

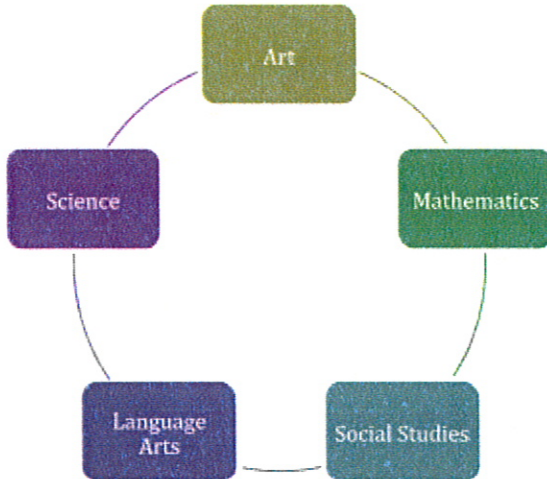
STEM School Chattanooga

9th Grade PBL

Unit Plan Template

Unit 3: Dynamics

Learning Target Topics



Art I: Examine materials, technologies, processes, and terminology used in visual art and integrate visual art ideas, issues, and themes.

Algebra I: Analyze the effects of applying translations to transform a graph.

Geometry: Apply geometric concepts in modeling situations; Represent transformations as functions using coordinates.

English I: Write arguments to support claims; Gather, evaluate, and cite information from research sources; Demonstrate command of standard English grammar, spelling, capitalization, and punctuation in writing.

Physical World Concepts: Analyze and apply Newton's three laws of motion; Investigate kinematics and dynamics; Investigate and apply Archimedes's, Pascal's and Bernoulli's principles.

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


| Grade Level | 9 th Grade | Unit Length | 3 Weeks |
|----------------------|---|-------------|---------|
| Unit Overview | The Unit 3 PBL on dynamics will introduce students to the essential concepts underlying the principles of movement and conservation of energy. Students will also apply algebraic and geometric concepts related to transformations on a coordinate plane to collaboratively design and build a life-size maze. Along with the study of motion, students will construct a Pumpkin Chunkin' launching device to test Newton's Laws and acceleration due to gravity and interpret the results of the quantitative data. Students will then demonstrate their design process, final design, and functionality of the launching device in a Pumpkin Chunkin' Contest. | | |
| Unit Essential Issue | <ul style="list-style-type: none"> Strand: Dynamics | | |
| Culminating Events | <p>For the Unit 3 PBL, the students will work collaboratively in groups of three. Student teams will research and design a Pumpkin Chunkin' launching device and a life-size maze. They will then write an Engineering Design Report and build a model of their design. Student groups will also participate in the life-size maze and demonstrate the launching device in a Pumpkin Chunkin' contest to observe the effects of Newton's Laws and acceleration due to gravity.</p> <p>Pumpkin Chunkin' Contest and Maze – Week of November 14th</p> <p>The culminating event for this PBL is a Pumpkin Chunkin' Contest demonstrating the constructed launching devices and maneuvering through the life-size mazes. The following items will be turned in as part of the assessment:</p> <ul style="list-style-type: none"> Engineering Design Report | | |

- Argumentative Writing Essay on the Pumpkin Launching Device Design Choice
- Pumpkin Chunkin' Constructed Launching Device
- Design and Construction of a 7'x7' Section of a Life-Size Maze

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 of the 7'x7' maze section.
- Physical World Concepts: The effectiveness of the launching machine based on the prediction of the launch vs. the measurement. This will include calculation of the projectile, assessment of impulse/momentum, and usage of all three Newton's laws in the Engineering Design Report.
- English I: Argumentative format, structure, and the correct use of standard English in the research-based argumentative writing essay supporting their chosen launching device type.
- Art: Form and balance in the model and aesthetics in the launching device design plan.
- World History: Research, citation, and use of analysis in historical content in the research-based argumentative writing essay supporting their chosen launching device type.

Common
Assessment

| | | | |
|---|--|---|--|
|  | STEM PBL Rubric | | PBL Unit: _____ Student: _____ Date: _____ |
| | Advanced | Proficient | Needs Improvement |
| Math Components: Algebra I | <ul style="list-style-type: none">Students will illustrate an explanation of the effects on the graph using technology. | <ul style="list-style-type: none">Students will identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. | |
| Math Components: Geometry | <ul style="list-style-type: none">Students will create at least two compositions of transformations, including correct notation.Students will explain a different way the same transformations could be achieved. | <ul style="list-style-type: none">Student can perform transformations in a coordinate plane, including the use of arrow notations, in the design of a maze. | |
| Science Components: Physical World Concepts | <ul style="list-style-type: none">Students can describe the pumpkin's projectile motion using vectors. | <ul style="list-style-type: none">Students will create a catapult or trebuchet suitable for launching a small pumpkin.Students will build the machine based using no automated parts or kits.Students can mathematically predict the distance of their pumpkin based on the mass of their pumpkin. | |
| Language Arts Components: English I | <ul style="list-style-type: none">Students can analyze and evaluate the research found concerning the launching device design to develop a strong, clear argument supporting their decision.Students can evaluate and select evidence from sources that most effectively supports their argument for both their claims and counterclaim.Students can use MLA format with sources and parenthetical | <ul style="list-style-type: none">Students can use proper argumentative writing structure in the 2-3 argumentative paragraph essay supporting the type of launching device design chosen.Students include at least 2 supporting points for the claim and 1 for the counterclaim in their argumentative essay.Students can use MLA documentation to cite their | |

| | | | | |
|-----------------------|---|--|---|--|
| | | citations correctly without errors. <ul style="list-style-type: none"> Students can write the report free of errors in grammar, capitalization, spelling, and punctuation. | sources and research in their writing. <ul style="list-style-type: none"> Students can write the report with few errors in grammar, capitalization, spelling, and punctuation. | |
| | Social Studies Components: World History | <ul style="list-style-type: none"> Accurately and effectively presents important details from reading materials to develop argument or claim. Presents thorough and detailed information to effectively support and develop the focus, controlling idea, or claim. Integrates relevant and accurate disciplinary content with thorough explanations that demonstrate in-depth understanding. | <ul style="list-style-type: none"> Accurately presents details from reading materials relevant to the purpose of the prompt to develop argument or claim. Presents appropriate and sufficient details to support and develop the focus, controlling idea, or claim. Accurately presents disciplinary content relevant to the prompt with sufficient explanations that demonstrate understanding. | |
| | Art Components: Art I | <ul style="list-style-type: none"> The design must include intricate details that enhance the aesthetics of the design. | <ul style="list-style-type: none"> Models will be assessed on their use of form. The model must be free-standing and visually balanced. | |
| | Minimum Requirement Components: Must be included to be graded | Algebra 1: <ul style="list-style-type: none"> Each variable in the efficiency equation must be defined. In the scatter plot, the independent and dependent variables must be defined. The Scatter plot must be completed on graph paper. Geometry: <ul style="list-style-type: none"> A two-dimensional design of the graph must be completed on graph paper. English I: <ul style="list-style-type: none"> Students must turn in a copy of the Launching Design Argumentative Essay to the English I PBL assignment in Google Classroom as a Google Doc. Argumentative essay must be in MLA format, including a Works Cited page for sources. PWC: <ul style="list-style-type: none"> All three of Newton's Laws must be stated and related to the machine's worthiness. The pumpkin's landing place must be predicted based on a projectile motion calculation. Path of projectile must use vertical and horizontal motion equations. Engineering Design Report must be complete and in the correct format prior to launch. Art: <ul style="list-style-type: none"> For the advanced portion: Must include a 2 dimensional drawing that is included in the Engineer Design Report. World History: <ul style="list-style-type: none"> Must have at least two primary and/or secondary sources. | | |
| Unit Learning Targets | Algebra 1: <ul style="list-style-type: none"> I can summarize, represent, and interpret data on two categorical and quantitative variables. I can reason quantitatively and use units to solve problems. Geometry: <ul style="list-style-type: none"> I can apply geometric concepts in modeling situations. I can visualize relationships between two-dimensional and three-dimensional objects. PWC: <ul style="list-style-type: none"> I can use Newton's Laws to describe the relationships of objects in motion. I can use mechanics to measure, calculate, describe, and represent the motion and energy of an object. I can use Archimedes's, Bernoulli's, and Pascal's principles to describe the behavior of fluids. English I: <ul style="list-style-type: none"> 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 (MLA) for citation. | | | |

| | | |
|------------|--|--|
| Vocabulary | <ul style="list-style-type: none"> I can demonstrate command of the conventions of Standard English grammar and usage when writing or speaking. I can demonstrate command of the conventions of Standard English capitalization, punctuation, and spelling when writing or speaking. <p>Art:</p> <ul style="list-style-type: none"> I can examine the correlation of material, technologies, processes, and terminology used in visual art with those used in other disciplines. I can integrate ideas, issues, and themes in visual art and other disciplines to design a visual representation of a model. <p>World History:</p> <ul style="list-style-type: none"> 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. | |
| | Math: Algebra I | <ol style="list-style-type: none"> Literal equation Formula Line of best Fit Line of Regression Correlation |
| | Math: Geometry | <ol style="list-style-type: none"> Efficiency Tension Compression Congruence Similarity |
| | Science: Physical World Concepts | <ol style="list-style-type: none"> Vector Velocity Acceleration Impulse Momentum Inertia Projectile |
| | Language Arts: English I | <ol style="list-style-type: none"> Argumentative Claim Counterclaim Refutation |
| | Social Studies: World History | <ol style="list-style-type: none"> Analysis Literary Support Logical Fallacies Disciplinary Content |
| | Art: Art I | <ol style="list-style-type: none"> Aesthetic Form Freestanding Balance |