|  |  |
| --- | --- |
| **Unit 2 - Forces (7 weeks)** **OVERVIEW: This unit provides the students with an opportunity to develop an understanding of the physical ideas and concepts that were developed during the seventeenth century by Sir Isaac Newton. Throughout the unit the students are constantly asked to explain familiar phenomena and situations by utilizing the concepts of force, momentum, work, mass, acceleration, and velocity. Furthermore, embedded in the unit is the goal of strengthening skills that allow students to be able to read popular scientific literature and write scientific papers. This unit has a strong emphasis on students doing science by providing multiple opportunities for them to measure and observe different phenomena through laboratory settings or classroom activities. Furthermore, the unit takes the students on a fast trip towards the contemporary understanding of the different forces that shape our universe and to think about scenarios on how the universe would look if one of those forces were not present. The importance of making this connection is to prepare students for a deeper understanding of how our universe is put together not just at the macroscopic level (understanding of starts, solar systems and galaxies) but also at the microscopic level (understanding of atomic interactions that make the things that we commonly use work). The culminating activity gives the students the opportunity to use their understanding of the concepts studied thorough out the unit to proposed solutions to some of the challenges that future engineers and architects will have to solve as they design and build structures on the Moon or Mars.****FOCUS:** Newton’s Laws* Law of Universal Gravitational attraction

 Friction Centripetal Force* Circular Motion
* Rotational equilibrium

 Rotational Motion* Torque
* Static Equilibrium

 Introduction to work done by gravity and light* + - Work-Energy Theorem

**OBJECTIVES:*** + - Describe how force affects the motion of an object.
		- Explain the relationship between the motion of an object and the net external force acting on the object.
		- Determine the net external force on an object.
		- Calculate the force required to bring an object into equilibrium.
		- Describe an object’s acceleration in terms of its mass and the net force acting on it.
		- Identify action-reaction pairs.
		- Explain the difference between mass and weight.
		- Find the direction and magnitude of normal forces.
		- Identify where work is being performed in a variety of situations.
		- Identify situations in which conservation of mechanical energy is valid.
		- Relate the concepts of energy, time and power.
		- Explain the effects of machines on work and power.
		- Explain how the apparent existence of an outward force in circular motion can be explained as inertia resisting the centripetal force.
		- Explain how Newton’s law of universal gravitation accounts for various phenomena, including satellite and planetary orbits, falling objects, and the tides.
		- Describe Kepler’s laws of planetary motion.
		- Distinguish between torque and force.
		- Identify the six types of simple machines.

. |  |
| **Standards*** **Focus Standard:**
* **SP1. Students will analyze the relationships between force, mass, gravity, and the motion of objects**

a. Measure and calculate the magnitude of frictional forces and Newton’s three Laws of Motion. e. Measure and calculate the magnitude of gravitational forces. g. Measure and calculate centripetal force. h. Determine the conditions required to maintain a body in a state of static equilibrium. * **Supporting content Standards**
* **SP6. The students will describe the correction to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.**

d. Describe the gravitational field surrounding a large mass and its effect on a ray of light. * **SP2. Students will evaluate the forms and transformations of energy.**

a. Analyze, evaluate, and apply the principle of conservation of energy and measure the components of work-energy theorem by• describing total energy in a closed system. • identifying different types of potential energy. • calculating kinetic energy given mass and velocity. • relating transformations between potential and kinetic energy. b. Explain the relationship between matter and energy. * **SP1. Students will analyze the relationships between force, mass, gravity, and the motion of objects.**

a. Calculate average velocity, instantaneous velocity, and acceleration in a given frame of reference.* **SP3. Students will evaluate the forms and transformations of energy.**
* **All Characteristics of Science Standards apply**

**ELA Reading and Writing Standards (Common Core):** ELACC11-12RI1: Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.ELACC11-12RI7: Integrate and evaluate multiple sources of information presented indifferent media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.  | **Enduring Understandings*** Newton’s laws are the expression of the relationships of forces, mass and motion.
* Acceleration has a direct relationship to force and an inverse relationship to mass.
* Mass is a measure of the inertia of an object. An equivalent statement is mass is the amount of matter of which an object is
* made.
* Weight is defined as of the force of gravity on an object.
* In order for work to be done on an object, movement must occur in the direction of a net force.
* Friction can exist between objects that are not moving with respect to each other (static) as well as between objects that are moving (kinetic) unless it is a frictionless environment.
* Net force is the vector sum of the applied forces on an object.
* Centripetal force is a force that keeps an object traveling in a circular path.
* Torque is an angular equivalent of force and is a vector quantity.
* An object is in equilibrium when the sum of forces acting on it is zero.
* An object is in static rotational equilibrium when the sum of torques acting on it is zero.
* A gravitational force exists between any two masses. The magnitude of this force is directly proportional the product of the two masses and inversely proportional to the square of the distance between the centers of the two masses.
* Gravity is a force.
* Light in space is affected by a gravitational field.
* The velocity of an object in a circular trajectory is always changing. Therefore the object is accelerating.
* The momentum of a particle changes if a force acts on it for some length of time. The product of this force times the time that the force acts on the object is called the impulse

  |
| **Essential Questions*** Why do objects start or stop moving?
* How is it that we stay on the surface of the Earth instead of being crushed against it by the force of gravity or fly into space?
* Why is friction a good thing and bad thing for motion when motion occurs?
* Why don’t structures like buildings and towers collapse?
* Why does work require motion?
* How does an object’s momentum affect a collision?
* Why do you stay in your seat on a roller coaster when it goes upside down in an inverted loop?
* How does torque affect motion?
* How can you represent (graphs, diagrams, mathematical relationships, pictures, or word descriptions) forces and motion?
* Is mass the same as amount of matter present?
* What would the world be like if Newton’s first law was turned off?
* If forces always come in pairs, how can anything move?
* Will a wall move if a student leans on it?
* What causes the sensation of weight?
* Is friction a necessary ingredient in our world? Why or why not?
* Can frictional force cause an object to accelerate?
* The headlines declare “Los Angeles Lakers gaining Momentum.” How can this statement be explained in physics terms?
* How are collisions and explosions influenced by the law of conservation of momentum?
* Would a mounted sniper’s rifle have recoil?
* Why is it essential that collisions between molecules of air be elastic?
* Why is the conservation of kinetic energy for elastic collisions different from conservation of energy?
* How do linear and rotational phenomena relate?
* Why does an ice skater spin faster when she pulls in her arms?
* What is the difference between centripetal and centrifugal force and is centrifugal force real?
* Why does centripetal force never appear on a free body diagram?
* How does the rotational motion of an engine get transformed into the linear motion of a car?
* Do you want your engine to make horsepower or torque?
* How are energy and work related?
* Throughout history, how have springs enabled war and peace development?
* What would driving a car be like if it had no suspension system?
* Is power the same as strength for an athlete?
* How dangerous are falls?
* Could the engine in a car convert 100% of the energy in the gasoline it burns into usable work?
* Is the universe winding down in terms of energy?
 | **Key Vocabulary Terms/Language*** resultant
* equilibrants
* clockwise torque
* counterclockwise torque
* lever arm
* Rotational equilibrium (2nd condition of equilibrium)
* Translational equilibrium (1st condition of equilibrium)
* Rotational inertia
* Tangential velocity
* Angular velocity
* Pivot point
* Center of mass
* Work
* weight
* significant figures
* calculate
* experiment
* precision
* accuracy
* SI units
* describe
* scientific notation
* conclusion
* hypothesis
* data
* contrast
* compare
* variable
* infer
* analyze
* Predict
* interpret
* percent difference
* static friction
* kinetic friction
* coefficient of friction
* vector quantity
* scalar quantity

 |
| **Misconceptions*** The state of rest is fundamentally different from the state of motion.
* Constant motion requires a constant force.
* If a body is not moving there is no force acting on it.
* The tension in a string is not a force.
* Motion follows the path of the stronger force on an object.
* Action-reaction forces act on the same object.

 * All objects can be moved with equal ease in the absence of gravity.
* Faster moving objects have larger forces acting on them; slower moving objects have smaller forces acting on them.

 * If the acceleration is zero, there is no force.
* The normal force on an object is equal to the weight of the object.

 * Equilibrium means all the forces on an object are equal.
* Once an object is moving, objects with greater mass push more than objects with less mass.
* Newton's third law is not always true.
* The Moon is not experiencing free fall.
* The force that acts on apple that falls to the ground is not the same as the force that acts on the moon.
* Gravitational force is the same on all falling bodies.
* Gravitational forces do not exist in space.
* An object moving in a circle with constant speed has no acceleration.
* An object moving in a circle will continue in circular motion when released.
* Light always travels in straight lines.
* Weight and mass are the same.
 | **Proper Conceptions*** Rest is a special case of motion. This is newton’s First Law: unless a force acts on the object, it will tend to stay at rest or in motion.
* Newton’s first law states that due to the property of inertia, a moving object resists changes in its state of motion.
* Bodies at rest are in a state of static equilibrium due to no net force acting on them or the sum of the forces acting on the body is zero.
* Tension in a string is a force.
* The direction of motion of an object is dictated by the direction of the net force in combination with the direction of the pre-existing motion.
* The paired action-reaction forces act on different objects
* To change the state of motion or rest of an object a force proportional to its mass must be applied.
* For objects of the same mass, acceleration will vary directly with an applied force. Changes in velocity are proportional to the force, but the actual velocity is not proportional to the force.

* If the acceleration is zero, the net force is zero.
* The normal force on an object is equal to the weight of the object only if it’s on a horizontal surface.
* Equilibrium means the sum of all the forces is zero.
* Once an object is moving, objects with greater change in momentum push more than objects with less change in momentum. The pushing dependents of mass and velocity and the rate at which they change.
* Newton’s third law is always true.
* Because the Moon is attracted by Earth’s gravitational force, the Moon is free falling towards Earth. However, due to the Moon’s orbital velocity, the moon revolves around the Earth on a nearly circular orbit.
* The same gravitational force that makes the apple fall attracts the Moon towards Earth.
* Gravitational force (weight) varies inversely with the square of the distance between the centers of the two masses and the force is directly proportional to the mass of the object falling. However, the gravitation is the same.
* Gravitational forces do exist in space. The gravitational force varies as the inverse of the square of the distance from the **object.** Therefore, as objects move away from Earth the gravitational force becomes smaller and smaller both does not completely disappears. For example the reason that planets orbit stars is the gravitational attraction that the stars exert on the planets.
* Acceleration is the rate of change of velocity and velocity is a vector. In a circular motion the direction of the velocity is always changing, hence there is always acceleration.
* Once released, the object will initially move in a trajectory tangential to the original circular path according to Newton’s First Law.
* Light can be bent by the action of the gravitational field of a very massive object.
* Weight is a force that is the gravitational force on object. Mass is the amount of matter of an object.
 |
| **Unit Requirements****Teacher notes: Mandatory Tasks:*** **MANDATORY Culminating Performance Task 1: Newtonian Vehicle (See Performance Task Folder )**
* **MANDATORY Unit Writing Performance Task 2 (See Performance Task Folder for rubric guidelines)**

**Performance Task 2:** Develop a comprehensive guide on safety and protection at home, school or community which integrates the laws of motion in a clear, practical/applicable manner to demonstrate transfer of knowledge. Students should evaluate their product/performance.* **Suggested Culminating Performance Tasks (See Performance Task Folder)**
* A Cut Above the Rest
* Frictional Force
* Rube Goldberg Machine (All 4 titles)
* Swinging
* Wigwag
* **Unit Assessment with Blueprint and DOK levels**
* Teacher notes: Unit assessment will be uploaded to Thinkgate website in accordance with assessment calendar for Physics
 |  |
| **Section 1 - \_\_Forces and the Laws of Motion\_\_\_ (3 weeks)** |  |
| **Learner Targeted Objectives and Goals*** Describe how force affects the motion of an object.
* Interpret and construct free-body diagrams.
* Explain the relationship between the motion of an object and the net external force acting on the object.
* Determine the net external force on an object.
* Calculate the force required to bring an object into equilibrium.
* Describe an object’s acceleration in terms of its mass and the net force acting on it. Predict the direction and magnitude of the acceleration caused by a known net force.
* Identify action-reaction pairs.
* Describe an object’s acceleration in terms of its mass and the net force acting on it.
* Predict the direction and magnitude of the acceleration caused by a known net force.
* Identify action-reaction pairs.
* Explain the difference between mass and weight.
* Find the direction and magnitude of normal forces.
* Describe air resistance as a form of friction.
* Use coefficients of friction to calculate frictional force.
* Explain how Newton’s law of universal gravitation accounts for various phenomena, including satellite and planetary orbits, falling objects, and the tides.
* Apply Newton’s law of universal gravitation to solve problems
* **Research Laboratory Investigations –(See Laboratory Activity Folder)**
* **Force Distribution Lab**
* **Forces Lab: Squeezing, Stretching, Bending, Sliding and Twisting.**

(This lab simplifies the real-life forces and actions that affect structures, in order to illustrate key concepts; includes animated drawing.* **Teacher Notes: Rationale: Content lab investigations**– can be used to target students’ misconceptions at the inception of a lesson. Employment of content lab investigations prior to instruction will 1)reveal students’ entry level conceptions and understanding 2)create the necessary conceptual conflict between students’ alternate conceptions and the proper conception 3) reveal erroneous assumption that students understand based on the words that they use to describe physical phenomena such as motion. Content lab investigations can be used to inform instruction which results in changing of students’ misconceptions.

**See Physics Worksheets PDF in Laboratory Activities Folder for Following Content Labs**Building a Model Bridge – P1A- P3AworksheetsWhat Keeps Things Moving? – P5A worksheetInvestigating Friction – P5B worksheetInvestigating Frictionless Motion – P5C worksheetUnbalanced Forces – P5D worksheetKinetic Energy – P6A worksheet (sides 2 & 3)Free-fall – P7A worksheetUsing a Ramp – P8B worksheet* **Writing Activity (See Writing Activities Folder)**

Writing prompt documentWriting Rubric* **Case Study Review (See Case Study Folder, Unit 3 Case Studies document)** in which students are allowed to explore real-life situations and connect to standards learned. Organization of case studies is as follows: 1st link – Case details, 2nd link – Student materials, 3rd link – Teacher materials
* **Literature Review Activity (See Literature Review Activity Folder)**

**MANDATORY** - Triangular snowflakes | **Knowledge and Skills****Learners will know:*** Cause of Motion
* Newton’s laws of motion
	+ Force and Inertia: the first law
	+ Force, mass, and acceleration: the second law
	+ Action and reaction: the third law
* Momentum and the laws of motion
* The law of universal gravitation
* Forces and the Laws of Motion

1. Mass, weight and gravity2. Friction3. Equilibrium* Implications of the Laws of Motion on Safety and Protection

**Learners will be able to:**Describe motion occurring in their daily activities* Predict how the laws of motion relate to one’s safety and protection.
* Design and conduct experiments
* Use appropriate techniques to gather, analyze, and interpret data
* Develop descriptions, explanations, predictions, and models using evidence
* Think critically and logically to make the relationships between evidence and explanations
* Recognize and analyze alternative explanations and predictions
* Communicate scientific procedures and explanations
* Compare and contrast motion concepts
* Observe and infer motion activities
* **Common Assessment with Blueprint and DOK levels ( See Assessment Folder)**

Standardized Prep AssessmentForcesAlternate Assessment* PowerPoint/Prezi note

<http://prezi.com/explore/search/?search=newton+laws+of+motion><http://prezi.com/explore/search/?search=friction><http://prezi.com/explore/search/?search=inertia><http://prezi.com/explore/search/?search=equilibrium>* More Power-Points (See Other Supporting Resources Folder)
* Supplemental Worksheets/Resources (See Other Supporting Resources Folder)

Rotational Equilibrium* Gizmo simulations
* Gravity Pitch

<http://www.explorelearning.com/index.cfm>?* 2D Collisions ( Gizmo includes information on center of mass)

<http://www.explorelearning.com/index.cfm>?* Project express video: \*Create Teacher Account

<https://www.georgiastandards.org/_layouts/GeorgiaStandards/login.aspx?ReturnUrl=%2fresources%2fPages%2fVideos%2fProjectExpressScienceVideos.aspx>* Bell Ringer activities (See Bell-Ringer Folder)

Force Questions GCSE powerpointVertically Challenged (bellringer activities)   |
| **Section 2 - \_\_\_Work and Energy\_\_\_\_\_\_\_ ( 2.5 weeks)** |  |
| **Learner Targeted Objectives and Goals*** Recognize the difference between the scientific and ordinary definitions of work.
* Define work by relating it to force and displacement.
* Identify where work is being performed in a variety of situations.
* Calculate the net work done when many forces are applied to an object.
* Identify several forms of energy.
* Calculate kinetic energy for an object.
* Apply the work–kinetic energy theorem to solve problems.
* Distinguish between kinetic and potential energy.
* Classify different types of potential energy.
* Calculate the potential energy associated with an

object’s position.* Identify situations in which conservation of mechanical

energy is valid.* Recognize the forms that conserved energy can take.
* Solve problems using conservation of mechanical energy.
* Relate the concepts of energy, time, and power.
* Calculate power in two different ways.
* Explain the effect of machines on work and power.
* Distinguish between torque and force.
* Calculate the magnitude of the torque on an object.
* Identify the six types of simple machines.
* Calculate the mechanical advantage of a simple machine.
* **Case Study Review (See Case Study Folder, Unit 3 Case Studies document)**  students are allowed to explore real-life situations and connect to standards learned. Organization of case studies is as follows: 1st link – Case details, 2nd link – Student materials, 3rd link – Teacher materials
 | **Knowledge and Skills****Learners will know:*** **Energy Transfer**

Energy operational definition, spontaneous and non-spontaneous/deliberate energy transferLaw of Conservation of EnergyKinetic and potential energyHeat – conduction, convection and radiationWorkPowerEfficiency of MachinesPower rating of electrical appliancesEnergy use and sources in the community, country and the world* **Human Activities That Impact on the Thermal Environment**
* **Conserving Energy and Energy Resources**

**Learners will be able to:*** Demonstrate relationships between and among closely related science principles in energy
* Suggest examples of observations that suggest a science principle
* Gather, synthesize and evaluate energy and energy related information from multiple sources
* Apply principles of scientific data to anticipate the effects of technological design decisions
* Communicate results of experiments or studies
* **Common Assessment with Blueprint and DOK levels ( See Assessment Folder)**
* [notion of torque](http://www.nationalstemcentre.org.uk/elibrary/file/8985/Physics%20Worksheets%20pdf.pdf)
* Rubric: [Diagram](https://ccpsshare.clayton.k12.ga.us/academicpath/Documents/Science/Physics/Unit%202_Forces/2nd-%20Unit%20Overview/Six%20flags%20over%20georgia.docx)
* Work and Energy Assessment
* Work and Energy assessment
* Unit Assessment
* Gizmo simulations
* Torque and Moment of Inertia

<http://www.explorelearning.com/index.cfm>?* Levers

<http://www.explorelearning.com/index.cfm>?* Inclined Plane - Simple Machine

<http://www.explorelearning.com/index.cfm>?* Pulley Lab

<http://www.explorelearning.com/index.cfm>?* Wheel and Axle

<http://www.explorelearning.com/index.cfm>?* PowerPoint/Prezi note

[http://prezi.com/explore/search/?search=torque](http://www.physicsclassroom.com/lab/energy/Elabs.cfm?search=torque) * Project express video: \*Create Teacher Account

<https://www.georgiastandards.org/_layouts/GeorgiaStandards/login.aspx?ReturnUrl=%2fresources%2fPages%2fVideos%2fProjectExpressScienceVideos.aspx>* Honda Rube Goldberg Video (See supplemental resources folder)
* Virtual Energy phet simulation Activity (See Supplemental resources Folder)
* Handout – Potential energy and conservative forces (See Supplemental Resources Folder)
 |
| **Section 3 - \_\_\_Circular Motion and Gravitation\_\_(1.5 weeks)** |  |
| **Learner Targeted Objectives and Goals*** Solve problems involving centripetal acceleration.
* Solve problems involving centripetal force.
* Explain how the apparent existence of an outward force in circular motion can be explained as inertia resisting the centripetal force.
* Explain how Newton’s law of universal gravitation accounts for various phenomena, including satellite and planetary orbits, falling objects, and the tides.
* Describe Kepler’s laws of planetary motion.
* Relate Newton’s mathematical analysis of gravitational force to the elliptical planetary orbits proposed by Kepler.
* Solve problems involving orbital speed and period.
* Describe Kepler’s laws of planetary motion.
* Suggested Laboratory Activity – Lady Bug Rotational Kinematics (See Laboratory Activity Folder)
 | **Knowledge and Skills****Learners will be able to:**Describe motion occurring in their daily activitiesPredict how the laws of motion relate to one’s safety and protection.Design and conduct experimentsUse appropriate techniques to gather, analyze, and interpret dataDevelop descriptions, explanations, predictions, and models using evidenceThink critically and logically to make the relationships between evidence and explanationsRecognize and analyze alternative explanations and predictionsCommunicate scientific procedures and explanationsCompare and contrast motion conceptsObserve and infer motion activities* **Common Assessment with Blueprint and DOK levels ( See Assessment Folder)**

Circular Motion Standardized TestChap\_b\_(8)* Gizmo simulations
* Uniform Circular Motion

<http://www.explorelearning.com/index.cfm>?* PowerPoint/Prezi notes (See supplemental resources folder for additional powerpoints)

[http://prezi.com/explore/search/?search=centripetal+acceleration](http://www.nationalstemcentre.org.uk/elibrary/file/8985/Physics%20Worksheets%20pdf.pdf?search=centripetal+acceleration)Gravity and Circular [Motion](http://www.physicsclassroom.com/lab/circgrav/CG4tg.pdf) * Project express video: \*Create Teacher Account

<https://www.georgiastandards.org/_layouts/GeorgiaStandards/login.aspx?ReturnUrl=%2fresources%2fPages%2fVideos%2fProjectExpressScienceVideos.aspx>* Supplemental Worksheets/Resources (See Supplemental Resources Folder)

Rotational EquilibriumTranslational rotational analogies |
| * **MANDATORY Writing Activity** (See Writing Activities Folder)
* Worksheet P1C– Looking at Bridges
* **Literature Review Activity** (See Literature Review Activity Folder)

Wrong-Way Planets**MANDATORY** - Wetdog PhysicsHold on to your stars**Supplemental Resources*** Graphic Organizers – Authentic engagement for learning science vocabulary: concept maps and other graphic organizers. Graphic organizers allow for visualization of concepts/terms to increase understanding/comprehension of science vocabulary.
* <http://www.mysciencebox.org/forcesbox/blockplan>

**Lesson 4**: Students work cooperatively to complete a graphic organizer of information on forces or related ideas: gravity, weight, friction, static friction, sliding friction, air resistance, tension, and compression.  Each student in the group will read about two forces, complete accompanying sections of the organizer, and teach the information to the other students.Strategies: Productive questioning, cooperative learning, reciprocal teaching* **Generic rubric for concept map development (See Supplemental Resources Folder)**
* GRASPS activities (See Supplemental Resources folder)

Sailing With the Wind**Differentiation*** **What activities and strategies are included to address the Exceptional Education Student?**

**Case Details**

|  |  |
| --- | --- |
| **Case Title:**  |  |
|  | Blackout |
| **Author(s):**  |  |
|  | Betul Kacar, Emory UniversityDavid Schaar, Decatur HS |
| **Date Published:**  |  |
|  | 9/29/2008 |
| **Grade Level(s):**  |  |
|  | High School |
| **Subject(s):**  |  |
|  | Physics |
| **Summary:**  |  |
|  | The worst power outage in US history gives Alex a chance to make some money. Will his plan for alternative energy win over the judges? |
| **Suggested Citation:**  |  |
|  | Kacar, B., & Schaar, D. A. (2008).*Blackout*. Retrieved May 14, 2012 from Emory University, CASES Online Web site: http://www.cse.emory.edu/cases/casedisplay.cfm?case\_id=1003 |
| **Notes:**  |  |
|  | Implemented Spring 2007 in College Preparatory freshman physics class with inclusion of students with special needs. (See Case Study Folder) |
| **Learning Objectives:**  |  |
|  | 1. Calculate power usage in kilowatt hours.
2. Calculate and communicate power usage for a chosen city, often extrapolating from state or national consumption figures.
3. Identify sustainable sources of power and cite examples appropriate for the geographic region they choose to transform.
4. Present a coherent plan for meeting the power needs of their chosen municipality using only sustainable energy sources.
5. Calculate the rough number and cost of power generation equipment required to put a plan into effect.
 |
| **State Standards:**  |  |
|  | *Georgia Performance Standards*SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science. SCSh3. Students will identify and investigate problems scientifically. SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations. SCSh6. Students will communicate scientific investigations and information clearly. SCSh9. Students will enhance reading in all curriculum areas by: (NSES Content Standard A) a. Reading in All Curriculum Areas: Read both informational and fictional texts in a variety of genres and modes of discourse, Read technical texts related to various subject areas c. Building vocabulary knowledge: Demonstrate an understanding of contextual vocabulary in various subjects, Use content vocabulary in writing and speaking, Explore understanding of new words found in subject area texts. d. Establishing context: Explore life experiences related to subject area content, Discuss in both writing and speaking how certain words are subject area related.SP3. Students will evaluate the forms and transformations of energy. SP5. Students will evaluate relationships between electrical and magnetic forces.  |

 | **Supplemental Resources*** Links to Ga DOE framework and ELA standard
* <https://www.georgiastandards.org/Frameworks/GSO%20Frameworks/9-12%20Science%20Traditional%20Physics%20Framework%20Forces.pdf>
* ELA Grade 11 Common Core Standards (See Course Documents and YAG Folder)
* Supporting resources aligned to the unit of study

A compendium of websites for circular motion. Includes simulations, videos, labs, etc.* [http://website-tools.net/google keyword/word/circular+motion+activities](http://website-tools.net/google%20keyword/word/circular%2Bmotion%2Bactivities)
* [http://website-tools.net/google-keyword/word/centripetal+acceleration](http://website-tools.net/google-keyword/word/centripetal%2Bacceleration)
* **Flash Animations for Physics**

<http://www.upscale.utoronto.ca/GeneralInterest/Harrison/Flash/> * **Video Clips and Animations**

<http://www.animations.physics.unsw.edu.au/?search=newton+laws+of+motion>* **Activity-Based Physics (ABP) Alternative Homework Assignments (AHAs) Problem**

<http://www.folksemantic.com/visits/72981>* **Lesson Module on Forces and Movement**
* [http://www.nationalstemcentre.org.uk/elibrary/resource/2149/theme-6-movement](https://ccpsshare.clayton.k12.ga.us/academicpath/Documents/Science/Physics/Unit%202_Forces/2nd-%20Unit%20Overview/Physics%20Worksheets%20pdf.pdf)

 * Textbook pages correlated to the standard(s) addressed
* Holt, pp. 120-124
* Holt, pp. 125-128
* Holt *Laboratory Experiments*, pp. 19-20
* Holt, pp. 129-134
* Lab: Holt, pp. 152-155
* Holt *Laboratory Experiments*, pp. 20-21
* Holt, pp. 135-143
* Holt *Laboratory Experiments*, pp. 22-24
* Holt, pp. 234-236, 898-903
* Holt, pp. 236-247
* Holt *Laboratory Experiments*, pp. 31-34
* Holt, pp. 254-257
* Holt *Laboratory Experiments*, pp. 35-36
* Bell Ringer activities (See Bell-Ringer Folder)
* Gizmo simulations (All Gizmos can be accessed at explorelearning.com
* Gravity Pitch

<http://www.explorelearning.com/>* 2D Collisions ( Gizmo includes information on center of mass)

<http://www.explorelearning.com/index.cfm>?* Uniform Circular Motion

<http://www.explorelearning.com/index.cfm>? * Torque and Moment of Inertia

<http://www.explorelearning.com/index.cfm>?* Levers

<http://www.explorelearning.com/index.cfm>?* Inclined Plane - Simple Machine

<http://www.explorelearning.com/index.cfm>?* Pulley Lab

<http://www.explorelearning.com/index.cfm>?* Wheel and Axle

<http://www.explorelearning.com/index.cfm>?* PowerPoint/Prezi notes

<http://prezi.com/explore/search/?search=newton+laws+of+motion>[http://prezi.com/explore/search/?search=friction](https://ccpsshare.clayton.k12.ga.us/academicpath/Documents/Science/Physics/Unit%202_Forces/2nd-%20Unit%20Overview/SkyIsFalling_SM.pdf?search=friction)[http://prezi.com/explore/search/?search=centripetal+acceleration](http://www.nap.edu/catalog.php?search=centripetal+acceleration)[http://prezi.com/explore/search/?search=inertia](http://www.iteaconnect.org/TAA/PDFs/ListingofSTLContentStandards.pdf?search=inertia)[http://prezi.com/explore/search/?search=torque](http://www.physicsclassroom.com/lab/vectproj/VP7tg.pdf?search=torque)[http://prezi.com/explore/search/?search=equilibrium](http://www.scholastic.com/createvideogames/?search=equilibrium)* Project express video: \*Create Teacher Account

[https://www.georgiastandards.org/\_layouts/GeorgiaStandards/login.aspx?ReturnUrl=%2fresources%2fPages%2fVideos%2fProjectExpressScienceVideos.aspx](http://www.gamestarmechanic.com/teachers?ReturnUrl=/resources/Pages/Videos/ProjectExpressScienceVideos.aspx)* Seeds of Science books or strategy guides

**Differentiation*** **What activities and strategies are included to address the English Language Learner?** [**Refer to WIDA standards**](http://www.wida.us/standards/ELP_StandardLookup.aspx)
* **What activities and strategies are included to address the Gifted/Advanced Learner?**
* Teacher notes: Gifted PBA **Teacher notes: Gifted**
* Students can learn a large number of skills while having fun making video games and animations. These skills can include: programming, math, creative thinking, literacy skills, logic, and engineering. Video game and digital animation correspond to a number of national STEM standards. A partial list of the STEM standards and skills integral to programming games and animations can be found at the following websites
* <http://www.nap.edu/catalog.php?record_id=13165>.
* <http://www.iteaconnect.org/TAA/PDFs/ListingofSTLContentStandards.pdf>
* Additional STEM standards can be incorporated by having students create games that incorporate physical principles like gravity and friction.
* Programming Languages Websites

<http://www.alice.org/><http://www.scholastic.com/createvideogames/><http://www.gamestarmechanic.com/teachers?cid=scibud><http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=18229><http://info.scratch.mit.edu/Educators><http://education.mit.edu/projects/starlogo-tng/learn><http://activategames.org/teaching-materials>* Lesson Module on Forces and Movement
* <http://www.nationalstemcentre.org.uk/elibrary/resource/2149/theme-6-movement>
* Force Vectors Laboratory Activity (See Supplemental Resources Folder, Physics\_1\_CAS (PDF file), pages 122-125)
* Rocket Races Culminating Project (See Supplemental Resources Folder, Physics\_1\_CAS (PDF file), pages 120-121
* Dance\_Physics PDF (See Supplemental Resources Folder)
* Teacher notes: Gifted Writing Assignment
* <http://production-app2.ibo.org/publication/19/part/4/chapter/21>

**Common Assessments*** (See individual sections for common assessments)

 * turning point or other audience response activities

Force Questions GCSE powerpoint (See bellringer folder)  |