ids Education

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The Caliper

Vernier

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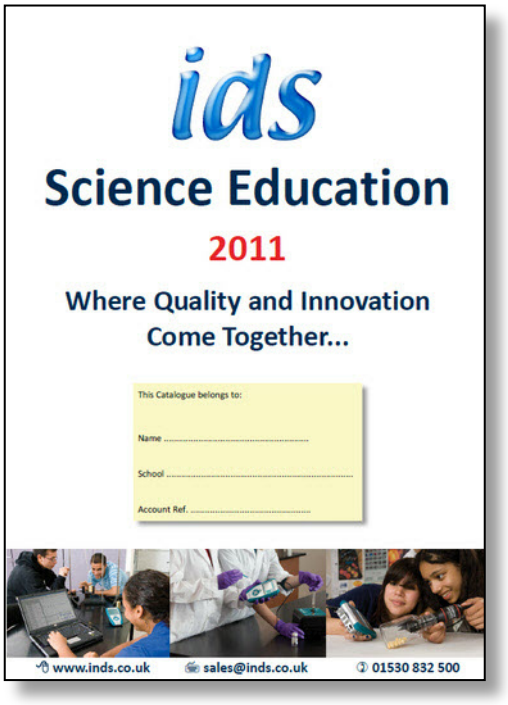
In this issue:

Out Now!



The **NEW** IDS Education catalogue is now available and will be sent out over the next few weeks.

If you would like a copy earlier please contact us and we will send it out straight away.

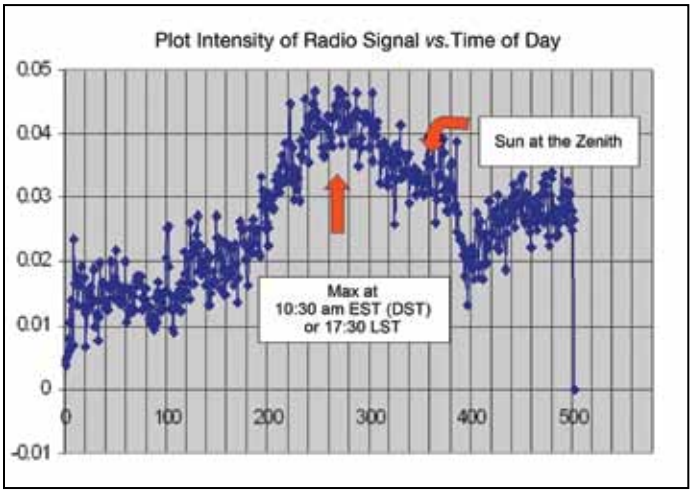
Physics

Locating a Black Hole

Using a Go!Link, the instrumentation amplifier, and Logger *Pro* software, students at Madonna High school, in Weirton, WV, recently applied Vernier hardware and software to the task of locating a massive black hole believed to exist at the centre of our galaxy.

Using a short wave radio, some custom circuitry, the Vernier instrumentation amplifier, a Go!lLink and Vernier Logger *Pro* software, students were able to monitor electromagnetic radiation emanating from Sagittarius A* (pronounced "Sagittarius A-star"), a radio source in the area around the black hole. These radio waves are apparently produced by the destruction of matter in an accretion disk surrounding the black hole.

The EM radiation is distributed broadly across radio frequencies; students chose to monitor 87.10 MHz, a short wave band near the frequency reserved for radio astronomy. Sampling at a rate of 500 samples per day over four days, students recorded the time of day when the peak in EM intensity was observed. Students were able to compare their results to astronomical data, verifying that their measurements correlated with the right ascension of Sagittarius A*.



A composite of the mean intensity of four days of sampling at 500 samples per day shows two maxima, one for the zenith of the Sun, and one for the right ascension of Sagittarius A.*

An Improvement to the Inverse Square Law Light Experiment

Richard Borne (Northern Illinois University) has suggested an improvement to the Inverse Square Law Light Experiment using our Optics Expansion Kit. He noticed that the intensity of our white LED lamp decreases somewhat over time when it is first turned on. Since students doing this experiment may take a few minutes to collect the light intensity *vs.* distance data, his suggestion is to turn on the LED light sources for a half hour or more before starting data collection. We have modified the documentation in our optics Expansion Kit and the instructions for our inverse square law lab to include these suggestions. Dr. Borne has nicely documented light intensity variation and its impact on the experimental results in the article.

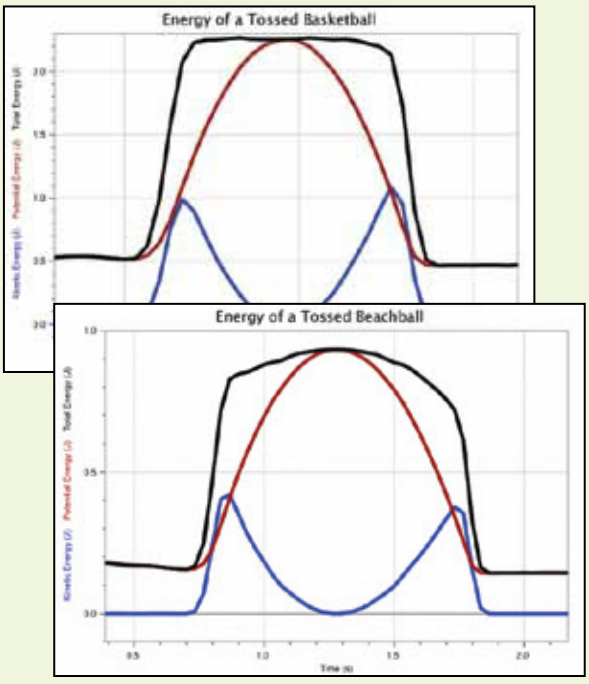
Physics Puzzle

by Matt Anthes-Washburn

While performing an experiment from the *Physics with Vernier* lab book, "Energy of a Tossed Ball," Kathy Morello and her students from St. Joseph's Academy in Baton Rouge, LA, found some perplexing results. In the experiment, a Motion Detector is used to measure the position and velocity of a ball tossed vertically. The relative quantities of gravitational potential energy (GPE) and kinetic energy (KE) are compared to the total mechanical energy (TME). Usually, we see that GPE increases as the ball rises and decreases as the ball falls, while the KE follows an inverse pattern. During the period the ball is in the air, the TME is generally constant (although frictional forces can cause the TME to decrease noticeably in some cases).

Morello and her students found precisely these results until they performed a trial with a beach ball. Unexpectedly, students found that the TME increased as the ball rose, an apparent increase in energy! Have they violated the law of conservation of energy? Where did this extra energy come from? Was there something wrong with the way they performed their measurements?

After some initial investigations, in which I was able to repeat Ms. Morello's results, I found that this question will likely lead to interesting teaching opportunities and perhaps new areas for independent student investigation. In order to encourage others to explore and debate this phenomenon, we are opening the discussion to the Vernier community at www.vernier.com/discussion/physics-puzzle



Physics

NEW! Centripetal Force Apparatus

Centripetal force is a difficult topic to teach, and it is even more difficult to study in the physics lab. Many physics instructors skip this activity, because it is just hard to do a careful, quantitative experiment. We have a new apparatus to help your students explore this common topic.

A rotating beam holds a variable mass, as well as a counterweight. The variable mass is on low-friction bearings, and is held to the circular path by a string. The string is attached to a force sensor via a swivel and pulleys. The beam can be spun by hand or by a falling mass. A slotted wheel on the beam allows for precise speed measurements using a Photogate.

You supply either a Dual Range Force Sensor or a Wireless Dynamics Sensor System (WDSS) for the force measurement. The speed can be measured using a Vernier Photogate or a Vernier Rotary Motion Sensor. Data can be collected using a LabQuest, LabQuest Mini or a LabPro.

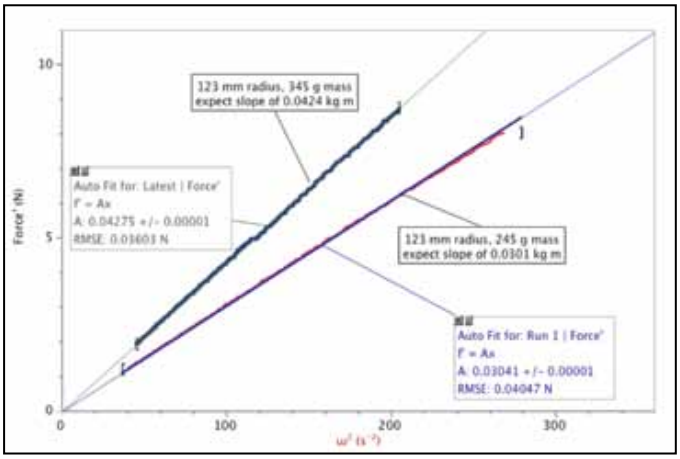
To illustrate the capability of the CFA , we did a quick experiment using a different perspective than is often used. We know $F=mv^2/r$, but that's the same as $F=m\omega 2r$, where ω is the angular velocity of the mass. This suggests an experiment that lets us explore a variety of speeds with one run and with a very simple graphical result.

If we just spin the beam by hand and let it slow down over 30 or 40 seconds, we'll have force as a function of angular speed. A graph of force *vs.* the square of the angular speed is a direct proportionality, where the slope represents the product of the ass and radius, since $F=(mr)\omega^2$.

We used Logger *Pro* to collect and graph the data, although you can do the same with LabQuest App.

Other things you can try with the CFA are experiments with a falling mass to study moments of inertia, torque, and angular acceleration. The new *Advanced Physics with Vernier – Mechanics* book includes an experiment with the apparatus.

Order Code: **VR113512 £312**



In this graph, two combinations of mass and radius were used; in each case, the slope is the product of mass and radius, and the functional relationship is a proportionality. We used a Photogate and Dual Range Force Sensor here, since those will be most commonly available.

Video Physics

Winners Share Their Projects

Congratulations to the winners of the Vernier Video physics contest! Winning entries included a demonstration of the circular motion of a hover puck, the cycloid nature of a rolling steel can, and the frame of reference of a supermarket checkout belt. Three grand prize winners each received an iPod touch with HD video recording, and second prize winners received gift cards to the iTunes store.

Winning projects can be seen at www.vernier.com/ios/contest.html and through a free update to Vernier Video Physics in the iTunes App Store: http://bit.ly/videophysics

New features of Video physics include pinch-to-zoom and panning of high resolution videos, Spanish language support, and additional options for importing and exporting video. Video physics was recently featured as "new and noteworthy," and "What's Hot" in the app store. Thanks for helping to spread the word.

iPod touch photo courtesy of Apple

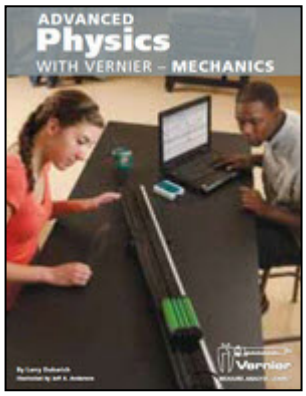
Physics

NEW! Advanced Physics with Vernier – Mechanics

by larry Dukerich

Advanced Physics with Vernier - Mechanics is a set of new experiments for a more in-depth introductory physics course. The book contains four introductory activities and 19 student experiments. Seventeen experiments use sensors with LabQuest, LabQuest Mini, or LabPro with Logger *Pro* software, or with LabQuest as a standalone device. Two experiments use the video analysis capabilities of logger Pro. These experiments represent most of the experiments included in the mechanics portion of a college course or an advanced physics course in high school, including an AP or IB physics course.

This book is unlike traditional lab manuals, which often guide students through the verification of physics concepts. This book takes the approach of providing students the opportunity to carefully examine phenomena and try to make sense of their findings. This leads the students to the discovery of important concepts.



The experiments assume that there will be regular interactions with an instructor and between student groups. While the experiments are designed around these interactions, they are not open-ended experiments that lack closure or direction. In addition, the experiments address the key concepts of a rigorous introductory physics course in a way that ensures all students will be prepared to move forward in the curriculum.

Instructor notes include discussion on how to lead students through a successful experiment. The book includes many extensions to challenge the most talented students.

Experiments include the investigation of:

Order Code: **VR114792 £50**

- Motion on an Incline
- Error Analysis
- Newton's First Law
- Newton's Second Law
- Newton's Third Law
- Projectile Motion
- Energy Storage and Transfer: Elastic Energy
- Energy Storage and Transfer: Kinetic Energy
- Energy Storage and Transfer: Gravitational Energy
- Impulse and Momentum
- Momentum and Collision
- Centripetal Acceleration
- Rotational Dynamics
- Conservation of Angular Momentum
- Simple Harmonic Motion: Mathematical Model
- Simple Harmonic Motion: Kinematics and Dynamics
- Pendulum Periods
- Physical Pendulum
- Centre of Mass

Physics Articles using Vernier Products

Logger *Pro* 3

Logger *Pro* 3

Logger *Pro* 3

There have been lots of great projects in *The Physics Teacher* using our software and hardware:

"An Experimental investigation of the End Effects for Blue Man Group® Pipes" by M. E. Bacon and Steven Torok (Thiel College, Greenville, PA) in the March 2011 issue uses our LabQuest and its internal microphone with Logger *Pro* to study a version of this unusual instrument built using pipes open on both ends.

"Using 'student Technology' in introductory physics: a Comparison of Three Tools to study Falling objects" by Fabio Saraiva da Rocha, Fabio Fajardo, Maricarmen Grisolia, Julio Benegas, Robert Tchitnga, and Priscilla Laws is in the March 2011 issue. It is an interesting article that came out of a meeting of physics instructors from all over the world, many from countries where very minimal physics apparatus is available. They compared three methods of taking experimental data on falling objects: Vernier Go!Motion, video analysis using a cell phone, and video analysis using a more expensive digital video camera.

"Innovative Interactive Lecture Demonstrations Using Wireless Force Sensors and Accelerometers for Introductory Physics Courses" by G. Yoder and J. Cook (Eastern Kentucky University) in the December 2010 issue describes several great demonstration ideas using our Wireless Dynamics Sensor System Logger *Pro*.

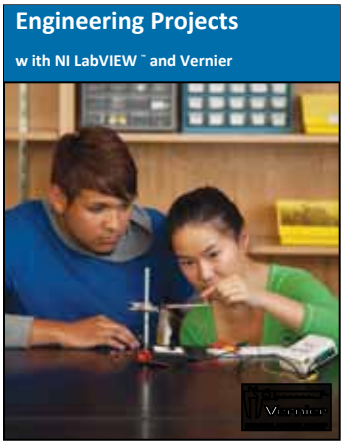
"Experiments with Helium-Filled Balloons" by Anthony C. Zable (Portland Community College, OR), in the December 2010 issue, has some innovative experiments using our Gas Pressure Sensor and Temperature Sensor.

"Measuring Model Rocket Engine Thrust Curves" by Kim Penn and William V. Slaton (University of Central Arkansas), in the December 2010 issue, describes how to use our Dual-Range Force Sensor and Logger *Pro* software to graph thrust *vs.* time for model rocket engines.

"An inexpensive Cosmic Ray Detector for the Classroom" by Jeffrey D. Goldader and Seulah Choi (The Baldwin school, Bryn Mawr, PA), in the December 2010 issue, explains how they built a cosmic ray detector to use with LabPro.

Engineering

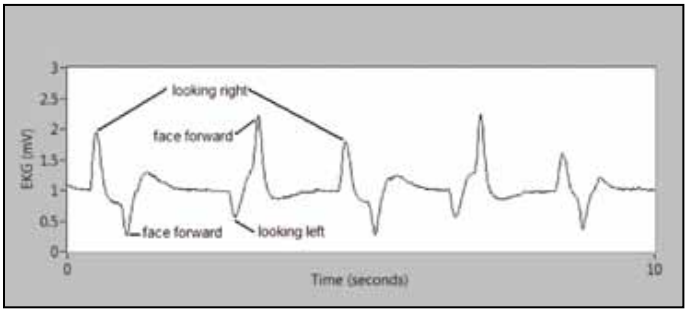
NEW! Engineering Projects Lab Book



Engineering Projects with NI LabVIEW™ and Vernier is a new book that introduces students to engineering concepts such as sensor construction, analogue and digital input, control systems, and voltage dividers. There are 12 projects and challenges, essential teacher information in each chapter, and sample LabVIEW programs included on CD.

In Chapter 8, the project's design requirements instruct the students to create a data-acquisition program to display and analyse an EKG waveform. They are given background information on the five major deflections on a normal EKG, how to properly connect an EKG sensor to a test subject, and tips for using the graphical analysis tools of a LabVIEW graph. Once they complete this project, the students are posed a challenge to compute the subject's heart rate from the EKG waveform. They must work with the waveform and determine how to design an appropriate signal processing algorithm.

Order Code: **VR113192**



Monitoring Eye Movement using EKG graphs

Chapter 8 concludes with an Extreme Challenge - to use the EKG Sensor to detect the electrical changes that occur in the movement of the eyes, and to turn on a green LED when the subject looks right, and a red LED when the subject looks left. The chart above shows the EKG reading of a subject looking left and right. Notice the peaks and valleys that occur in the waveform when the subject looks left and right, but also when looking forward.

Students who take on this challenge will be learning how the EKG Sensor works, signal processing, digital output, LabVIEW programming, troubleshooting and many other pieces required to solve this problem. And if they can activate an LED based on eye motion, perhaps they will wonder what else they can do?

What Can You Teach with Vernier and LabVIEW?

National Instruments recently ran a contest called "What can you teach with LabVIEW?" Teachers were invited to submit videos showing creative ways to use LabVIEW to teach science and engineering concepts in the classroom. Winners were awarded prize money and a technology bundle. Several users of Vernier technology were prize winners or received honourable mention including:

Ralf Widenhorn, Justin Dunlap, Elliot Mylott, Ryan Klepetka (Portland State University)

Computed Tomography scanner:
www.youtube.com/watch?v=YQ_KgU42uRU

Dominic Audia and Doug Herman (Iowa City West High School)

Heart Rate Monitor with audible alarm:
www.youtube.com/watch?v=lP4I6HbpQIA

Rebecca Morrison (Runnels School)

Singing Magnets:

www.youtube.com/watch?v=Rgs95LdHZWc

Nelson Nunalee (Ravenscroft school)

Video Mood Ring:

www.youtube.com/watch?v=jvAwZgMy9oE

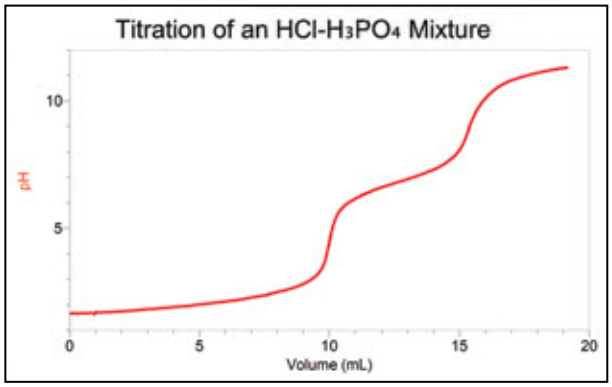
Chemistry

Investigating an Acid Mixture

An interesting and challenging problem for Chemistry students is the investigation of a mixture. For this issue, we offer a chemistry experiment in which the student analyses a mixture of hydrochloric acid, HCl, and phosphoric acid, H_3PO_4.

The student is presented with the task of conducting a seemingly routine acid-base titration. However, the student must analyse the titration data to determine how much HCl and how much H_3PO_4 were in the mixture. As an added bonus, the student will determine the K_{a2} of H_3PO_4.

For the complete lab, go to:
www.inds.co.uk/howto/acid_mixture.htm

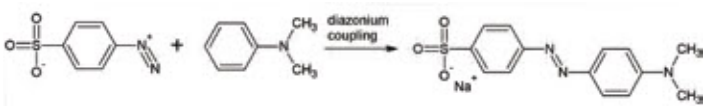


Organic Chemistry Experiments with Vernier

By Melissa Hill, ph.D.

Good news for all you organic chemists out there! Our chemistry offerings have expanded to incorporate organic chemistry experiments that utilize four sensors: Melt station, Wide-Range Temperature Probe, SpectroVis Plus and Vernier Mini Gas Chromatograph. There are 16 organic chemistry experiments available for free download. The experiments cover a broad range of topics, including synthesis, separation methods, analysis of unknowns and thermodynamic properties. Each of these files includes a complete student lab handout, instructor information on preparing reagents, hazard information on chemicals used, and sample graphs. As always, they are in Microsoft Word format, so you can edit them to your specifications. These files can be found at:
www.inds.co.uk/chemistry/experiments.htm

One experiment, highlighted here, is the organic synthesis of methyl orange and how this has important applications to the textile industry. Methyl orange, 4-4-[(dimethylamino)phenylazo] benzenesulfonic bcid, is an azo dye that forms orange crystals and is commonly used as an acid-base indicator, due to the fact that its anion form is yellow and its acid form is red. It can be synthesized from sulfanilic acid and n,n-dimethylaniline using a diazonium coupling reaction, a common reaction for treating an aliphatic amine to yield a carbocation.



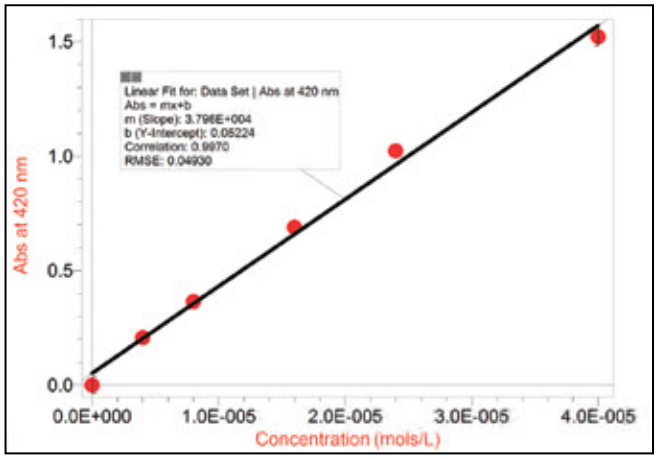
Diazontized sulfanilic acid *n,n-dimethylaniline* *Methyl orange*

After students have completed their syntheses, the precise concentration of synthesized methyl orange, and thereby the product purity, can be determined using the Vernier SpectroVis Plus spectrophotometer after performing a Beer's Law analysis on a methyl orange standard. Students can also observe the visible absorption spectral changes associated with the acidic and basic forms of the compound.

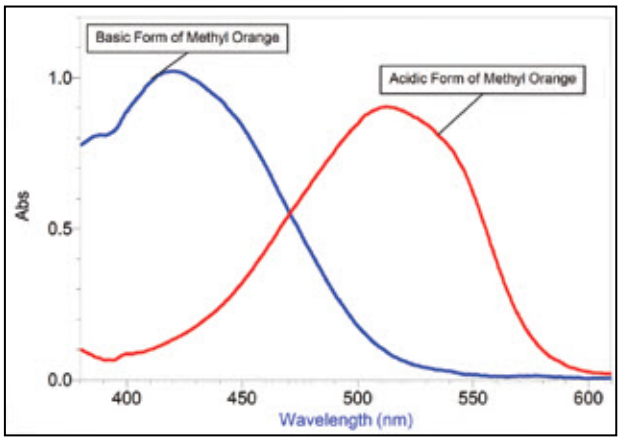
Synthesized methyl orange

The synthesized methyl orange can then be used to dye various types of fabrics, so students can experience firsthand the importance of organic chemistry in the textile industry.

Detailed student instructions for this synthesis are available for free download at:
www.inds.co.uk/chemistry/experiments.htm



Beer's law analysis of pure methyl orange



Absorbance spectrum of lab-synthesized methyl orange

NEW! Melt Station

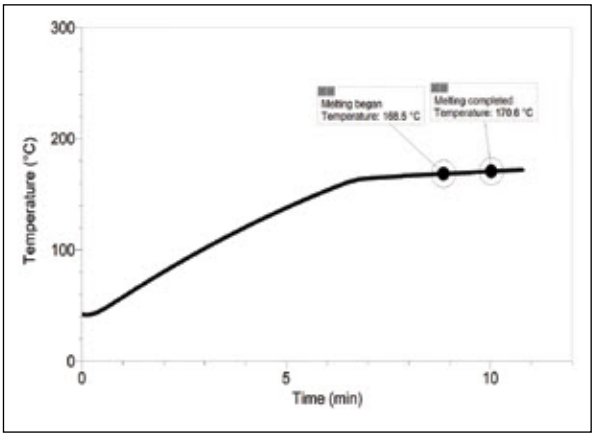
Determining the Melting Temperature of Solids

Vernier has expanded their chemistry offerings to incorporate organic chemistry with the addition of Melt Station, a new sensor for determining the melting temperature of solids. Melting temperature is a physical property often used to help identify compounds or to check the purity of a compound. pure organic compounds generally have a sharp melting temperature, typically melting over a few degrees. The presence of an impurity lowers the pure compound's melting temperature and broadens the temperature range over which it melts. a s a result, a solid's melting temperature is useful not only s an aid in identification but also as an indication of purity.

Melt station reports accurate temperature results using a built-in RTD (Resistance Temperature Detector), over a range from ambient to 260°C. A high-quality 6X magnification viewing lens allows for clear observation of the samples and an innovative, adjustable tilt offers an optimal viewing angle. For added safety, Melt Station has an automatic shut-off feature. A cooling fan significantly reduces waiting time between tests.

Melt Station connects to a Vernier interface (LabQuest, LabQuest Mini, Go!Link, or LabPro), allowing you to monitor and record readings with Logger *Pro* 3 software or LabQuest App. A new feature of Logger *Pro* and LabQuest App is the ability to observe a graph of time-dependent temperature data combined with a new Data Mark feature, providing excellent accuracy and precision. The sample data show a time-dependent temperature graph with the Data Marks indicating the melting temperature range of acetaminophen.

For free experiments using Melt station, go to: www.inds.co.uk/chemistry/experiments.htm



Logger Pro graph of the melting temperature of acetaminophen

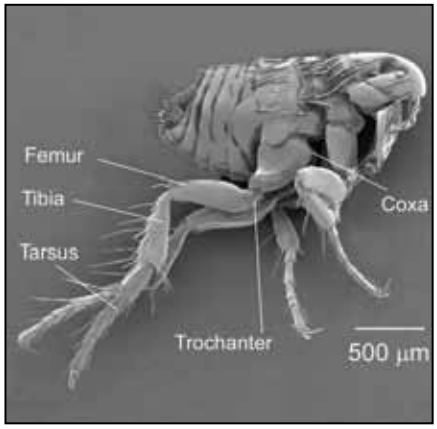
Order Code: **VR113536 £416**

Biology

Biomechanics of a Jumping Flea

We've all heard of the age-old Bennet-Clark/Rothschild debate about flea jumping, right? Just to refresh your memory, Henry Bennet-Clark, the researcher who discovered in 1967 that fleas store the elastic potential energy for their jump in a material called resilin, made predictions on the mechanics of flea jumping.

Bennet-Clark hypothesized that fleas take to the air by use of the tarsus (toe) in the application of a liftoff force. On the other hand, Miriam Rothschild proposed that fleas use their knees (trochanters) to push off.



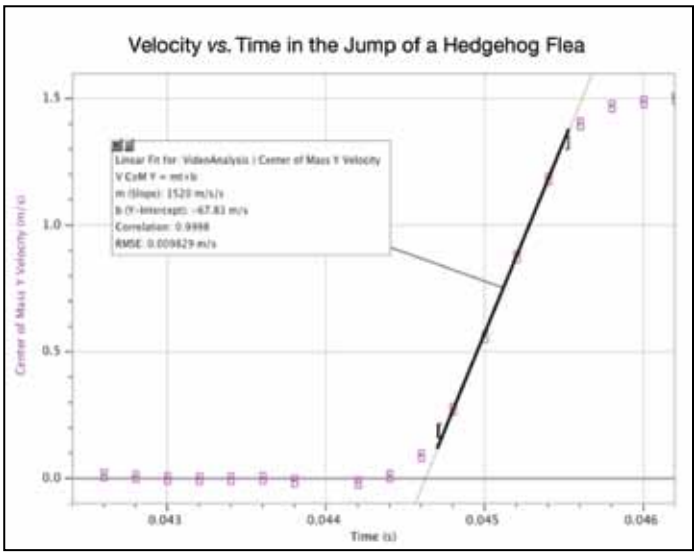
Researchers Gregory Sutton and Malcom Burrows, at Cambridge University, recently revisited the debate, applying high-speed imagery, shot at 5000 frames per second, to the problem. The researchers found that, while both the trochanter and tarsus often make contact with the ground, the measured acceleration continues throughout the flea's jump, even after the trochanter has left the ground, while the tarsus is the only source of liftoff force.

Additionally, in 10% of jumps, fleas push off using only the tarsus, and the resulting acceleration is unaffected. amazingly, that acceleration is around 1,500 m/s^2, or 150 *g*!

Conclusion? Fleas don't use their knees; they go with their toes. Sutton and Burrows were kind enough to share sample video files of hedgehog flea jumps, which you can download and analyse yourself using the video analysis features of lLogger *Pro* 3. To download the files, go to www.vernier.com/innovate/157

To carry out the analysis, we tracked the head and the tail with separate point series and used the new Centre of Mass feature of Logger *Pro* 3.8.4 to track the flea's motion. We imported an electron micrograph (provided), to scale the video, using the flea's tibia and the photo analysis feature of Logger *Pro* 3. Finally, we adjusted the frame rate to 5000 fps. Our measured acceleration agreed with that found by sutton and Burrows.

Reference: Sutton, G. P. and Burrows, M. (2011). Biomechanics of Jumping in the Flea. J. Exp. Biol. 214, 836-847.



Looking for ways to include inquiry investigations in your biology class? Check out the "Cell Respiration" investigation available at: www.inds.co.uk/education/resources.htm#Cell_Respiration

Science Humour

Q: What is the simplest way to observe the optical Doppler effect?

a : go out at night and look at cars. The lights of the ones approaching you are white, while the lights of the ones moving away from you are red.

Q: Does a radioactive cat have 18 half lives?

And a couple of bar jokes…

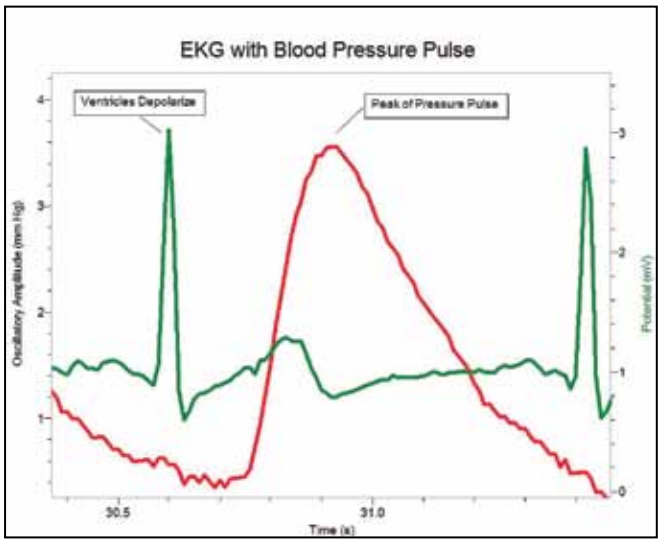
- Helium walks into a bar. The bartender says, "sorry, we don't serve noble gases here." Helium doesn't react.
- A bar walks into a guy, oh sorry, wrong reference frame.

Biology

Monitor Blood Pressure and EKG Simultaneously Using Logger *Pro*

By John Melville, ph.D.

John Melville, Vernier's Biology staff scientist, has developed an innovative way to demonstrate how the electrical and physical events of the cardiac cycle are related using a Blood Pressure Sensor and an EKG sensor with our award-winning Logger *Pro* software.



Blood pressure is a measure of the changing fluid pressure within the circulatory system. it varies from a peak pressure produced by contraction of the left ventricle of the heart, to a low pressure, which is maintained by closure of the aortic valve and elastic recoil of the arterial system.

An electrocardiogram (ECG or EKG) is a graphical recording of the electrical events occurring within the heart. In the healthy heart, there is a pacemaker in the right atrium (the sinoatrial node) that initiates an electrical sequence of events in the heart.

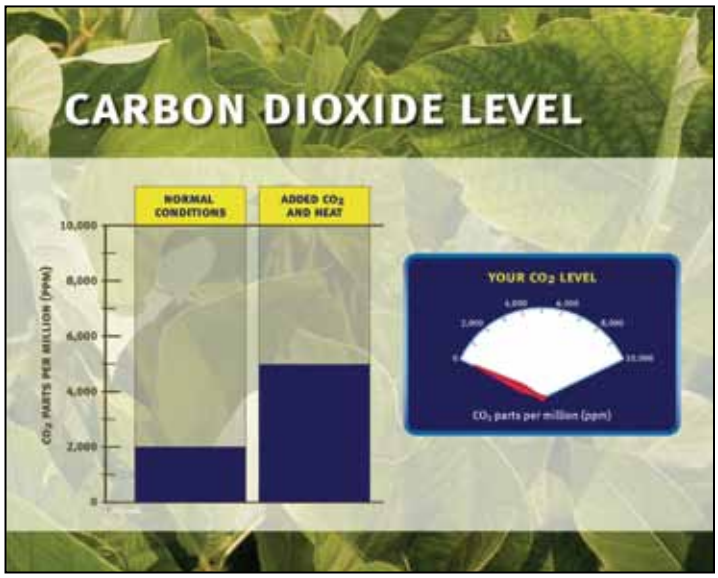
This impulse then passes between the atria to the atrioventricular node, and from there to the ventricles. The ventricles depolarise and contract, producing the peak blood pressure within the circulatory system.

If you measure arterial blood pressure while you perform an EKG, you should see that each QRS complex of the EKG will occur just before a pressure pulse occurs in an artery. This is a common exercise or demonstration in college physiology courses. a s shown in the graph provided, you can easily demonstrate this to your class using Logger *Pro* software. All you need is a Blood Pressure Sensor, an EKG Sensor, and an appropriate Vernier interface (LabQuest, LabQuest Mini, or LabPro).

To record a Blood pressure pulse and EKG simultaneously, follow the directions at www.inds.co.uk/howto/bp_plus_ekg.htm

CO_2 Sensor in Museum Exhibit

Jeff Kennedy Associates, Inc. and scientists from Brown University have developed an interesting museum exhibit using three of our Co 2 sensors. We wrote the software for it using LabVIEW. As you can see in the photo, there are two sealed containers containing plants. In this case, they used kudzu, a rapidly growing invasive plant on the east coast. One container has normal air. The CO_2 level in that container is monitored with one sensor. The other tank has a pipe leading into it where visitors are asked to exhale their breath in order to add extra CO_2. A second sensor monitors the (higher) CO_2 level in that tank. The third sensor reads the CO_2 concentration in the pipe. The idea is to see how much the extra CO_2 encouraged the kudzu growth. The apparatus was part an exhibit called "seasons of Change" that opened at the EcoTarium in Worcester, MA. It will be travelling to other locations, and other versions, customized for other regions of the country, are planned.



For additional information about the museum exhibit, go to http://seasons.terc.edu/abouttheexhibit.html

Software & Hardware

Software Updates

Have you updated your Vernier applications recently? We regularly release updates to support new devices and add new features. Keeping up to date with software releases is one way to keep things running smoothly in your classroom or lab.

Logger *Pro* 3.8.4 - Logger *Pro* 3.8.4 was released in February, 2011. This update is free to all users of any previous version of Logger *Pro* 3, and is available at:
www.inds.co.uk/education/software.htm#Free_Logger_Pro_Updates

Version 3.8.4 adds Data Marks and Data Tags, allowing you to attach notes to particular data points. Data Marks were developed to support the new Melt station. Video analysis acquires several new features, including the ability to automatically skip frames and to calculate the centre of mass for multiple objects.

In case you're several versions back, version 3.8.3 added support for Ocean Optics devices in 64-bit Windows systems, as well as localization to nine non-English languages. A moveable linear curve lets students adjust the fit by dragging the line itself. The release includes support for the new LabQuest Mini and the Vernier SpectroVis Plus and Windows 7, first introduced in version 3.8.2.

LabQuest 1.5 - LabQuest 1.5 was released in March, 2011. Version 1.5 adds Data Marks and Tags, as well as the new Data Matrix. The Matrix is ideal for water quality testing with multiple sensors on multiple sites and days.

LabQuest now supports the WDSS, with the addition of a Bluetooth radio dongle. New sensor support includes the Melt Station and the Anemometer. This free update is at:
www.inds.co.uk/education/labquest_update.htm

The previous 1.4 update added support for the new SpectroVis Plus, as well as offering improved battery life, support for additional sensors and printing to Wi-Fi printers.

Logger Lite 1.5 – Logger Lite 1.5 was released in March 2010 to support LabQuest Mini and Windows 7 (including 64-bit machines), and also adds linear fits. This free update is available at:
www.inds.co.uk/education/software.htm#Free_Logger_Lite_Updates

Accessibility Features in Logger *Pro*

In the new Windows version of Logger *Pro* 3.8.4, we greatly improved the accessibility features for blind and low-vision students. Access these features by selecting accessibility from the File menu. You can check a box to turn on Continuous Tone Meters. This causes the program to play a tone with a frequency depending on the sensor reading; for example, you can hear a frequency increase when the temperature of a probe increases.

Note that this can be useful for sighted people. It is a great way to find shorts, loose wires and intermittent connections. You can also use it to alert you with sound of an event, like a peak on a Mini GC graph.

There is also an option for audio graph playback. When this is selected, the program will play sound to represent a graph of previously collected data.

We have also improved the Logger *Pro* support for JAWS software for blind students.

Você Fala Português?

Did you know that our software is available in several languages?

New languages supported in Logger *Pro* 3.8.4 include Czech, Polish and Dutch. We now directly supply English, Spanish, French, German, Italian, Portuguese, Russian, Dutch, Czech, Polish and Arabic on the principal Logger *Pro* CD, but Logger *Pro* and Logger Lite are each available in 14 languages. LabQuest App is available in 25 languages!

How to store Your LabQuests

Question: What is the best way to store a LabQuest over the summer holidays?

Answer: The best treatment is to simply box up the LabQuest for the summer and leave it disconnected from the charger. Over the summer, the battery will slowly lose its charge, but it will be undamaged.

When you return in the autumn, we recommend that you charge the LabQuest for a full 8 hours before using it. When you first turn on a LabQuest, it may take as long as 3 minutes for it to reboot if the battery completely lost charge.

Exposing the battery to temperatures over 35°C (95°F) will significantly reduce its lifespan. If your school storage area is unusually hot, you may want to keep your LabQuest in a location that remains cooler.

More details on the longevity of the battery can be found at:
www.inds.co.uk/howto/battery_life.htm

Environmental

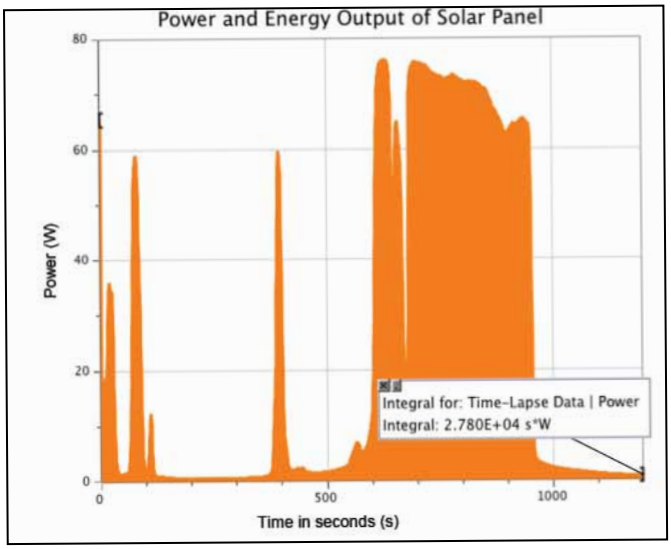
Experimenting with Solar Panels

using the New High Current Sensor and the 30-Volt Voltage Probe

Two of our newest sensors, the High Current Sensor and the 30-Volt Voltage Probe, are well suited for exploring solar panels. During some of our early prototyping, we thought it would be nice to take some data with accompanying video. The result is a very interesting Logger *Pro* project: as the passing clouds block the panel, a connected automobile head lamp dims and there is a drop in the measured current, voltage, and power. When under direct sunlight, you can see nice peaks in each of the graphs, and the head lamp shines brightly. We connected the solar panel to a head lamp, with a High Current sensor in series and a 30-Volt Voltage probe across the two terminals of the lamp. We used the Video Capture feature of Logger *Pro*, setting the Time-lapse Capture options to 1 second between frames. The video was synchronized with data collection, with a duration of 20 minutes (1200 s). Using current and voltage data, we created a calculated column for power (current * voltage).

We even used the integral tool to measure the total amount of energy produced (27,800 W*s or 27.8 kJ).

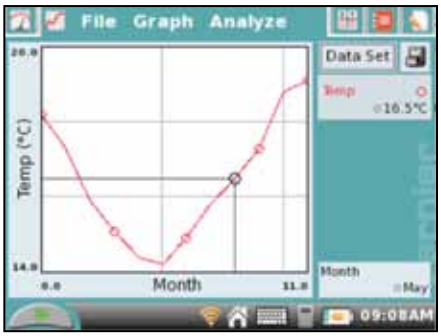
For more information go to
www.inds.co.uk/howto/solar_panels.htm



Data Matrix: Making Field Work Easier

LabQuest has always been a great tool for collecting data in the field. The new Data Matrix data-collection mode in LabQuest App v. 1.5 (released in March) takes it to a whole new level. You can now freely move between sites and days within one file, placing each piece of data exactly where it belongs. Moving around between multiple sites throughout the day? The Data Matrix makes it easy to keep your data organized. Coming back to the same site next month? Not a problem. Just open the original file and drop the new data in the appropriate place. This is illustrated in the graph below, where river temperature data were measured once per month over the course of a year.

Another major enhancement in the Data Matrix is that sensors can now be connected and disconnected at any time without stopping data collection.



This new flexibility allows you to test for an unlimited number of parameters at a given site even though LabQuest has a limited number of ports.

It also opens the door to collecting data with incompatible sensors - use them one at a time and the incompatibility goes away.

Whether you are studying water quality over the length of a river or over the course of a year, the Data Matrix will be an invaluable tool for you and your students. Give it a try by updating to LabQuest App v. 1.5

LabQuest Battery Boost Provides More Time in the Field

Now that fieldwork is so easy with the Data Matrix, you may find that you want to spend more time outside than your LabQuest battery allows. That's where our new LabQuest Battery Boost can help. This compact external battery pack provides hours of additional use of your LabQuest when AC power is not available.

The Battery Boost can be charged using your LabQuest power supply, a car charger (included), or through a computer's USB port. Once charged, connect it to your LabQuest and enjoy hours of additional data-collection time. If you are driving from site to site, the Battery Boost's car charger accessory (included) allows you to plug your LabQuest directly into your car as a power source while it also charges the internal battery.

More details on the longevity of the battery can be found at: www.inds.co.uk/howto/battery_life.htm

Environmental

NEW! Vernier Anemometer

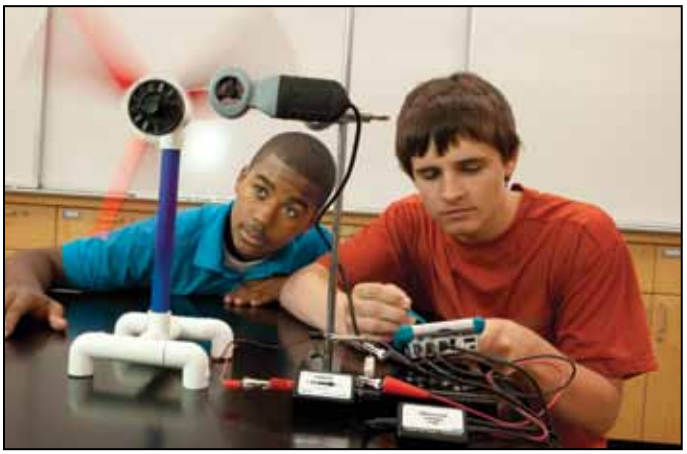
The Anemometer is now shipping. It is an impeller-type anemometer that measures wind speed in the range of 0.5 to 30 m/s. The Anemometer fits in your palm for wind study measurements in the field. To use it, simply hold the Anemometer so that the wind blows directly into the sensor. You can also attach the accessory rod to a standard camera mount on the back. This allows you to position it in wind tunnels or in front of fans for wind turbine experiments.

Here are some other ways you may use the Anemometer:

- Measure the wind speed of air generated by a variable speed fan.
- Use an Anemometer, a Current Sensor, and a Differential Voltage Probe to investigate the effect of design, number and size of rotors and blades of a windmill's electrical energy output.
- Use an Anemometer and an Infrared Thermometer to determine how wind speed affects the rate of cooling of an object.
- Investigate why wind speed is slower over land than it is over the ocean.
- Use an Anemometer and a compass to determine wind direction.

Kid Wind project® is working closely with Vernier to produce a series of experiments to quantify the power and energy output of Kid Wind's wind turbines. We have found their hardware easy to use, and it provides a large amount of data for a variety of simple or complex experiments that students commonly perform. A sample lab, "The Effect of Load on Power Output: Wind Turbines," is available for download at:
www.inds.co.uk/education/sensors/anemometer.htm#Wind_Turbine

Order Code: **VR113528 £93**



Two New Faces at IDS

Olivia and Kate, the latest additions to the IDS team.

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