

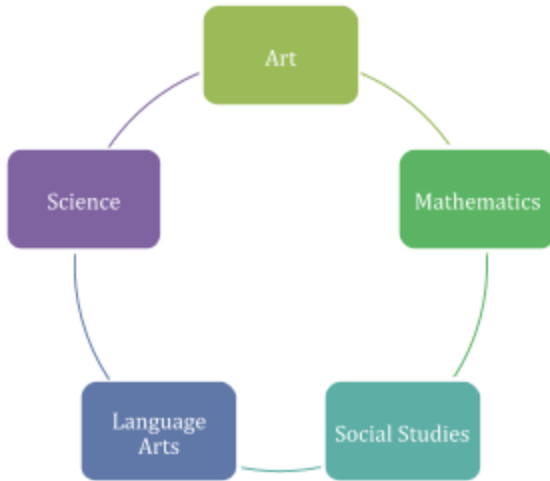
# STEM School Chattanooga

## 9<sup>th</sup> Grade PBL

### Unit Plan Template

## Unit 5: Dynamics

### Learning Target Topics



Art I: Plan and produce a work combining technologies, media, and processes of visual art with those of another discipline.

Algebra I: Solve quadratic equations in one variable.  
 Geometry: Apply geometric concepts in modeling situations;

English I: Write narratives to develop experiences; Use digital media to enhance understanding and interest; Adapt speech to concept or task.


Physical World Concepts: Analyze and apply Newton's three laws of motion; Investigate kinematics and dynamics.

World History: Research historical information; Write arguments to support a claim.

Grade Level	9 <sup>th</sup> Grade	Unit Length	3 Weeks
Unit Overview	The Unit 5 PBL on dynamics will introduce students to the essential concepts underlying the principles of movement and conservation of energy. Along with the study of motion, students will construct a variety of catapult launching devices to test Newton's Laws and acceleration due to gravity and interpret the results of the quantitative data, using digital fabrication in the final designs and documenting their process in a video documentary. Students will then demonstrate their design process, final design, and functionality of the launching device in a Catapult Challenge Competition.		
Unit Essential Issue	<ul style="list-style-type: none"> <li>• Strand: Dynamics</li> </ul>		
Culminating Events	<p>For the Unit 5 PBL, the students will work collaboratively in groups of 4-5. Student teams will research and design a catapult launching device. They will then sketch and build various models of their design, using digital fabrication for the models. Student groups will demonstrate the launching device in a Catapult Challenge Competition to observe the effects of Newton's Laws and acceleration due to gravity. Students will also create a video documentary, including weekly prototype report clips documenting the fabrication process, testing, and final design reflection.</p> <p><b>Catapult Challenge Competition - April 13</b>          The culminating event for this PBL is a Catapult Challenge Competition demonstrating the constructed launching devices. The following items will be turned in as part of the assessment:</p> <ul style="list-style-type: none"> <li>• Video Documentary on the Catapult Design, Fabrication Process and Reflection</li> <li>• Catapult Launching Device and Prototypes</li> <li>• Written argumentative report justifying the team's choice of design</li> <li>• PWC Catapult Physics Worksheet</li> <li>• Algebra AD graphed either on paper or digitally</li> </ul>		

- The following items will be assessed by the appropriate content area teacher:
- Algebra I/Geometry: Correct use of the mathematical learning targets in the design and launch of the catapult.
  - Physical World Concepts: The research and analysis of the physics of the machines in the Catapult Physics Worksheet
  - English I: Use of the Launching Device Documentary Video to document the building process, testing, and final design of the catapult launching device.
  - Art: Form and balance in the model and aesthetics in the launching device design plan.
  - World History: Research, citation, and use of analysis of historical content in the research-based argumentative writing supporting their chosen launching device type.

Common Assessment

Common Assessment			<h2 style="margin: 0;">STEM PBL Rubric</h2>		PBL Unit: _____ Student: _____ Date: _____
			<b>Advanced</b>	<b>Proficient</b>	<b>Needs Improvement</b>
	<b>Math Components: Algebra I</b>	<ul style="list-style-type: none"> <li>● Students will predict the angles for release point that is optimal to achieve a launch covering the longest distance.</li> <li>● Prediction must be graphed and supported using mathematical evidence and terminology.</li> </ul>	<ul style="list-style-type: none"> <li>● Students will explain the equation that shows the trajectory of a projectile launch in the video documentary.</li> <li>● Students will explain the function that would describe it.</li> </ul>		
	<b>Math Components: Geometry</b>	<ul style="list-style-type: none"> <li>● Student can alter the scale of an existing catapult or trebuchet design.</li> <li>● Completed design using TinkerCad</li> </ul>	<ul style="list-style-type: none"> <li>● Student can design to scale a catapult which satisfies specified physical constraints.</li> <li>● Completed design using TinkerCad</li> </ul>		
	<b>Science Components: Physical World Concepts</b>	<ul style="list-style-type: none"> <li>● Include in the video documentary footage from your final prototype.</li> <li>● Include and point out in the documentary the following terms used correctly to describe what is happening in the video documentary:               <ul style="list-style-type: none"> <li>○ Newton's 3 Laws</li> <li>○ Accuracy vs Precision</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Students will create a catapult or trebuchet suitable for launching a marshmallow.</li> <li>● Students will build the machine based using no automated parts or kits.</li> <li>● Complete PWC Catapult Worksheet</li> </ul>		
	<b>Language Arts Components: English I</b>	<ul style="list-style-type: none"> <li>● Students will use innovative digital and video elements to tell the story of their launching device design and construction.</li> <li>● Video includes an analysis of the designs through successes, failures, and predictions for the next design.</li> <li>● Videos will include personal interviews from team member(s) about roles, struggles, and/or successes.</li> </ul>	<ul style="list-style-type: none"> <li>● Video documents the design and construction process, from first to final design, in weekly prototype clips.</li> <li>● Students will include reflections and next steps in the weekly prototype clips.</li> <li>● Students will use speech and domain-specific vocabulary in the video that is appropriate to the task and purpose.</li> </ul>		
	<b>Social Studies Components: World History</b>	<ul style="list-style-type: none"> <li>● Accurately and effectively presents important details from reading materials to develop argument or claim.</li> <li>● Presents thorough and detailed information to effectively support and develop the focus, controlling idea, or claim.</li> </ul>	<ul style="list-style-type: none"> <li>● Accurately presents details from reading materials relevant to the purpose of the prompt to develop argument or claim.</li> <li>● Presents appropriate and sufficient details to support</li> </ul>		

		<ul style="list-style-type: none"> <li>Integrates relevant and accurate disciplinary content with thorough explanations that demonstrate in-depth understanding.</li> </ul>	<p>and develop the focus, controlling idea, or claim.</p> <ul style="list-style-type: none"> <li>Accurately presents disciplinary content relevant to the prompt with sufficient explanations that demonstrate understanding.</li> </ul>	
	<p>Art Components: Art I</p>	<ul style="list-style-type: none"> <li>Model must perform task effectively.</li> <li>Two or more different digital fabrication elements.</li> <li>Analyze the process of building the model as you use the fabrication processes in the documentary video.</li> </ul>	<ul style="list-style-type: none"> <li>Final model will be assessed on their use of form.</li> <li>Final model must be free-standing and visually balanced.</li> <li>Final model must have one element of digital fabrication.</li> </ul>	
	<p>Minimum Requirement Components: <b>Must be included to be graded</b></p>	<p>Algebra:</p> <ul style="list-style-type: none"> <li>Quadratic equation that relates to the launch of the designed catapult with variables defined.</li> </ul> <p>Geometry:</p> <ul style="list-style-type: none"> <li>A two-dimensional design of the graph must be completed using Tinker Cad.</li> </ul> <p>English I:</p> <ul style="list-style-type: none"> <li>The Documentary video must include ORIGINAL still images or live video of your launching device and fabrication process.</li> <li>Video should be no more than 5 minutes long.</li> <li>Students must turn in a copy of the Documentary Video to the English I PBL assignment in Google Classroom.</li> </ul> <p>PWC:</p> <ul style="list-style-type: none"> <li>Machine must fit the size requirements mentioned in the pacing guide.</li> </ul> <p>Art:</p> <ul style="list-style-type: none"> <li>Model must be sturdy and well put together within the size standards.</li> </ul> <p>World History:</p> <ul style="list-style-type: none"> <li>Argumentative report should be a minimum of 2 paragraphs long.</li> <li>Must have at least one primary and/or secondary sources.</li> </ul>		
<p>Unit Learning Targets</p>	<p>Algebra 1:</p> <ul style="list-style-type: none"> <li>I can use the quadratic equation to model and solve problems.</li> <li>I can reason quantitatively and use units to solve problems.</li> <li></li> </ul> <p>Geometry:</p> <ul style="list-style-type: none"> <li>I can apply geometric concepts in modeling situations.</li> <li>I can visualize relationships between two-dimensional and three-dimensional objects.</li> </ul> <p>PWC:</p> <ul style="list-style-type: none"> <li>I can use Newton's Laws to describe the relationships of objects in motion.</li> <li>I can use mechanics to measure, calculate, describe, and represent the motion and energy of an object.</li> </ul> <p>English I:</p> <ul style="list-style-type: none"> <li>I can write narratives to develop real or imagined experiences or events using effective techniques, well-chosen details, and well-structured event sequences.</li> <li>I can make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</li> </ul> <p>Art:</p> <ul style="list-style-type: none"> <li>I can plan and produce a work combining technologies, media, and processes of visual art with those of another discipline.</li> <li>I can synthesize the use of expanded media, techniques, and processes to create a model form in a specific medium.</li> <li>I can analyze and employ different types of media, techniques, and processes used to create various</li> </ul>			

art forms .

World History:

- I can write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- I can gather information from multiple sources, assessing the usefulness of each source and integrating information into the text successfully, avoiding plagiarism and following a standard format for citation.;

Vocabulary

Math: Algebra I	<ol style="list-style-type: none"><li>1. Quadratic Equation</li><li>2. Vertex</li><li>3. Parabola</li><li>4. Projectile</li></ol>
Math: Geometry	<ol style="list-style-type: none"><li>1. Efficiency</li><li>2. Tension</li><li>3. Compression</li><li>4. Congruence</li><li>5. Similarity</li></ol>
Science: Physical World Concepts	<ol style="list-style-type: none"><li>1. Vector</li><li>2. Velocity</li><li>3. Acceleration</li><li>4. Impulse</li><li>5. Momentum</li><li>6. Inertia</li><li>7. Projectile</li></ol>
Language Arts: English I	<ol style="list-style-type: none"><li>1. Documentary</li><li>2. Fabrication</li><li>3. Predictions</li></ol>
Social Studies: World History	<ol style="list-style-type: none"><li>1. Analysis</li><li>2. Literary Support</li><li>3. Logical Fallacies</li><li>4. Disciplinary Content</li></ol>
Art: Art I	<ol style="list-style-type: none"><li>1. Aesthetic</li><li>2. Form</li><li>3. Freestanding</li><li>4. Balance</li></ol>