

### INVESTIGATING OUR NATURAL AND ENGINEERED WORLD.

Unit 1	Unit 2	Unit 3	Unit 4	SLO	Unit 5	Unit 6:
3.5 wks BLOCK/7 wks YR	3 wks BLOCK/6 wks YR	4.5 wks BL/9 wks YR	3 wks BLOCK/6 wks YR	Exam	2 wks BL/4 wks YR	1 wk BL/2 wks
Kinematics SP1	Forces SP2	Momentum and	Sounds, Waves and Light SP4		Electricity &	Modern
		Energy SP3	, ,		Magnetism SP5	Physics SP6
SP1. Obtain, evaluate,	SP2. Obtain, evaluate,	SP3. Obtain, evaluate,	SP4. Obtain, evaluate, and		SP5. Obtain,	SP6. Obtain,
and communicate	and communicate	and communicate	communicate information		evaluate, and	evaluate, and
information about the	information about how	information about	about the properties and		communicate	communicate
relationship between	forces affect the motion	the importance of	applications of waves.		information about	information
distance, displacement,	of objects.	conservation laws for	a Dayalan and usa		electrical and	about nuclear
speed, velocity, and	a. Construct an	mechanical energy	a. Develop and use mathematical models to		magnetic force	changes of
acceleration as functions	explanation based on	and linear	explain mechanical and		interactions.	matter and
of time.	evidence using Newton's	momentum in	electromagnetic waves as a		a. Develop and use	related
a. Plan and carry out an	Laws of how forces affect	predicting the	propagating disturbance that		mathematical	technological
investigation of one-	the acceleration of a	behavior of physical	transfers energy. (Clarification		models and	applications.
dimensional motion to	body.	<b>systems.</b> a. Ask	statement: Mathematically		generate diagrams	a. Develop
calculate average and	bouy.	questions to compare	describe how the velocity,		to compare and	and use
instantaneous speed and	Explain and predict the	and contrast open and	frequency, and wavelength of a		contrast the	models to
velocity.	motion of a body in	closed systems.	propagating wave are related.)		electric and	explain,
velocity.	absence of a force and	b. Use mathematics	propagating wave are related.)		gravitational forces	compare, and
<ul> <li>Analyze one-</li> </ul>	when forces are applied	and computational	b. Develop and use models to		between two	contrast
dimensional problems	using Newton's 1st Law	thinking to analyze,	describe and calculate		charged objects.	nuclear
involving changes of	(principle of inertia).	evaluate, and apply	characteristics related to the		charged objects.	processes
direction, using algebraic	. Calaulata tha	the principle of	interference and diffraction of		b. Plan and carry	including
signs to represent vector	Calculate the	conservation of	waves (single and double slits).		out investigations	radioactive
direction.	acceleration for an object	energy and the Work-			to demonstrate	decay, fission,
. Amala ana dia anatanal	using Newton's 2nd Law,	· · ·	c. Construct an argument that		and qualitatively	and fusion.
Apply one-dimensional	including situations	Kinetic Energy Theorem.	analyzes the production and		explain charge	b. Construct
kinematic equations to	where multiple forces act	meorem.	characteristics of sounds		transfer by	an argument
situations with no	together.	Calculate the kinetic	waves. (Clarification statement:		conduction,	to compare
acceleration, and positive,	<ul> <li>Identify the pair of</li> </ul>	energy of an object.	Includes, but not limited to,		friction, and	and contrast
or negative constant	equal and opposite	Calculate the	Doppler Effect, standing waves,		induction.	mechanisms
acceleration.	forces between two		wavelength, the relationship			and
	interacting bodies and	amount of work	between amplitude and the			and



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- b. Analyze and interpret data using created or obtained motion graphs to illustrate the relationships among position, velocity, and acceleration, as functions of time.
- c. Ask questions to compare and contrast scalar and vector quantities.
- d. Analyze and interpret data of two-dimensional motion with constant acceleration. • Resolve position, velocity, or acceleration vectors into components (x and y, horizontal and vertical). • Add vectors graphically and mathematically by adding components. • Interpret problems to show that objects moving in two dimensions have independent motions along each coordinate axis. • Design an experiment to investigate the projectile motion of an object by collecting and analyzing data using
- relate their magnitudes and directions using Newton's 3rd Law. b. Develop and use a model of a Free Body Diagram to represent the forces acting on an object (both equilibrium and nonequilibrium).
- c. Use mathematical representations to calculate magnitudes and vector components for typical forces including gravitational force, normal force, friction forces, tension forces, and spring forces.
- d. Plan and carry out an investigation to gather evidence to identify the force or force component responsible for causing an object to move along a circular path.
- Calculate the magnitude of a centripetal acceleration.
- e. Develop and use a model to describe the mathematical relationship between

- performed by a force on an object.
- c. Plan and carry out an investigation demonstrating conservation and rate of transfer of energy (power) to solve problems involving closed systems.
- d. Construct an argument supported by evidence of the use of the principle of conservation of momentum to
- explain how the brief application of a force creates an impulse.
- describe and perform calculations involving one dimensional momentum.
- connect the concepts of Newton's 3rd law and impulse. experimentally compare and contrast

- energy of the wave, and the relationship between frequency and pitch.)
- d. Plan and carry out investigations to characterize the properties and behavior of electromagnetic waves. (Clarification statement: Properties of waves include, but not limited to, amplitude, frequency, wavelength, and the relationship between frequency or wavelength and the energy of the wave.)
- e. Plan and carry out investigations to describe common features of light in terms of color, polarization, spectral composition, and wave speed in transparent media.
- Analyze experimentally and mathematically aspects of reflection and refraction of light waves and describe the results using optical ray diagrams.
- Perform calculations related to reflections from plane surfaces and focusing using thin lenses.

- c. Construct an explanation based on evidence of the behavior of charges in terms of electric potential energy.
- d. Plan and carry out an investigation of the relationship between voltage, current, and power for direct current circuits. (Clarification statement: Application of Ohm's Law to different circuit configurations, not limited to parallel and series, and calculations of equivalent resistance are expected.)
- e. Plan and carry out investigations to clarify the relationship between electric currents and magnetic fields.

- characteristics of radioactive decay. (Clarification statement: Include alpha, beta, and gamma decays and their effects.)
- their effects.) c. Develop and use mathematical models and representatio ns to calculate the amount of substance present after a given amount of time based on its half-life and relate this to the law of conservation of mass and energy.



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kinematic equations. •	mass, distance, and force	inelastic and elastic	f. Plan and carry out	(Clarification
Predict and describe how	as expressed by	collisions.	investigations to identify the	statement: This
changes to initial	Newton's Universal Law		behavior of light using lenses.	includes coils and
conditions affect the	of Gravitation		(Clarification statement:	their importance in
resulting motion. •			Investigations concerning	the design of
Calculate range and time			Snell's Law, optical ray	motors and
in the air for a horizontally			diagrams, and thin lens	generators.)
launched projectile			equation should be	
			conducted.)	
			g. Plan and carry out	
			investigations to describe	
			changes in diffraction patterns	
			associated with geometry and	
			wavelength for mechanical and	
			electromagnetic waves	

### **Physics Standards**

The Georgia Standards of Excellence for science are designed to provide foundational knowledge and skills for all students to develop proficiency in science. The Project 2061's *Benchmarks for Science Literacy* and the follow up work, *A Framework for K-12 Science Education* were used as the core of the standards to determine appropriate content and process skills for students. The Cobb Teaching and Learning Standards focus on a limited number of core disciplinary ideas and crosscutting concepts which build from Kindergarten to high school. The standards are written with the core knowledge to be integrated with the science and engineering practices needed to engage in scientific inquiry and engineering design.

The Georgia Standards of Excellence drive instruction. Hands-on, student-centered, and inquiry-based approaches should be the emphasis of instruction. The standards are a required minimum set of expectations that show proficiency in science. However, instruction can extend beyond these minimum expectations to meet student needs.

Science consists of a way of thinking and investigating, as well a growing body of knowledge about the natural world. To become literate in science, students need to possess sufficient understanding of fundamental science content knowledge, the ability to engage in the science and engineering practices, and to use scientific and technological information correctly. Technology should be infused into the curriculum and the safety of the student should always be foremost in instruction.

The Georgia Standards of Excellence are designed to continue student investigations of the physical sciences that began in grades K-8, and provide students the necessary skills to be proficient in physics. These standards include more abstract concepts such as nuclear decay processes, interactions of matter and energy, velocity,



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acceleration, force, energy, momentum, properties and interactions of matter, electromagnetic and mechanical waves, and electricity, magnetism, and their interactions. Students investigate physics concepts through experiences in laboratories and field work using the process of inquiry.

#### SP1. Obtain, evaluate, and communicate information about the relationship between distance, displacement, speed, velocity, and acceleration as functions of time.

- a. Plan and carry out an investigation of one-dimensional motion to calculate average and instantaneous speed and velocity.
- Analyze one-dimensional problems involving changes of direction, using algebraic signs to represent vector direction.
- Apply one-dimensional kinematic equations to situations with no acceleration, and positive or negative constant acceleration.
- b. Analyze and interpret data using created or obtained motion graphs to illustrate the relationships among position, velocity, and acceleration, as functions of time.
- c. Ask questions to compare and contrast scalar and vector quantities.
- d. Analyze and interpret data of two-dimensional motion with constant acceleration.
- Resolve position, velocity, or acceleration vectors into components (x and y, horizontal and vertical).
- Add vectors graphically and mathematically by adding components.
- Interpret problems to show that objects moving in two dimensions have independent motions along each coordinate axis.
- Design an experiment to investigate the projectile motion of an object by collecting and analyzing data using kinematic equations.
- Predict and describe how changes to initial conditions affect the resulting motion.
- Calculate range and time in the air for a horizontally launched projectile.

#### SP2. Obtain, evaluate, and communicate information about how forces affect the motion of objects.

- a. Construct an explanation based on evidence using Newton's Laws of how forces affect the acceleration of a body.
- Explain and predict the motion of a body in absence of a force and when forces are applied using Newton's 1st Law (principle of inertia).
- Calculate the acceleration for an object using Newton's 2nd Law, including situations where multiple forces act together.
- Identify the pair of equal and opposite forces between two interacting bodies and relate their magnitudes and directions using Newton's 3rd Law.
- b. Develop and use a model of a Free Body Diagram to represent the forces acting on an object (both equilibrium and non-equilibrium).
- c. Use mathematical representations to calculate magnitudes and vector components for typical forces including gravitational force, normal force, friction forces, tension forces, and spring forces.
- d. Plan and carry out an investigation to gather evidence to identify the force or force component responsible for causing an object to move along a circular path.
- Calculate the magnitude of a centripetal acceleration.
- e. Develop and use a model to describe the mathematical relationship between mass, distance, and force as expressed by Newton's Universal Law of Gravitation.

## SP3. Obtain, evaluate, and communicate information about the importance of conservation laws for mechanical energy and linear momentum in predicting the behavior of physical systems.

a. Ask questions to compare and contrast open and closed systems.



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b. Use mathematics and computational thinking to analyze, evaluate, and apply the principle of conservation of energy and the Work-Kinetic Energy Theorem.

- Calculate the kinetic energy of an object.
- Calculate the amount of work performed by a force on an object.
- c. Plan and carry out an investigation demonstrating conservation and rate of transfer of energy (power) to solve problems involving closed systems.
- d. Construct an argument supported by evidence of the use of the principle of conservation of momentum to:
- explain how the brief application of a force creates an impulse,
- describe and perform calculations involving one dimensional momentum,
- connect the concepts of Newton's 3rd law and impulse, and
- experimentally compare and contrast inelastic and elastic collisions.

#### SP4. Obtain, evaluate, and communicate information about the properties and applications of waves.

- a. Develop and use mathematical models to explain mechanical and electromagnetic waves as a propagating disturbance that transfers energy.
- (Clarification statement: Mathematically describe how the velocity, frequency, and wavelength of a propagating wave are related.)
- b. Develop and use models to describe and calculate characteristics related to the interference and diffraction of waves (single and double slits).
- c. Construct an argument that analyzes the production and characteristics of sound waves.
- (Clarification statement: Includes, but is not limited to, Doppler Effect, standing waves, wavelength, the relationship between amplitude and the energy of the wave, and the relationship between frequency and pitch.)
- d. Plan and carry out investigations to characterize the properties and behavior of electromagnetic waves.
- (Clarification statement: Properties of waves include, but are not limited to, amplitude, frequency, wavelength, and the relationship between frequency or wavelength and the energy of the wave.)
- e. Plan and carry out investigations to describe common features of light in terms of color, polarization, spectral composition, and wave speed in transparent media.
- Analyze experimentally and mathematically aspects of reflection and refraction of light waves and describe the results using optical ray diagrams.
- Perform calculations related to reflections from plane surfaces and focusing using thin lenses.
- f. Plan and carry out investigations to identify the behavior of light using lenses.
- (Clarification statement: Investigations concerning Snell's Law, optical ray diagrams, and thin lens equation should be conducted.)
- g. Plan and carry out investigations to describe changes in diffraction patterns associated with geometry and wavelength for mechanical and electromagnetic waves.

#### SP5. Obtain, evaluate, and communicate information about electrical and magnetic force interactions.

- a. Develop and use mathematical models and generate diagrams to compare and contrast the electric and gravitational forces between two charged objects. (Clarification statement: Coulomb's and Universal Gravitation Law should be addressed.)
- b. Plan and carry out investigations to demonstrate and qualitatively explain charge transfer by conduction, friction, and induction.
- c. Construct an explanation based on evidence of the behavior of charges in terms of electric potential energy.



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- d. Plan and carry out an investigation of voltage, current, and power for direct current circuits.
- (Clarification statement: Application of Ohm's Law to different circuit configurations, not limited to parallel and series, and calculations of equivalent resistance are expected.)
- e. Plan and carry out investigations to clarify the relationship between electric currents and magnetic fields.

(Clarification statement: This includes coils and their importance in the design of motors and generators.)

#### SP6. Obtain, evaluate, and communicate information about nuclear changes of matter and related technological applications.

- a. Develop and use models to explain, compare, and contrast nuclear processes including radioactive decay, fission, and fusion.
- b. Construct an argument to compare and contrast mechanisms and characteristics of radioactive decay.
- (Clarification statement: Include alpha, beta, and gamma decays and their effects.)
- **c.** Develop and use mathematical models and representations to calculate the amount of substance present after a given amount of time based on its half-life and relate this to the law of conservation of mass and energy.