07-2024	HS H/CP/GEN Principles of Science	2 Week(s)	9	Science	Allison Zmuda, Casey Banh, Marshall Edens

Focus

We can now distinguish different types of matter based on their particles. Equally interesting is the behavior of those particles. Watch out! Particles are colliding with each other and anything they encounter. From the biggest explosions to the unsettling ear pops on an airplane, particles are at work.

We will discover how temperature, volume, and pressure play a role in predicting just how those pesky particles will behave.

Stage 1: Learning Goals

Established Goals	Transfer	
Standards	Long-Term Transfer Goals	
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. Clarifying Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules. Assessment Boundary: Assessment is	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Approach science as a reliable and testable way of knowing and explaining the natural world and designed world. (Life-Long Learner) (T1) ■ Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions. (Innovative Problem Solver) (T2)	
	Meaning	
	Understandings	Essential Questions
	What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ Matter can be understood in terms of the types of atoms present and the	What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering... ■ How do substances combine or change (react) to make new substances? (Q1)

limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature. (3.2.9-12.E)	interactions both between and within atoms. (U1)	How does one characterize and explain these reactions and make predictions about them? (Q2)
Acquisition of Knowledge & Skill		
Profile of a CV Learner	Knowledge	Skills
Innovative Problem Solving: Students will be able to independently use their learning to approach new problems with curiosity and creativity while consistently seeking growth through self-reflection and a willingness to accept constructive feedback. (PCVL.IPS) Life-Long Learner: Students will be able to independently use their learning to analyze past and ongoing performance, adjust thinking processes to new contexts, and use information to make informed and conscientious decisions. (PCVL.LLL)	What facts and basic concepts should students know and be able to recall? Students will know... - The pressure in a sealed container is inversely proportional to the volume. $P_1V_1 = P_2V_2$ i.e. as volume increases, pressure decreases. (K1) - The pressure in a sealed container is directly proportional to the temperature. $P_1/T_1 = P_2/T_2$ i.e. as temperature increases, pressure increases. (K2) - The pressure in a sealed container is directly proportional to the number of particles. $P_1/n_1 = P_2/n_2$ i.e. as number of particles increases, pressure increases. (K3) - Reaction rate will increase with an increase in pressure. (K4) - Reaction rate increases with increased number of particles. (K5) - Reaction rate increases with increased temperature. (K6) - Reaction rate increases with increased pressure. (K7)	What discrete skills and processes should students be able to use? Students can... - I can use mathematical and graphical methods for predicting how pressure of a gas changes with temperature. (S1) - I can use mathematical and graphical methods for predicting how pressure of a gas changes with volume. (S2) - I can use mathematical and graphical methods for predicting how pressure of a gas changes with increased particle count. (S3) - I can predict how reaction rates change due to change in temperature, volume, number of particles, and pressure. (S4) - I can represent particle motion with a drawing to explain observations. (S5)

Periodic Table

Draft Date 07-24-2026	Course HS H/CP/GEN Principles of Science	Duration 2 Week(s)	Grades 9	Subjects Science	Team Marshall Edens, Casey Banh, Allison Zmuda
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Focus

Mass and volume are properties of matter that we can explore without understanding the inner structure of atoms. More patterns emerge as we investigate the hidden subatomic structure and how this determines other interesting properties.

We will learn how to predict the properties of an atom based on its structure and resulting position within the periodic table of elements.

Stage 1: Learning Goals

Established Goals	Transfer		
Standards	Long-Term Transfer Goals		
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. Clarifying Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen. Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Approach science as a reliable and testable way of knowing and explaining the natural world and designed world. (Life-Long Learner) (T1) ■ Make and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions. (Communicator) (T2) ■ Evaluate systems, in order to connect how form determines function and how any change to one component affects the entire system. (Global Citizen, Innovative Problem Solver) (T3)		
	Meaning		
	Understandings		
	What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ Matter can be understood in terms of the types of atoms present and the		

understanding of ionization energy beyond relative trends. (3.2.9-12.A) Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. Clarifying Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen. Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions. (3.2.9-12.C)	interactions both between and within atoms. (U1)	<table><tr><th colspan="2">Essential Questions</th></tr><tr><td colspan="2">What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering...</td></tr><tr><td colspan="2"> How do particles combine to form the variety of matter one observes? (Q1) </td></tr></table>	Essential Questions		What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering...		How do particles combine to form the variety of matter one observes? (Q1)	
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How do particles combine to form the variety of matter one observes? (Q1)								
Acquisition of Knowledge & Skill								
Knowledge		Skills						
What facts and basic concepts should students know and be able to recall? Students will know...		What discrete skills and processes should students be able to use? Students can...						
- Atoms are made up of protons, neutrons and electrons. (K1) - Protons determine the identity (aka which element) of an atom. (K2) - Neutrons hold the protons together in the nucleus. (K3) - Electrons determine the reactivity of an atom. (K4) - Elements are arranged in the periodic table by their atomic number and by properties. (K5) - Elements are grouped into broad categories of metals, non-metals, and metalloids. (K6) - Elements belong to a “chemical family” which share similar properties. (K7) - The row number of an element determines the number of electron shells. (K8) - The column number of an element determines the number of electrons on the outermost shell. (K9)		- I can predict the structure of any atom and its properties based on the position of an element box on the periodic table. (S1) - I can predict the bond type that will occur between two atoms. (S2) - I can draw a Bohr model of an atom. (S3)						
Profile of a CV Learner								
- Communication: Students will be able to independently and confidently adapt their writing and speaking in relation to audience, task, and purpose, as well as practice active listening to understand other perspectives, viewpoints, and cultures. (PCVL.CM) - Global Citizenship: Students will be able to mindfully and respectfully seek to understand the ideas and perspectives of others to responsibly participate in all facets of local and global society. (PCVL.GC) - Life-Long Learner: Students will be able to independently use their learning to analyze past and ongoing performance,								

adjust thinking processes to new contexts, and use information to make informed and conscientious decisions. (PCVL.LLL)

- Valence electrons are the electrons on the outermost shell and are concerned with bonding. (K10)
- Atomic radius is the total distance from the center of the nucleus to the outermost electron shell. (K11)
- Atomic radius increases going down and going to the left along the periodic table. (K12)
- Electronegativity is an atom's ability to attract shared electrons in a chemical bond. (K13)
- Electronegativity increases going up and going to the right along the periodic table. (K14)
- Ionic bonds occur when one atom takes an electron from another atom. (K15)
- Covalent bonds occur when two electrons are shared between two atoms. (K16)
- Most atoms prefer to have 8 valence electrons. This is known as the "Octet Rule". (K17)



Uniform Acceleration

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Focus

Now that we have several ways to visualize simple moving objects, let's add some complexity by looking at acceleration. Uniform acceleration is the turbo boost of physics, where objects not only move steadily but also crank up their speed with each passing moment. It's like riding a rocket that accelerates faster and faster, thrilling with the promise of ever-increasing velocity and the boundless potential to explore new frontiers of space and time.

We will represent and predict the motion of objects that experience acceleration. We will also differentiate between objects with constant velocity and uniform acceleration.

Stage 1: Learning Goals

Established Goals	Transfer
Standards	Long-Term Transfer Goals
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision. Clarifying Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and	What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions. (Innovative Problem Solver) (T1) ■ Participate in respectful discourse with peers, teachers, and experts in the field to share ideas, perspectives, and findings. (Collaborator, Communicator) (T2)

modifying the design to improve it. Examples of a device could include a football helmet or a parachute.

Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations. (3.2.9-12.K)

Profile of a CV Learner

- Collaboration: Students will be able to independently engage and meaningfully contribute to a team to reach a common goal, through mutual reflection, feedback, and shared responsibility. (PCVL.CO)
- Innovative Problem Solving: Students will be able to independently use their learning to approach new problems with curiosity and creativity while consistently seeking growth through self-reflection and a willingness to accept constructive feedback. (PCVL.IPS)

Meaning	
Understandings	Essential Questions
What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ All forces between objects arise from a few types of interactions: gravity, electromagnetism, and the strong and weak nuclear interactions. (U1)	What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering... ■ How can one predict an object's continued motion, changes in motion, or stability? (Q1)
Acquisition of Knowledge & Skill	
Knowledge	Skills
What facts and basic concepts should students know and be able to recall? Students will know... ■ Uniform acceleration is when an object's velocity changes by the same amount in every equal time interval. The rate of change of velocity is constant. (K1) ■ The difference between velocity (a vector describing speed and direction) and acceleration (a vector describing the rate of change of velocity). (K2) ■ Slope on a velocity vs time graph is acceleration. (K3)	What discrete skills and processes should students be able to use? Students can... ■ I can determine when objects are speeding up or slowing down from a position vs time graph. (S1) ■ I can differentiate between constant velocity motion and uniform acceleration motion in words and graphically. (S2) ■ I can use mathematical and graphical methods for predicting uniform acceleration motion. (S3) ■ I can create a velocity v time graph from a position v time graph. (S4)



Waves

Draft Date	Course	Duration	Grades	Subjects	Team
06-07-2024	HS H/CP/GEN Principles of Science	2 Week(s)	9	Science	Allison Zmuda, Casey Banh, Marshall Edens
Focus					
Let's switch gears and explore nature's symphony of motion, waves. Waves can be found across land, sea, sky, and even outer space. From the whispering melodies of radio waves coursing through the air, to the light waves that paint the world in hues of wonder, waves carry the pulse of energy and information that connects us all. We will explore various forms of waves, learn to identify their characteristic properties, and how they are used in everyday life.					
Stage 1: Learning Goals					
Established Goals		Transfer			
Standards		Long-Term Transfer Goals			
Pennsylvania Academic Standards Science (2023): 9-12 Standards ■ Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. Clarifying Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.		What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to... ■ Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions. (Innovative Problem Solver) (T1) ■ Participate in respectful discourse with peers, teachers, and experts in the field to share ideas, perspectives, and findings. (Collaborator, Communicator) (T2)			
		Meaning			
		Understandings	Essential Questions		
		What specifically do you want students to understand? What inferences should they make? Students will understand that... ■ Waves are a repeating pattern of motion that transfers energy from	What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering... ■ What are the characteristic properties and behaviors of waves? (Q1)		

Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively. (3.2.9-12.T)

- Evaluate questions about the advantages of using digital transmission and storage of information.

Clarifying Statement: Examples of advantages could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft.

Assessment Boundary: N/A (3.2.9-12.U)

- Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Clarifying Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.

Assessment Boundary: Assessment is limited to qualitative descriptions. (3.2.9-12.W)

place to place without overall displacement of matter. (U1)

- What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there? (Q2)
- How are instruments that transmit and detect waves used to extend human senses? (Q3)

Acquisition of Knowledge & Skill

Knowledge

What facts and basic concepts should students know and be able to recall?
Students will know...

- Certain features are fundamental to waves (crests, troughs, wavelength, frequency, wave height, amplitude).
 - Wavelength is the distance between two crests or two troughs.
 - Frequency is the number of crests that pass a fixed point each second (unit: Hertz (Hz))
 - Wave height is the total vertical distance between trough and crest.
 - Amplitude is half the wave height. (K1)
- Electromagnetic waves pass through matter or without matter present. All other forms of waves (ex: sound, oceanic, seismic) require a medium. (K2)

Skills

What discrete skills and processes should students be able to use? Students can...

- I can identify the characteristic properties of waves. (S1)
- I can identify the common forms of waves. (S2)
- I can list examples of how waves are experienced in everyday life. (S3)
- I can explain how waves impact daily life and society through history. (S4)

Profile of a CV Learner

- Collaboration: Students will be able to independently engage and meaningfully contribute to a team to reach a common goal, through mutual reflection, feedback, and shared responsibility. (PCVL.CO)
- Innovative Problem Solving: Students will be able to independently use their learning to approach new problems with curiosity and creativity while consistently seeking growth through self-reflection and a willingness to accept constructive feedback. (PCVL.IPS)

- Information is transmitted in electromagnetic waves. (ex: radio and wifi) (K3)