



Internet of Things (IoT) at UCF



UNIVERSITY OF CENTRAL FLORIDA

*UCF RET Site: Collaborative Multidisciplinary
Engineering Design Experiences for Teachers*

Physics 1 (Algebra Based)

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Physics 1

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READ THIS FIRST

- Write all lessons and activities in present tense.
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- These lessons will be published. All work should be your own. Be sure to cite references where appropriate and only use images in the public domain/creative commons or that you develop. All lessons will be run through turnitin.com prior to publication.
- Remember to do your 3R reflection include an updated copy of your lesson plan, developed assessment tools, presentation materials, to the evaluator. See implementation plan instructions developed by the evaluator. Send within a week after completing the lesson to bonnie.swan@ucf.edu

RET Site: Lesson/Unit Plan

Subject Area(s): Forces in Equilibrium, Newtons Laws of Motion,

Course(s): Physics, Physical Science

Grade Level: 11-12

Suggested Length of Lesson: 2 Weeks

Lesson Summary: Using a combination of knowledge/skills learned during lessons on Newtons Laws of Motion and Force in Equilibrium. Students (small groups) will utilize problem solving skills as well as engineering technology software to design, construct, and test a wooden bridge. The goals: construct a bridge that meets size requirements provided by instructor, maximize holding strength, and meet an imaginary budget that would align with practices in the real world.

Prerequisite Knowledge: Forces, Equilibrium, Newton's Laws of Motion

<p>Materials/Technology Needed</p> <ul style="list-style-type: none"> ▪ Wood (popsicle sticks) ▪ Glue (glue sticks of wood glue) ▪ Bridge Designer Software (link in Resources Used) ▪ Testing Weight (anything available that can be added in increments and easily measured) ▪ Weight apparatus (anything available that allows for the test weight to hang on bridge) 	<p>Where this Fits/Lesson Dependency</p> <ul style="list-style-type: none"> ▪ Cumulative Activity, provide real world scenarios of application of topics
<p>Lesson Objective(s)/Learning Goal(s) (2-4)</p> <ul style="list-style-type: none"> ▪ Construct a bridge that meets size requirements provided by instructor ▪ Maximize bridge holding strength ▪ Meet an imaginary budget that would align with practices in the real world. 	<p>Standard(s)/Benchmark(s) Addressed (2-4)</p> <ul style="list-style-type: none"> ▪ <i>Standards:</i> <ul style="list-style-type: none"> – P.12.3 Interpret and apply Newton's three laws of motion. – N.1.7 Recognize the role of creativity in constructing scientific questions, methods and explanations (L)
<p>Standards for Mathematical Practice</p> <ul style="list-style-type: none"> ▪ Algebra I & Geometry 	<p>Instructional Strategies</p> <ul style="list-style-type: none"> ▪ Guided Instruction ▪ Active Learning ▪ Progressive Feedback
<p>Evidence of Learning (Assessment Plan)</p> <ul style="list-style-type: none"> ▪ Completion of Project & Associated Activities with satisfactory or higher achievement according to instructor Rubric 	

Description of Lesson Activity/Experiences

1. *Small group work using hands on activity to design, plan, and build a wooden bridge.*
2. Individual work utilizing real-world Engineering software.

Recommended Assessment(s) and Steps

- Rubric

List of Materials/Resources Used

- Wood (popsicle sticks)
- Glue (glue sticks of wood glue)
- Bridge Designer Software (<https://bridgedesigner.org/>)
- Testing Weight (anything available that can be added in increments and easily measured)
- Weight apparatus (anything available that allows for the test weight to hang on bridge)

Engineering Connection (60-100 words/3 sentences)

By utilizing design software commonly used in undergrad pre-engineering courses to design the bridge and complete activities. Students are actively engineering in the real world use of Physics and Engineering practices.

Engineering Category (choose one)

	relating science and/or math concepts to engineering (primarily science & math with some engineering)
X	engineering analysis or partial design (primarily engineering with some science/math)
	engineering design process (full engineering design)

Key Words

Force, Equilibrium, Load

Introduction/Motivation (written as if talking to students)

Today we begin the project you all have been waiting for, our annual bridge project! This project will give you hands on experience designing and building bridges in a real-world scenario. Yes, you can now answer the “when will I ever use this?”. Before we begin, know this will be half small group project and half individual with multiple chance for extra credit!

Lesson Closure (written as if talking to students)

Hopefully you all enjoyed the project, and now know the importance of Physics, Engineering, and budgeting in the real world.

Lesson Background & Concepts for Teachers

Tie it all together type activity/project. Useful at the end of a semester or year as a fun and engaging way for students to simulate real world application of Physics and Engineering topics.

Important Vocabulary

Term	Definition
Force	any influence that, when unopposed, will change the motion of an object.
Equilibrium	a state in which opposing forces or influences are balanced.
Load	force exerted on a surface or body.
Truss	a framework, typically consisting of rafters, posts, and struts, supporting a roof, bridge, or other structure.
Member	support that is a constituent part of any structure or building

Troubleshooting Tips

Work through example project and activities before assigning (reason for end of semester or year timeframe).

Other Helpful Information

There are many ways to apply weight/load to the bridges for testing. Start by using what you have and build off what worked and what didn't year over year.

Attachments

- Example Software Activities
 - *Design, Construct, & Successfully Test the following Bridge Configurations while also maintaining the required Budget.*
 - *Site Config: 1A Budget: \$500, 000*
 - *Site Config: 1B Budget: \$400, 000*
 -
- Example Presentation/with Rubric
- Example Software Activity Instructions

References

Acknowledgements

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