

Advancing Science

Activities List

(Updated: October 2010)

The table on the following pages lists the activities currently available from the *Advancing Science* Program, along with a brief description of each activity. The major science van supplies and/or equipment used in the lab are indicated in **bold** print. All major materials needed for the activity can be supplied by *Advancing Science*, unless otherwise noted.

Designation Explanation: Labs labeled **Materials Loan Only** can't easily be done in a single van visit. Therefore, we encourage you to **borrow** the equipment to do the lab over several days, so your students get the most out of the activity.

Program participants should not feel limited by this list -- it is not meant to be inclusive. There are many other experiments and activities for which the science van equipment is suitable.

A note about grade levels and subject areas: Those listed are recommendations only, based on past experience and teacher suggestions. Many of the listed activities can be tailored for different audiences.

What about the PA ACADEMIC STANDARDS FOR SCIENCE and TECHNOLOGY? There are lists available at the *Advancing Science* website that show the Science and Technology Standards the AS staff feels each activity meets. Visit www.advancingscience.org and click on the "Activities" link to view these lists.

For more information, or to obtain a copy of any activity, please contact the *Advancing Science* Mobile Educators at 717-337-6150, 717-337-6166, or 717-337-6274 or E-mail us at: advancingscience@gettysburg.edu

Subject Areas: **B** = Biology; **C** = Chemistry; **E** = Earth & Space Sciences; **M** = Mathematics; **P** = Physics

How the list is set up:

The activity list has been divided into three sections, one each for grades K-4, 5-8, and 9-12. Each activity is represented by a 4 digit number: the prefix (1, 2 or 3), and then a decimal point followed by 3 more digits. All you need to know about the numbers after the prefix is that they are unique to the activity.

Many of our activities can be used across grade levels, so they are listed in more than one section. While the prefixes change, the digits after the decimal remain the same no matter which section the activity appears.

Number Code: Activity numbers are coded with the following **prefixes:**

1. = Elementary (Grades K - 4) **2.** = Middle School (Grades 5 - 8) **3.** = High School (Grades 9 -12)

Advancing Science Activities List for High School (9-12)

CBW Activity	Activity Number	Name of Activity	Capsule Description of Activity	Grade Level	Subject Area
	3.051	Rewiring the Brain: An Exercise in Neuronal Plasticity	Students discover how adaptable the brain really is in this simple yet powerful activity. Hitting a target is easy... until students don special "diopter" lenses. Can their brains get straightened out? And what happens once the lenses are removed? Great potential for inquiry learning in this lab.	7-12	B
	3.102	Advanced Simple Machines	Students use materials from K'nex kits to create simple machines, study their uses, and solve problems.	4 - 9	P
	3.103	DNA K'Nex - Replication and Transcription	Students use materials from K'nex kits to build DNA and mRNA molecules. This flexible set allows students to build and learn about phosphate groups, deoxyribose and ribose sugars, hydrogen bonds, codons, nucleotides, and more.	7 - 12	B
C	3.151	Microbes In The Environment	Students find out "where the germs are" as they swab a number of different choice locations, inoculate agar plates, then use an incubator to see how many microorganisms develop.	3 - 12	B
	3.152	Effectiveness of Hand Washing	Students test their hand washing technique by inoculating agar plates before and after washing, then using an incubator to see how many microorganisms develop.	5 - 12	B
C	3.153	Introduction to Microscopy & Bacterial Staining Methods	Students use proper technique to stain collected strains of bacteria, then examine them under the oil-immersion lens of a compound microscope. (Good follow up to labs 151, <i>Microbes In The Environment</i> , or 152, <i>Effectiveness of Hand Washing</i>)	9-12	B
C	3.160	Alternative Energy- Solar Cars	Students will use hydrogen fuel cells to demonstrate the effectiveness of alternative fuel sources.	5-12	E, C
C	3.161	Alternative Energy-Hydrogen Fuel Cell Cars	Students will use solar panels to demonstrate the effectiveness and importance of the sun's angle of incidence for generating electricity by measuring current and voltage.	5-12	E, C
C	3.230A	Introduction to the Compound Microscope	Students learn the parts and function of the compound microscopes while looking at a variety of prepared slides on low, medium and high power.	4-12	B,E
C	3.230B New	The Digital Pond	Students will develop skills need manipulate various features of digital microscopy. Using pond water samples they will capture, edit and compare images of protozoa	5 - 12	B, E
C	3.231	Protozoa Lab	Students explore and record the microscopic world of pond water using the Science Van's compound microscopes.	4-12	B
C	3.232	The Effect of Drugs on Daphnia	Students use compound microscopes to compare the heart rates of <i>Daphnia</i> before and after exposure to household drugs (alcohol, caffeine, nicotine) or temperature changes.	5-12	B, C
	3.233	Hair Analysis	Students use their observation and critical thinking skills to develop a procedure for identifying hairs collected from a crime scene. Note: This is a multi-day lab.	9 - 12	B
C	3.234	The Effect of Environmental Toxins on Daphnia	Students use compound microscopes to compare the heart rate and behavior of <i>Daphnia</i> before and after exposure to environmental toxins (antifreeze and laundry detergent).	5-12	B, C, E

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C	3.235	Elodea and Plasmolysis	Students use digital scopes to monitor the effect of salt solution on the cell wall and cell membrane.	5-12	
C	3.236	DIY Digital Scopes and Motic Software	Step by step guide which will walk you through the basics of setting up and using the digital scopes.	5-12	
	3.237	Mitosis and the Cell Cycle: Breaking up is Hard to Do	Using the digital scopes, students will identify the stages of mitosis, capture the images, and prepare a report for printing.	5-12	B
	3.241	Static electricity **Demonstration**	Teacher uses Van der Graaff generator to show various effects of static electricity.	K - 12	C, P
	3.251	Circuits: Simple, Series, And Parallel	Students use Basic Electricity Kits to study the differences and similarities between three kinds of electrical circuits.	4-10	P
	3.253	Electrical Resistors	Students will use a multi meter to increase their understanding of resistance, read the colors on a resistor to determine the resistance, compare color coded resistance to actual resistance, understand tolerance and its importance, and review how to change per cent to decimals.	6-12	P
C	3.280	Leaf Pack	Leaf Pack Kit- create an artificial leaf pack and place in a stream or pond for 3 to 4 weeks. Examine in the classroom to evaluate the macroinvertebrate population. Identification keys included. Can be used in conjunction with Stream study.		
C	3.281	Water Quality Testing	Students use Water Test Kits to measure various water quality parameters such as alkalinity and hardness.	4-12	C
C	3.282.1	Stream Study- Chemistry	Students use a water test kits and colorimeters to study the chemical aspects of a stream.	K - 12	B, C, E, P
C	3.282.2	Stream Study-Physical	Students use a variety of equipment to evaluate the physical parameters of the stream, including depth profiles and flow rate.	K - 12	B, C, E, P
C	3.283	Dissolved Oxygen Lab	Students compare the amount of dissolved oxygen in different samples of water using the Science Van's Water Test Kits.	5-12	B, C
C	3.284	Advanced Stream Study	Students use the LabPro Interface & TI-83+ Calculator with various sensors to make a high-tech examination of water quality. Parameters tested: Flow Rate, Turbidity, Temperature, pH, Nitrate concentration, Ammonium Nitrogen concentration, and Total Dissolved Solids.	7-12	B, C
C	3.285	Macroinvertebrates as Stream Health Indicators	Students use kicknets and other materials to collect macroinvertebrates from a stream or pond. Using the <i>Pollution Tolerance Index</i> they will then assess the health of the stream.	5-12	B, E, P
C	3.286	ESI: Watching the Watershed	Students analyze eight prepared water samples using water Test Kits to try to determine from which business/industry particular pollutants have come from.	7-12	B,C,E
C	3.287 New	Stream in Bucket	If you can't take your class to the stream, bring the stream to your classroom. Macroinvertebrates and leafpaks will be brought into your classroom to analyze and sort. (Sept-Oct and March-May)	K-12	B,E
C	3.301	Where Does the Water Go? **Demonstration**	Teacher uses the Groundwater Simulation System to explain the movement of water beneath the surface of the earth, as well as the dangers of pollution.	3-12	E

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C	3.302	Enviroscape - Wetlands Model **Demonstration**	Teacher uses the Wetlands model to demonstrate how our daily activities, as well as industry and agriculture affect wetlands through runoff.	K - 12	E
C	3.303 New	Enviroscape-Drinking and Waste water Treatment Model	Teacher uses the Wastewater and Drinking Water Treatment model to demonstrate water sources for cities, rural areas, industrial and recreational areas. Effective treatment methods will be demonstrated as well.	K - 12	E
C	3.311	Observation and Classification of Mineral Specimens	Students use microscopes and rock identification kits to examine and determine the identity of different mineral samples.	K - 12	E
C	3.321	Topographic Map Lab	Students use Contour Map Kits to learn how to create a two dimensional topographic Map from a three dimensional model.	4-12	E
C	3.322	Topo Map II	Students use rocks, oil-based clay, and Contour Map Kits to create their own topographic map, then exchange maps to try to re-create each others' models. (Designed as a follow up to Topographic Map Lab)	4-12	E
	3.331	Earth, Sun, Moon	Students get concrete methods to learn the abstract concepts of rotation, revolution, time, seasons, and moon phases using Sun, Earth, & Moon Models.	5-9	E
C	3.401	Household Acids and Bases Testing	Students use pH meters and pH test paper to determine the relative acidity of various familiar substances. (Good introduction to the pH meter.)	4-12	B, C
C	3.403	Acid Rain	Students use pH Meters to explore the neutralizing effectiveness of two soil types. They also use the meters to discover how severe acid rain is in different parts of the country, and how power plants and other polluting facilities cause acid rain.	4-12	B, C, E
C	3.404	pH, Inc.	Problem solving activity in which students use pH meters to determine the best and most economical way to clean up an acid spill. (Good follow up to Acid Rain.)	4-12	B, C
C	3.405	Soil Testing	Determine the pH and water retention ability of three different soil types. Add different acidifying fertilizers and measure the pH change as you learn about acid loving plants.	5-12	B, C
C	3.406	Effect of Temperature on Germination	Students will manipulate the soil conditions to simulate seasonal change and day-night changes. Temperature will be monitored using Vernier Temperature probes.	4-12	B,E,P
	3.512	Bright Line Spectroscopy	Students use hand held spectrometers to observe the bright line spectra of elements such as hydrogen, helium, neon and more. Atoms of these gases are excited using electrical energy from the accompanying power supply.	8-12	C, P
	3.531	Introduction to Spectrophotometry	Students view the visible light spectrum produced by the spectrophotometers in a interesting and unconventional way.	4-12	P,C
	3.532	Spectral Curve of Food Coloring	Students use spectrophotometers to determine the wavelength at which a colored solution absorbs the most light energy.	4-12	C, P
C	3.533	The Effect of Concentration on Absorbance	Students use spectrophotometers to explore the relationship between the concentration of a substance and the amount of light energy it can absorb. (Good follow up to Spectral Curve.)	4-12	C, P
	3.534	Physical Or Chemical Change?	Students use spectrophotometers to determine whether color changes are physical or chemical in nature. (Good follow up to Spectral Curve.)	7-12	C, P

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C	3.535	Spectral Curve Of Leaf Pigments	Students use spectrophotometers to determine the wavelength at which an extract of leaf or vegetable pigment absorbs the most light energy. (Good "real world" substitute for Spectral Curve.)	7-12	B, C
	3.536	My Business is Going Under	Determine the time of a "murder" using spectrophotometers as students perform a new twist on absorbance versus concentration in this Forensics Investigation. (Good substitute for lab 533, <i>The Effect of Concentration on Absorbance</i>)	9-12	C
	3.537	Spectral Analysis of Suntan Lotions	Students use spectrophotometers to determine and compare how well various SPF sunscreens absorb ultraviolet radiation.	9-12	B, C
	3.538	Spectral Curve of Kool-Aid	Students use spectrophotometers to determine if colors separated out in column chromatography are pure or mixtures. (Good follow up to lab 571, <i>Extraction And Identification Of Dyes.</i>)	8-12	C
	3.539	Analysis of Aspirin Using Visible Spectrophotometry	Students use Spectrophotometers to determine the purity of synthesized aspirin or a brand of commercial aspirin product.	10-12	C
C	3.54	Determination of Iron in Water	Students use Spectrophotometers to determine the amount of iron in a variety of water samples.	10-12	C
	3.541	A Study of Reaction Rates with the Spectrophotometer	Students use the Spectrophotometers interfaced with computers with SpectroPro software and produce an absorbance versus time graph. The concentration of one reactant is halved and the reaction rates compared with the original. The order with respect to each reactant is determined.	10-12	C
C	3.542	The Effect of Alcohol on Biological Membranes	In this experiment, beet root is used to test the effect of three different alcohols (methanol, alcohol, propanol) on biological membranes. Spectrophotometers are used to quantify the effect of these alcohols and the damage they inflict on the cell membrane.	5-12	B, C
C	3.543	Spectrophotometric Determination Of NOx In Car Exhaust	Students collect air and car exhaust samples, prepare them and compare to a series of standards using the Spectronic 20 D+	10-12	C
	3.571	Extraction And Identification Of Dyes	Students use column chromatography supplies to separate dyes in colored solutions.	5-12	C
	3.572	Thin Layer Chromatography	Students use thin layer chromatography sheets (non-polar silica gel) to separate a variety of different commercial food colors and compare them to FD&C standards.	8-12	C
	3.573	Paper Chromatography of Candies	Students use paper chromatography strips to separate the colors of the coatings of several candies and compare them to FD&C standard colors.	8-12	C
	3.574	Thin Layer Chromatography of Pen Inks	Students use thin layer chromatography to determine which pen was used to leave a prank note.	8 - 12	C

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	3.651	Newton's Laws of Motion	Students use a kinesthesia cart to study inertia, the acceleration of different masses when propelled by a constant force, equal and opposite actions, and projectile motion. (For older students, a more in-depth look at Newton's second law involves ULI Motion Detectors and Computers.)	K - 12	P
	3.652	The Auditorium Luge	Students use graphing calculators, calculator based laboratories, motion detectors and a kinesthesia cart to acquire and analyze data for an object undergoing constant acceleration.	9-12	P
	3.682	DNA Electrophoresis	Students separate fragments of DNA by size of molecule using electrophoresis gel boxes, then analyze the results. (Basis of DNA fingerprinting) Note: This is a multi-day lab. DNA is not supplied by Adv Sci. "Mock DNA" option is available.	9-12	B
	3.683	Solving a Crime Using DNA Electrophoresis	Set up a simulated murder scene and run crime scene DNA evidence on electrophoresis gel boxes to match to one of the suspects. Note: This is a best as a multi-day lab. DNA is not supplied by Adv Sci. "Mock DNA" option is available.	9-12	B
	3.684	Introduction to Electrophoresis: Molecules on the Move	Students will develop an understanding of the mechanism behind the concept of DNA electrophoresis. They will use food coloring as a replacement for DNA which allows a good visual in one class period. Restriction enzymes are covered as well.	5-12	B
	3.721	Computer Graphing	Uses Excel™ Software on the Science Van's Computers to create simple bar, line and pie graphs from data collected by students. Loan only.	4-12	B, C, E, M, P
C	3.723	Stream Bottom Profile	Students use Excel™ Software on Computers to create three dimensional maps of stream bottom depth profile data.	5-12	E, M, P
	3.724	The Revolution of the Moons of Jupiter	Apply the laws of motion to calculate the mass of Jupiter using software from Project CLEA (Contemporary Laboratory Experiences in Astronomy)	9-12	E
C	3.725	EcoBeaker HS	Students use Portable Computers to investigate ecological scenarios in this interactive software. Concepts the software covers include: Population Ecology, Ecosystems, and Conservation Biology.	7-12	B, E
C	3.726	Science Sleuths	Students use Portable Computers to investigate and solve mysteries with this interactive software. Equipment, videos and other resources are used to determine who's at fault in an accident, what washed ashore, why people got sick or what is causing lawnmowers to explode. Can be used by students working in small groups or as a Teacher - led class project.	5-9	B, C, E, M, P
	3.727	Statistics with Microsoft Excel	During this lab, students will not only learn how to edit simple mathematical formulas with Microsoft Excel spreadsheets, but will also learn about the X^2 Statistical Test and how the test can be run using a simple spreadsheet. Students can use their own data or follow instructions for pre-written experiments to gather data for this lab.	6-12	B, C, E, M, P
C	3.728	Introduction to GIS Analysis	Students will identify the uses and benefits of GIS. While manipulating data layers, students will produce maps and solve problems using the information obtained.	6-12	B, E

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C	3.729	The Three G's: GPS, Geocache and GIS Part 1	Part 1 is an introduction to the use of GPS receivers and how they acquire their data. Students will learn to find latitude and longitude coordinates as an introduction to geocaching.	6-12	B, E, P
C	3.73	The Three G's: GPS, Geocache and GIS Part 2	Part 2 Students will manipulate GIS data to produce maps which will be used to solve problems. The focus of the problems are Chesapeake Bay watershed related.	6-12	B, E
C	3.731	Geocaching for Knowledge: A Mock Stream Study with GPS Receivers	After an introduction to GPS and geocaching, students will be given latitude and longitude coordinates to find. Stream quality facts will be in the various caches. Working in teams the students will determine the overall health of the mock stream. Content of the caches can be adjusted to fit subject needs.	4-12	B, E, P
C	3.732	Basic GIS and Toxic Release	Using ArcView GIS software students will develop skills needed to produced maps showing EPA toxic release sites in Pennsylvania. Students will be asked to determine possible environmental impact from the chemical waste.	6-12	E,C
C	3.741	Cellular Respiration with Peas	Using the Vernier LabPros and peas, students will measure the effect of germination on CO2 production during cellular respiration.	5-12	E, B
C	3.742	Salted Peas: Respiration and CO2 Production	Using the Vernier LabPros and peas, students will measure the effect of salinity of the soaking solution used to germinate the peas and how this will effect CO2 production during respiration.	5-12	E, B
C	3.74	Photosynthesis	Students use computerized probes to determine the changes in CO2 levels (reflecting rates of respiration and/or photosynthesis) of leaves in both light and dark chambers.	7 - 12	B
C	3.752	A Good Sock	Smelly or not, socks usually do a good job keeping the heat in. In this activity, students use Laptop Computers and ULI Temperature Probes to discover the effectiveness of cotton and wool socks and the problem with wet socks. (This lab can also be done using the LabPro/TI-83+ system).	4-12	B, C, E, P
	3.753	Endothermic And Exothermic Reactions	Students use Computers and ULI Temperature Probes to study the two different reaction types. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	C
C	3.754	Freezing and Melting of Water	Students use Computers and ULI Temperature Probes to determine and compare the freezing and melting temperatures of water. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	C
C	3.755	Mixing Warm & Cold Water	Students use Computers and ULI temperature probes to construct a simple calorimeter, mix cold and warm water, then determine heat lost by the cooling water and gained by the warming water. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	C, P
	3.756	Temperature Probe Response Time	Students use Computers and ULI Temperature Probes to determine the response time of the probe. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	B, C, E, P

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C	3.758	Energy Content of Foods	Students use Computers and ULI Temperature Probes to analyze the amount of energy contained in different food types. (This lab is available in both Biology and Chemistry based versions, and can also be done using the LabPro/TI-83+ system.)	9-12	B, C
	3.759	Evaporation and Intermolecular Attractions	Students use Computers and ULI Temperature Probes to relate temperature changes during evaporation to the strength of intermolecular forces of attraction. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	C
	3.76	Heat of Fusion for Ice	Students use Computers and ULI Temperature Probes to determine the amount of energy required to melt a gram of ice, then calculate the molar heat of fusion for ice. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	C, P
	3.761	Using Freezing Point Depression to Find Molecular Weight	Students use Computers and ULI Temperature Probes to first find the freezing temperature of a pure solvent, then add a known mass of another substance, and determine the molecular weight of the added substance by the resulting change in the freezing point. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	C
	3.762	Energy Comparison of Chemical and Physical Changes	Determine the heat of combustion and the heat of solidification of wax using Computers and ULI Temperature Probes.	9-12	C, P
C	3.763	The Complexity of Global Warming	Students learn just how difficult it is to fully understand the concept of global warming. In this inquiry based lab, students can choose from a variety of relationships that can either increase or decrease the effect of global warming and test their hypotheses by using Laptop Computers and LabPro interfaces.	6-12	B, C, E
C	3.764	The Greenhouse Effect	Students use Laptop Computers and LabPro interfaces with temperature probes to investigate the Greenhouse Effect using various models.		
	3.767	Additivity of Heats of Reaction: Hess's Law	Students use Computers and ULI Temperature Probes to measure the heat of three different chemical reactions, confirming Hess's Law. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	C
C	3.768	What Causes the Seasons?	Students use a simulated sun—a light bulb—to shine on a ULI Temperature Probe attached to a globe. They then study how the tilt of the globe influences warming caused by the lighted bulb.	5-12	P, E
	3.772	Picket Fence Free Fall	Students measure the acceleration of a freely falling body using Computers, ULI Photogates and a Picket Fence.	9-12	P
	3.773	Projectile Motion	Students measure the velocity of a ball using Computers and ULI Photogates, then predict the impact point of a ball in projectile motion.	9-12	P
C	3.781	Effect of Water Type on pH of Acid Rain	Students use Computers and ULI pH probes to compare the effect on pH of dissolving acid into various kinds of water. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	B, C
C	3.782	Generating Acid Rain	Students use Computers and ULI pH probes to create and analyze the primary acids that comprise acid rain. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	B, C, E

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C	3.783	Acid Dissociation Constant, Ka	Students use Computers and ULI pH probes to experimentally determine the dissociation constant of an acid, then see if changing solution concentration has an effect on the equilibrium constant.	9-12	C
C	3.784	Titration Curves of Strong and Weak Acids and Bases	Students use Computers and ULI pH Probes to study the shapes of titration curves made with various combinations of strong and weak acids and bases. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	C
	3.791	Motion Match	Students will gain a first-hand understanding of graphs and the information they convey through this interactive activity. Students move their bodies back and forth using Laptop Computers and ULI Motion Detectors to match a graph of distance (from the detector) vs. time. If they are successful matching the graph, they can attempt to match a velocity vs. time graph.	3-9	M, P
	3.792	Kinetic - Potential Energy Transfer	Students use Computers and ULI Motion Detectors to compare energy transfers in two different types of common ball.	5-12	C, P
	3.793	Momentum: A Crash Lesson	students will use computers and ULI motion detectors to measure the velocity of a vehicle and calculate its momentum as it crashes into a moveable barrier. (This lab can also be done using the LabPro/TI-83+ system.)	6-12	P
	3.794	Energy of a Tossed Ball	Students use Computers and ULI Motion Detectors to study the energy changes as a ball is tossed straight upward, slows down until it reaches the top of its path and then speeds up on its way back down. (Similar to # 2.792, <i>Kinetic - Potential Energy Transfer</i> .) (This lab can also be done using the LabPro/TI-83+ system.)	5-12	P
C	3.795	Ocean Floor Mapping	Students use portable computers and ULI Motion Detectors to simulate mapping the floor of the ocean. (Good follow up to lab 321, <i>Topographic Map Lab</i> .)	5-12	P, E
	3.796	Graph Matching	Advanced version of lab 3.791 for Physics: students will analyze the motion of a student walking across the room, predict, sketch, and test distance vs. time and velocity vs. time kinematics graphs using a laptop computer and motion detector.	11-12	M, P
	3.801	Boyle's Law	Students use Computers and ULI Pressure Sensors to determine the relationship between pressure and volume in a confined gas. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	B, C, P
	3.802	Pressure Temperature Relationship in Gases	Students will use computers with ULI Temperature and Pressure sensors to determine what kind of mathematical relationship exists between the pressure and absolute temperature of a confined gas. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	C
	3.803	Enzyme Action: Testing Catalase Activity	Students will use a Computer and ULI Pressure Sensor to measure and compare the initial rates of reaction for the destruction of hydrogen peroxide by the enzyme catalase at various enzyme concentrations, temperatures and pH values.	7-12	B
C	3.804	Factors Affecting Transpiration	Students will use a Computer and ULI Pressure Sensor to measure and compare the initial rates of transpiration of a plant subjected to varying environmental pressures such as humidity, light, and heat.	7-12	B

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	3.805	Get A Grip!	Students use Computers, interfaces and pressure sensors to measure their gripping power. They will see if their gripping power changes as they grip an object for a longer time. They will also compare their gripping power with their classmates.	5 - 9	B, C, P
C	3.811	Effect of Temperature on Fermentation	Students use Computers and ULI Pressure Sensors to determine how temperature effects the rate at which yeast respire. (This lab can also be done using the LabPro/TI-83+system.)	7-12	B, C, P
	3.821	Control of Human Respiration	Students use Computers, ULI Biology Pressure Sensors and Respiration Belts to study human respiration under different conditions. (This lab can also be done using the LabPro/TI-83+ system.)	9-12	B
	3.831	Limitations on Cell Size: Surface Area to Volume	Students determine the importance of surface area to volume ratios using Computers and ULI Conductivity Probes. (This lab can also be done using the LabPro/TI-83+ system.)	7-12	B
c	3.832	Diffusion Through Membranes	Students use a portable computer and ULI Conductivity probe to study the effect of temperature, concentration gradients and the presence of a second molecule on diffusion.	7-12	B
	3.853	Heart Rate and Exercise	Students use Computers and Vernier Heart Rate Monitors to determine their physical fitness level.	5-12	B
	3.854	Heart Rate	Students use Computers and Vernier Heart Rate Monitors to measure human heart rates in different situations.	9-12	B
	3.862	Pulleys	Use computerized Force Probes to explore the mechanical advantages of pulley systems.	5-12	P
C	3.871	Reflectivity of Light	Students compare the amount of light reflected by various surfaces using Computers and ULI Light Sensors. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	P
C	3.872	Polaroid Filters	Students use Computers and ULI Light Sensors to measure the intensity of transmitted light and study the transmission of light by Polaroid filters. (This lab can also be done using the LabPro/TI-83+ system.)	5-12	P
	3.873	Lightstick Kinetics	Students use Computers and ULI's with Light Sensors and Temperature Probes to measure the decay curve of the activity of a glow-in-the-dark light stick as a function of temperature.	10-12	C
C	3.881	Alpha, Beta, and Gamma	Students use Computers and ULI's with Radiation Detectors to determine the differences in alpha, beta and gamma radiation.	8-12	C, P
	3.882	Distance and Radiation	Students use Computers and ULI's with Radiation Detectors to show how the intensity of gamma radiation varies with distance from a point source.	9-12	C, P
C	3.883	Half-Life Measurement	Students use Computers and ULI's with Radiation Detectors and Isogenerator to measure the half-life decay constant of Barium-137.	9-12	C, P
	3.884	Potassium in Dried Fruit	Students use Computers and ULI's with Radiation Detectors to determine the radiation given off by various foods such as dried apricots, dried bananas and salt substitute.	9-12	C, P
	3.891	Sound Waves & Beats	Students use computers and ULI Microphones to measure the amplitude, frequency and period of sound waves, as well as observe beats.	9-12	P
	3.892	Speed of Sound Lab	Students use Laptop Computers and LabPro interfaces to measure the speed of sound and compare their experimental value to the known value.	8-12	P
	3.896	Magnetic Field Explorations	Students use computers and ULI Magnetic Field Sensors to measure, graph and analyze magnetic field strength	5-12	P

Advancing Science Activities List for High School (9-12)

CBW Activity	Activity Number	Name of Activity	Capsule Description of Activity	Grade Level	Subject Area
	3.897	Electromagnets: Winding Things Up	Students use computers and ULI Magnetic Field Sensors to study the relationship between coils of wire and the strength of an electromagnet.	5-12	P
C	3.898	Seafloor Spreading	Students use Laptop Computers and LabPro interfaces to study one of the major pieces of evidence supporting the Theory of Plate Tectonics. Magnetic Field Sensors are used to observe the changing polarity of simulated bedrock on both sides of a seafloor.	5-12	E
C	3.901	Alcohol Content in Commercial Products	Students use the gas chromatograph to analyze products such as mouthwash and rubbing alcohol for actual alcohol content.	10-12	C
C	3.902	Measurement of Petroleum Based Hydrocarbons	Students use the gas chromatograph to separate and analyze hydrocarbons in various gasoline products.	10-12	C
	3.903	Volatile Organic Compounds in Cosmetics	Students use the gas chromatograph to separate and identify organic compounds in various perfumes.	10-12	C
C	3.904	Analysis and Comparison of Gasolines Using Gas	Students use the gas chromatograph to determine the octane rating of "regular" and "premium" gasolines.	10-12	C
C	3.905	Analysis of the Stuff of Life	Students use the gas chromatograph to separate and identify compounds in various products; many different compounds can be examined, as long as it has an odor, evaporates (leaves no residue on a glass surface) or is partially volatile (some of it evaporates when put in a glass vial.)	10-12	C
C	3.906	Analysis of Hydrocarbon Distillate Mixture	This advanced lab gives students the opportunity to separate a hydrocarbon mixture by fractional distillation and to examine their level of success in achieving a separation by gas chromatography.	10-12	C
	3.921	Evaluation of Fluorescent Highlighter Markers by Fluorometry	Students will analyze and compare different brands of markers as well as various colors of each brand to compare and identify the degree of fluorescence of each.	10 - 12	C
	3.922	Analysis of Nicotine in Cigarettes by Fluorometry	Students compare the amount of nicotine in a variety of cigarettes (regular, lights, ultralights) for differences in nicotine content. A standard nicotine solution can be used for quantitative comparison.	9-12	C
	3.923	Analysis of Quinine in Tonic Water	Students use fluorimeters to analyze and compare various brands tonic water for quinine content.	10 - 12	C
	3.931	Comparison of Synthetic versus Natural Perfumes	Students use the infrared spectrophotometer to identify differences between synthetic and natural perfumes.	10-12	C
C	3.932	Analysis of Combustion Exhaust	Students use the infrared spectrophotometer with a gas cell to analyze car exhaust and identify its components.	10-12	C
C	3.933	Analysis of Motor Oils	Students use the infrared spectrophotometer to analyze and compare natural, synthetic, new and used motor oils.	10-12	C
C	3.934	Characterization of Plastics For Recycling	Students use the infrared spectrophotometer to analyze, identify and compare several common plastics.	10-12	C
	3.935	Comparison of Tapes & Labels	Students use the infrared spectrophotometer to analyze, identify and compare various glues and adhesives.	10-12	C

Advancing Science Activities List for High School (9-12)

CBW Activity	Activity Number	Name of Activity	Capsule Description of Activity	Grade Level	Subject Area
C	3.936	Measurement of V. O. C.s in Essential Oils	Students use the infrared spectrophotometer to analyze, identify and compare various volatile organic compounds.	10-12	C
C	3.937	Analysis of Petroleum Hydrocarbons	Students use the infrared spectrophotometer to analyze, identify and compare various hydrocarbon compounds found in fuels.	10-12	C
C	3.938	IR Analysis of Stuff of Life	Students use the infrared spectrophotometer to analyze, identify and compare various substances found around the home, from foodstuffs to motor oils.	10-12	C
	3.941	Confirming Esterification with the IR	Students use the Thermo - Electron FTIR to analyze the reactants (alcohol and acid) and the product (ester) to confirm that the desired reaction has taken place.	10 - 12	C
	3.942	Identifying Crime Scene Fibers Using the IR	Students will analyze various fabrics and fibers to identify the polymer content for the purpose of linking a crime scene sample to a perpetrator.	10 - 12	C
	3.943	Identifying Crime Scene Plastic Films Using the IR	Students will analyze various plastics and thin films to identify the polymer content for the purpose of linking a crime scene sample to a perpetrator.	10 - 12	C
	3.944	Identifying Crime Scene Powered Using the IR	Students will try to identify a white powder from a crime scene using the FTIR. This evidence will be used to try to solve a mock crime.	10 - 12	C
	3.951	Determine the SPF of Sunscreen Lotions	Students use the Scanning UV-Visible Spectrophotometer to examine standard SPF's and then find the SPF value of an unknown sunscreen.	10-12	C
	3.952	Characterizing Colors of Spice Extracts	Students use the Scanning UV-Visible Spectrophotometer to examine and catalog the spectra of known spices. Spectra of whole foods are then compared to identify what spices are in those foods.	10-12	C
	3.953	Analysis of Olive Oils	Students use the Scanning UV-Visible Spectrophotometer to analyze three different grades of olive and then characterize an unknown oil.	10-12	C
	3.971	Microscale Synthesis of Aspirin	Students use the Microscale Glassware to safely synthesize a small quantity of acetylsalicylic acid.	10-12	C
C	3.874 New	Earth's Reflective Qualities	Using the Vernier LabPros, students will measure the reflective quality of various surfaces and colors found on the Earth's surface.	5-12	E, B
C	999.733 New	Hot Spots: Using GPS to Map Temperature Variations	Using Vernier LabPros with TI 83 calculators and GPS units, students will investigate the presence of various microclimates within an area. Can be used in conjunction with the GIS lab # 999.734.	6-12	E
C	999.734 New	Map your Schoolyard's Hot Spots	Combining data collected from lab # 999.733 with the ArcView GIS software students will develop beginner level skills to develop and add data layers to a map of your school campus.	6-12	E
C	999.161 New	H-Fuel Cell Racing	Students charge the H-fuel cell using light and then use that fuel to power a car. Student measure distance traveled and calculate fuel efficiency in several different units.	9-12	E, C, P, M
C	3.242	Kill A Watt	Using kilowatt meters, students will monitor electrical usage and Vernier LabPros will be used to determine the lumens emitted by various light sources.	5-12	
C	999.743 New	Primary Production and Dissolved Oxygen	Using Hach Dissolved Oxygen kits, students will measure the rate of respiration in an aquatic environment. Net and gross productivity will be determined.(AP Biology Lab 12)	8-12	

Advancing Science Activities List for High School (9-12)

CBW Activity	Activity Number	Name of Activity	Capsule Description of Activity	Grade Level	Subject Area
C	3.735 New	America's Least Wanted: GIS and Invasive Species	Students will be introduced to the basic principles of ArcView GIS software needed to produced maps showing invasive species and their unchecked spread throughout Pennsylvania and the United States.	5-12	
C	999.785 New	What's the Water Treatment	Students measure the pH, turbidity and total dissolved solids in a prepared water sample then proceed to do a three step clean up measuring the same parameters after each step to determine effectiveness.	7-12	B, E
	999.254	Ohms Law - Using the Multimeter	Students use Basic Electricity Kits and Multimeters to measure current, voltage and resistance in four kinds of electrical circuits. Students compare measured resistance to resistance calculated using Ohm's Law	8-12	P
C	999.736	Get The Travel Bug	Using GPS receivers and the internet students will place a geocaching Travel Bug and monitor the travel bug as it is carried around the country by geocachers. A high tech versison of the "flat Stanley" project.	k-12	
	3.999	DIY Vernier	Learn the basic set up and operation of the Vernier LabPros with both the laptops and calculators.	4-12	
	999.154 New	Solar Water Disinfectent: Using the Sun to Solve a Global Problem	understand the value to have the ability to disinfect water using the sun. This activity is written as an inquiry based activity but can be adapted.	9-12	B, E
	999.945	IR Thermometer New	In this lab students will use an infared thermometer to accurately measure the temperature of an object. They will deteremine (estimate) the emmissivity of an unknown sample.	10-12	C, P