Alabama Science

Physics

Motion and Stability: Forces and Interactions

Kinematics

Scale, Proportion, and Quantity

1 Obtain, evaluate, and communicate ideas about kinematics, including scalar quantities (distance and speed) and vector quantities (position, displacement, velocity, and acceleration). P.1

Kinematics

Patterns

Kinematics

Cause and Effect

Kinematics

Patterns

Dynamics

Cause and Effect

2 Construct explanations of dynamics from evidence, using Newton's laws of motion. P.2

a Evaluate the effects of balanced and unbalanced forces on an object's motion. P.2.A

b Use mathematical, graphical, and narrative methods to explain the relationships among net force, mass, and acceleration of a single object. P.2.B

Dynamics

Systems and System Models

Dynamics

Cause and Effect

Analyze data to create and interpret graphs of position, velocity, and

a **Analyze data to create and interpret graphs of position, velocity, and acceleration versus time for one-dimensional motion.** P.1.A

acceleration versus time for one-dimensional motion. P.1.A	
Analyze free fall motion using one-dimensional kinematics to determine the acceleration due to gravity (g). P.1.B	**b** Analyze free fall motion using one-dimensional kinematics to determine the acceleration due to gravity (g). P.1.B
Analyze and interpret data to explain changes in the vector quantities of position, velocity, and acceleration in two-dimensional projectile motion, including projectiles launched horizontally and at an angle. P.1.C	**c** Analyze and interpret data to explain changes in the vector quantities of position, velocity, and acceleration in two-dimensional projectile motion, including projectiles launched horizontally and at an angle. P.1.C
Use mathematics and computational thinking to solve problems, using kinematics equations in both one- and two-dimensional motion. P.1.D	**d** Use mathematics and computational thinking to solve problems, using kinematics equations in both one- and two-dimensional motion. P.1.D
Create free and fixed body diagrams to model all the forces acting on a single object. P.2.C	**c** Create free and fixed body diagrams to model all the forces acting on a single object. P.2.C
Create an explanation of the nature of forces and the interactions among them, including tension, friction, gravitation, and normal forces, using free-body diagrams. P.2.D	**d** Create an explanation of the nature of forces and the interactions among them, including tension, friction, gravitation, and normal forces, using free-body diagrams. P.2.D
Analyze data to identify the pair of equal and opposite forces between two interacting bodies and relate their magnitudes and	**e** Analyze data to identify the pair of equal and opposite forces between two interacting bodies and relate their magnitudes and directions using Newton's third law. P.2.E

directions using Newton's third law. P.2.E	
Energy	**Conservation**
	Energy and Matter 3 Design and carry out experiments to verify that energy and momentum are conserved in closed systems. P.3
	Conservation
	Scale, Proportion, and Quantity
	Conservation
	Energy and Matter
	Conservation
	Scale, Proportion, and Quantity
	Conservation
	Cause and Effect
Use mathematical and computational thinking to explain the relationships among work, power, and time. P.3.A	a **Use mathematical and computational thinking to explain the relationships among work, power, and time.** P.3.A
Create mathematical and graphical representations to depict the transformation of energy from one form to another, including kinetic energy, gravitational potential energy, elastic potential energy, and work due to friction. P.3.B	b **Create mathematical and graphical representations to depict the transformation of energy from one form to another, including kinetic energy, gravitational potential energy, elastic potential energy, and work due to friction.** P.3.B
Use models to illustrate the relationship between the work	c **Use models to illustrate the relationship between the work performed on an object and the object's total mechanical energy.** P.3.C

performed on an object and the object's total mechanical energy. P.3.C	
Qualitatively and quantitatively evaluate the relationship among the force acting on an object, the time of interaction, and the change in linear momentum (impulse) of the object. P.3.D	**d** **Qualitatively and quantitatively evaluate the relationship among the force acting on an object, the time of interaction, and the change in linear momentum (impulse) of the object.** P.3.D
Obtain, evaluate, and interpret data related to collisions (both elastic and inelastic) and their effects on both linear momentum and energy conservation. P.3.E	**e** **Obtain, evaluate, and interpret data related to collisions (both elastic and inelastic) and their effects on both linear momentum and energy conservation.** P.3.E
Motion and Stability: Forces and Interactions	**Fluids** **Cause and Effect** 4 Use mathematics and computational thinking to analyze the effects of pressure changes and buoyant forces in fluid systems. P.4 **Fluids** **Scale, Proportion, and Quantity** **Fluids** **Systems and System Models** **Fluids** **Scale, Proportion, and Quantity** **Circular Motion** **Systems and System Models** 5 Develop and use models to analyze the circular motion of objects. P.5 **Circular Motion** **Scale, Proportion, and Quantity**

	Circular Motion	
	Systems and System Models	
Plan and carry out experiments to determine the density of objects. P.4.A	a	Plan and carry out experiments to determine the density of objects. P.4.A
Use and solve algebraic formulas to determine the relationships between pressure, force, area, and density. P.4.B	b	Use and solve algebraic formulas to determine the relationships between pressure, force, area, and density. P.4.B
Design solutions to determine the magnitude and direction of the buoyant force acting on an object and the effects of the buoyant forces on the object's motion. P.4.C	c	Design solutions to determine the magnitude and direction of the buoyant force acting on an object and the effects of the buoyant forces on the object's motion. P.4.C
Use the buoyant force acting on an object and free body diagrams to determine the acceleration of submerged objects. P.4.D	d	Use the buoyant force acting on an object and free body diagrams to determine the acceleration of submerged objects. P.4.D
Use mathematics and free-body diagrams to relate the tangential velocity, the radius of orbit, the centripetal acceleration, and force to each other for an object moving in a circle. P.5.A	a	Use mathematics and free-body diagrams to relate the tangential velocity, the radius of orbit, the centripetal acceleration, and force to each other for an object moving in a circle. P.5.A
Develop and use a model to describe the mathematical relationship between mass, distance, and force as expressed by	b	Develop and use a model to describe the mathematical relationship between mass, distance, and force as expressed by Newton’s law of universal gravitation. P.5.B

Newton's law of universal gravitation. P.5.B	
Energy	**Electricity**
	Scale, Proportion, and Quantity 6 Obtain, evaluate, and communicate information concerning static and current electricity. P.6
	Electricity
	Systems and System Models
	Electricity
	Scale, Proportion, and Quantity
	Electricity
	Systems and System Models
	Electricity
	Scale, Proportion, and Quantity
Develop and use a model to describe the mathematical relationship among charge, distance, and force as expressed by Coulomb's law. P.6.A	**a Develop and use a model to describe the mathematical relationship among charge, distance, and force as expressed by Coulomb's law.** P.6.A
Obtain, evaluate, and communicate information regarding the relationship among voltage, current, and power for direct current circuits. P.6.B	**b Obtain, evaluate, and communicate information regarding the relationship among voltage, current, and power for direct current circuits.** P.6.B
Create models of series, parallel, and mixed direct current circuits. P.6.C	**c Create models of series, parallel, and mixed direct current circuits.** P.6.C

Use mathematics and computational thinking to determine the voltage, current, and resistance for an entire circuit and at each resistor or load. P.6.D	**d Use mathematics and computational thinking to determine the voltage, current, and resistance for an entire circuit and at each resistor or load.** P.6.D
Waves and Their Applications in Technologies for Information Transfer	**Waves** **Scale, Proportion, and Quantity** 7 Obtain, evaluate, and communicate information regarding the propagation, properties, and applications of waves. P.7 a Use mathematics and computational thinking to describe the relationships among the velocity, frequency, and wavelength of a propagating wave. P.7.A **Waves** **Energy and Matter**
Use results of investigations to explain the production and characteristics of sound waves including interferences, the Doppler effect, and standing waves. P.7.B	**b Use results of investigations to explain the production and characteristics of sound waves including interferences, the Doppler effect, and standing waves.** P.7.B
Obtain, evaluate, and communicate information to explain the properties and behavior of electromagnetic waves. P.7.C	**c Obtain, evaluate, and communicate information to explain the properties and behavior of electromagnetic waves.** P.7.C