

## Science and Engineering (SCEN) CTY Course Syllabus

When		What	How
WEEK 1	Monday	Morning	Introduction <ul style="list-style-type: none"> <li>- Introductions</li> <li>- Classroom procedures</li> <li>- Syllabus overview</li> <li>- Lab safety</li> <li>- Pre-assessment</li> <li>- Student Expectations</li> </ul>
			<i>Topic: The Scientific Method (part 1)</i> <ul style="list-style-type: none"> <li>- <b>Activity:</b> Building a Paper Bridge (group)</li> <li>- Discuss problem solving: importance of research, planning and teamwork</li> </ul>
		Afternoon	<i>Topic: The Scientific Method (part 2)</i> <ul style="list-style-type: none"> <li>- <i>Warm-up:</i> Activity: How to tie a shoelace</li> <li>- Discuss creating a detailed procedure</li> </ul>
			<ul style="list-style-type: none"> <li>- Designing An Experiment worksheet</li> <li>- Understanding Variables worksheet</li> </ul>
		Evening	<i>Topic: Basics of Matter - mass, weight</i>  <i>Topic: Measurement</i> <ul style="list-style-type: none"> <li>- <i>Warm-up:</i> What is the difference between mass and weight? Be specific.</li> <li>- Discuss units of measure: metric versus English units (worksheet) - Conversion of Units</li> </ul>
	Tuesday	Morning	<i>Topic: Vectors</i> <ul style="list-style-type: none"> <li>- <i>Warm-up:</i> Read <i>The Cartoon Guide to Physics Chapter 1</i> (pp. 3-13), <i>Can You Feel the Force?</i> pp. 30-31 0 - Take notes</li> <li>- Discuss vectors (<i>The Cartoon Guide to Physics</i> pp. 53-55): <b>force, displacement, velocity, acceleration</b></li> </ul>
			<i>Topic: Math Skills</i> <ul style="list-style-type: none"> <li>- Review metric conversions</li> <li>- Learn/Review Proportions and Cross Multiplication (Worksheet)</li> </ul>
		Afternoon	<i>Topic: Motion (part 1)</i> <ul style="list-style-type: none"> <li>- Doing a Lab Write-Up worksheet</li> <li>- Pre-Algebra skills - How to use equations</li> <li>- Practice using motion equations</li> <li>- Set-up for Lab: Finding average speed - Problem, Materials, Procedure, Data Table</li> </ul>
		Evening	<i>Topic: Motion (part 2)</i> <ul style="list-style-type: none"> <li>- Perform Lab: Finding average speed</li> <li>- Informal lab report               <ul style="list-style-type: none"> <li>- Why are we calculating average speed?</li> <li>- What were some challenges that you found? What would you have done differently?</li> </ul> </li> <li>- Create motion <i>graphs</i> (time vs. distance) to identify velocity and change in velocity (acceleration)</li> </ul>
	Wednesday	Morning	<i>Topic: Forces (part 1)</i> <ul style="list-style-type: none"> <li>- <i>Warm-up:</i> Book Pages Friction Activity - Describe why the books could not be pulled apart from one another</li> <li>- Define forces - change speed, direction,</li> </ul>

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			<ul style="list-style-type: none"> <li>or both</li> <li>- Discuss types of forces (gravity, centripetal, friction) - Handout</li> <li>- Lab: Science Friction (pp.194-195 <i>Forces, Motion, and Energy</i>)</li> <li>- More on friction - static vs. kinetic, etc. <i>Can You Feel the Force?</i> pp. 28-29</li> <li>- Introduce net force: balanced and unbalanced forces</li> <li>- Read <i>Can You Feel the Force?</i> pp. 21-23</li> <li>- Draw free body diagrams</li> </ul>
	Afternoon	Project: Balsa Bridges	<ul style="list-style-type: none"> <li>- Watch <i>Building BIG: Bridges</i> VHS tape (1 hr) - Take notes on possible bridge designs</li> <li>- Introduce factors/forces in building bridges</li> <li>- Begin bridge design</li> </ul>
	Evening	Project: Balsa Bridges (cont.)	<ul style="list-style-type: none"> <li>- Finish bridge design</li> <li>- Begin building bridges</li> </ul>
Thursday	Morning	Project: Balsa Bridges (cont.)	<ul style="list-style-type: none"> <li>- Finish building bridges</li> <li>- Test bridges - discuss improvements</li> </ul>
	Afternoon	Topic: Gravity (part 1)	<ul style="list-style-type: none"> <li>- <i>Warm-up:</i> If you dropped a basketball and a bowling ball from the same height, which would hit the ground first? A feather and a pen? Explain.</li> <li>- Discuss gravity - student ideas? Make a list</li> <li>- Activity: Falling Water (p. 35 <i>Forces, Motion, and Energy</i>)</li> <li>- Apply gravity to motion - gravity is a type of acceleration (gravitational constant) - calculate weight</li> <li>- Lab: Finding Weight - Measure mass and calculate weight. Measure weight on spring scale. Calculate % error.</li> <li>- Calculate velocity (<math>\Delta v = g \times t</math>)</li> </ul>
	Evening	Topic: Gravity (part 2)	<ul style="list-style-type: none"> <li>- Discuss air resistance vs. surface area. Drop a flat piece of paper vs. crumpled piece of paper</li> <li>- Ask: Does an object's velocity continue to increase forever? Discuss terminal velocity ... only when air is present ... in vacuum, acceleration continues infinitely.</li> <li>- Show sky-diving video?</li> </ul>
Friday	Morning	Quiz #1	<ul style="list-style-type: none"> <li>- Quiz: Forces and Motion</li> </ul>
		Topic: Projectile Motion (part 1)	<ul style="list-style-type: none"> <li>- <i>Warm-up:</i> p. 43 #113 <i>Mad About Physics</i></li> <li>- Read <i>The Cartoon Guide to Physics</i> pp. 33-36</li> <li>- Discuss orbits in space (incorporate vectors)</li> </ul>

When		What	How
	Afternoon	<i>Topic:</i> Projectile Motion (part 2)	<ul style="list-style-type: none"> <li>- <i>Warm-up:</i> Does the angle of projection affect the distance an object travels? Explain. If yes, what would do you think would be the best angle of projection? Write a short procedure for how you might test it.</li> <li>- <b>Lab:</b> Rockets - Go over logistics, start lab.</li> </ul>
Sunday	Evening	<b>Lab:</b> Rockets	<ul style="list-style-type: none"> <li>- Discuss rockets and angles of launching.</li> <li>- Complete Lab</li> </ul>

When		What	How	
WEEK 2	Monday	Morning	<b>Project:</b> Catapults	<ul style="list-style-type: none"> <li>- Discuss catapults. Any practical applications?</li> <li>- Build catapults</li> </ul>
		Afternoon	<b>Project:</b> Catapults (cont.)	<ul style="list-style-type: none"> <li>- Build catapults</li> <li>- Run distance calculations/tests</li> </ul>
			<b>Project:</b> Laws of Motion	<ul style="list-style-type: none"> <li>- Read <i>The Cartoon Guide to Physics</i> <ul style="list-style-type: none"> <li>- first law: pp. 18-22</li> <li>- second law: pp. 23, 30-32</li> <li>- third law: pp. 47-52</li> </ul> </li> <li>- Read <i>Can You Feel The Force</i></li> <li>- (IF TIME) Begin to work on "commercials" and posters for one law of motion</li> </ul>
		Evening	<b>Project:</b> Laws of Motion (cont.)	- Complete law of motion "commercials"
	Tuesday	Morning	<b>Presentations:</b> Newton's Laws	<ul style="list-style-type: none"> <li>- Present laws of motion "commercials"</li> <li>- Recap Newton's Laws <ul style="list-style-type: none"> <li>- First Law</li> <li>- Second Law - Practice Problems</li> <li>- Third Law - <i>Mad About Physics</i> p. 98 #247, 115 #284</li> </ul> </li> </ul>
			Afternoon	<i>Topic:</i> Momentum
		<b>Project:</b> Eggsellent Cars *** need 6 raw eggs		<ul style="list-style-type: none"> <li>- Ask: Why is necessary for safety in cars such as seatbelts and airbags? How is this related to or affected by momentum?</li> <li>- Start to design "Eggsellent Cars"</li> </ul>
		Evening	<b>Project:</b> Eggsellent Cars (cont.)	<ul style="list-style-type: none"> <li>- Complete "Eggsellent Cars"</li> <li>- Test cars on track</li> <li>- Discuss results/improvements</li> </ul>
	Wednesday	Morning	<i>Topic:</i> Kinetic and Potential Energy	<ul style="list-style-type: none"> <li>- <i>Warm-up:</i> Why do the largest drops on roller coasters usually happen in the beginning of the ride?</li> <li>- Discuss kinetic and potential energy</li> </ul>

When		What	How
	Afternoon	<b>Project:</b> Mousetrap Cars	<ul style="list-style-type: none"> <li>- Calculate kinetic and potential energy</li> <li>- Design and build a mousetrap powered car that can go the farthest distance (variation - fastest speed)</li> </ul>
	Evening	<b>Project:</b> Mousetrap Cars (cont.)	<ul style="list-style-type: none"> <li>- Complete and test cars</li> <li>- Discuss results/improvements/best designs</li> </ul>
	Thursday	Morning	<i>Topic:</i> Kinetic Energy and Temperature
	Afternoon	<i>Topic:</i> Gas Pressure (part 1)	<ul style="list-style-type: none"> <li>- Discuss and calculate pressure (<math>P = F/A</math>)</li> <li>- Review earlier lab - gas takes up volume</li> <li>- <b>Activity:</b> Film canister rockets</li> <li>- <b>Activity:</b> Build a contraption to maximize amount of Mentos can be dropped into a bottle to form a soda fountain</li> </ul>
	Evening	<i>Topic:</i> Gas Pressure (part 2)	<ul style="list-style-type: none"> <li>- Test Mentos contraptions</li> <li>- <b>Demonstration:</b> Egg in a Bottle</li> <li>- <b>Demonstration:</b> Gas Pressure Kit</li> </ul>
	Friday	Morning	<i>Topic:</i> Forces in Fluids
	Afternoon	<i>Topic:</i> Work	<ul style="list-style-type: none"> <li>- Discuss and calculate work</li> <li>- Interpret work diagrams - Is work happening in this situation?</li> </ul>
		<i>Topic:</i> Simple Machines (part 1)	<ul style="list-style-type: none"> <li>- <a href="http://www.edheads.com/simplemachines">www.edheads.com/simplemachines</a></li> <li>- Discuss six simple machines - go over definitions</li> <li>- Calculate overall mechanical advantage and mechanical efficiency</li> </ul>
Sunday	Evening	<i>Topic:</i> Simple Machines (part 2)	<ul style="list-style-type: none"> <li>- Game <i>Mousetrap</i></li> <li>- Draw Rube Goldberg Diagrams</li> </ul>

When		What	How	
WEEK 3	Monday	Morning	<i>Topic: Simple Machines (part 3)</i> - Complete Rube Goldberg Diagrams - Review	
		Afternoon	Quiz #2 <i>Topic: Electric Charge</i> - Discuss the source of charges (electrons) - Introduce charge distribution - <b>Activity:</b> Detecting Partial Charge (scotch tape)	
			Evening	<i>Topic: Electromagnetic Radiation (part 1)</i> - Introduce radiation. What distinguishes between the different types of radiation?
		Tuesday	Morning	<i>Topic: Electromagnetic Radiation (part 2)</i> - Draw electromagnetic spectrum. - Discuss wavelength/frequency/velocity - calculations - Discuss visible light spectrum - prisms - rainbows - double rainbows.
	Afternoon		<i>Topic: Holography</i> - What is holography? - <b>Lab:</b> Making a holographic picture	
	Evening		<i>Topic: Electricity (part 1)</i> - Introduce Ohm's Law - Ohm's Law calculations - Introduce circuits - <b>Activity:</b> Light Bulbs and Lemons - <b>Activity:</b> Electronic Playgrounds	
	Wednesday	Morning	<i>Topic: Electricity (part 2)</i> - <b>Activity:</b> Electronic Playgrounds (cont.) - Discuss and draw circuits in series and parallel	
		Afternoon	<i>Topic: Magnetism</i> - Introduce magnets - Discuss magnetic fields - <b>Activity:</b> Making a compass - Discuss: How do compasses work?	
		Evening	<i>Topic: Electricity Can Cause Magnetism</i> - Intro electromagnets - <b>Activity:</b> Making an Electromagnet	
	Thursday	Morning		- SPEs
			<i>Topic: Magnetism Can Produce Electricity</i> - Discuss how magnetism can produce electricity - Study generators. - <b>Activity:</b> Using a magnet to run a motor	
		Afternoon		- Review for Post-test - Who Wants to Be a Millionaire
		Evening		- Post-test
	Friday	Morning		- Practice presentation for closing ceremony
Afternoon		Closing Ceremonies/Conferences		