Vernier

Measure. Analyze. Learn.™

PROBEWARE SOLUTIONS FOR **COLLEGE CHEMISTRY** 2010

VERNIER TECHNOLOGY ADOPTED BY COLLEGE CHEMISTRY LABS

Below is a sampling of some of the more than 400 universities, colleges, and community colleges that use Vernier probeware in their chemistry curriculum.

Alabama A&M University
Allen County Community College
American International College
American University
Augusta State University
Avila University
Boston College
Bowling Green State University
Brigham Young University-Idaho
Brown University
Bryn Mawr College
California Poly State University
California State University
California University of Pennsylvania
Calvin College
Central Wyoming College
Chicago State University
Clark Atlanta University
College of William & Mary
Columbus State University
Cornell College
Cuyahoga Community College
Dickinson College
Duke University
Eastern Kentucky University
Edinboro University of Pennsylvania
Elmhurst College
Emory University
Evergreen State College
Fairfield University
Florida Community College
Florida Institute of Technology
Georgia College & State University
Gonzaga University
Grossmont College
Harvard University
Hastings College
Haverford College
Hillsdale College
Hiram College
Illinois State University
Indiana University of Pennsylvania
Inver Hills Community College
Jacksonville University
James Madison University
John Brown University
Kansas Wesleyan University
Keene State College
Kennesaw State University
Kent State University
Lehigh University
Linfield College
Lipscomb University
Lone Star College
Long Island University
Longwood University
Los Angeles Valley College
Louisiana State University
Lower Columbia College
Loyola University
Marymount College
McNeese State University
Mendocino College
Methodist University
Miami University
Michigan Tech University
Mid Michigan Community College
Middle Tennessee State University
Milwaukee School of Engineering
Minnesota State University
Missouri State University
Monroe Community College
Montana State University
Montgomery County Community College
New Jersey Institute of Technology
New York City Tech College
North Dakota State University
Northern Arizona University
Ohio University
Oregon Health & Science University
Oregon State University
Pennsylvania State University
Pima Community College
Pittsburg State University
Portland Community College
Purdue University
Queensborough Community College
Rose-Hulman Institute of Tech
Rutgers University
San Francisco State University
San Jose State University
Scottsdale Community College
Sonoma State University
Stony Brook University
Suffolk County Community College
SUNY
Sussex County Community College
Texas A & M University
University of Akron
University of Alabama
University of Arizona
University of Arkansas
University of California
University of Colorado-Denver
University of Connecticut
University of Denver
University of Florida
University of Hawaii at Hilo
University of Illinois
University of Iowa
University of Kentucky
University of Louisiana
University of Massachusetts
University of Miami
University of Minnesota
University of Missouri
University of Nevada
University of New Hampshire
University of New Mexico
University of North Carolina
University of North Texas
University of Notre Dame
University of Oregon
University of San Diego
University of San Francisco
University of South Carolina
University of Tennessee
University of Texas
University of Washington
University of Wisconsin
US Naval Academy
Utah State University
Virginia Tech
Wagner College
Washington State University

NEW LabQuest® Mini

Collecting data exclusively on computers or netbooks? LabQuest Mini may be the perfect solution for you.

LabQuest Mini is the perfect solution for chemistry educators collecting data with a computer. LabQuest Mini interfaces with Logger *Pro* software for unparalleled power, analysis, and a small lab-bench footprint.

*Pages **10–11*** ONLY **$149**

NEW Mini GC®

Analyzing compounds in general chemistry and organic chemistry is now easier and more affordable with Vernier's new gas chromatograph. Students can learn to separate and identify compounds using technology that is thousands of dollars less than a traditional GC. Unique features include:

- Use room air as a carrier gas
- Enjoy a small footprint for your lab bench—Mini GC is half the size of a shoe box
- Connect via USB to either a computer or to LabQuest as a standalone device

See Insert ONLY **$1,749**

NEW Improved SpectroVis® Plus

Vernier has updated its popular spectrometer with improved features:

- Improved range: 380–950 nm (VIS-NIR)
- 1 nm between reported values
- Improved optical resolution (~2.5 nm)
- New support for fluorescence

Pages 18-19 ONLY **$449**

2 **WHICH INTERFACE IS RIGHT FOR ME?**
Choose between LabQuest, LabQuest Mini, and Go! Link.

3 **LOGGER *PRO***
Award-winning data-acquisition, graphing, and analysis software.

4 **LABQUEST**
Our color, touch-screen interface. This durable handheld is compatible with over 60 Vernier sensors.

13 **SENSORS**
Purchase **one set** per lab station (2 –3 students) or build your own from the list of recommended sensors.

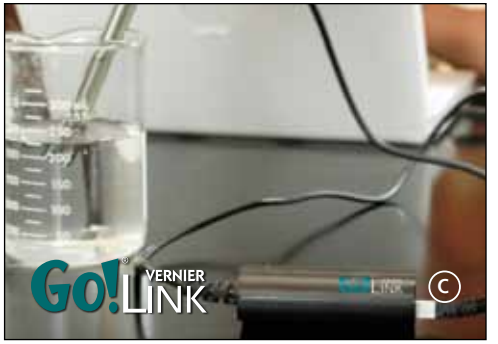
14 **CURRICULA**
Enhance your curriculum with Vernier lab books.

16 **FEATURED PRODUCTS**
- Wide-Range Temperature Probe 16
- **NEW** Mini GC Insert
- Vernier Drop Counter 17
- Stir Station 17
- Ohaus Balances 23
- Spectrometers 18-22
- **NEW + IMPROVED** SpectroVis Plus 18-19
- **NEW** Spectrum Tube Single Power Supply 22

25 **WORKSHOPS**
Find a hands-on workshop in your area.

INTERFACE CHOICES

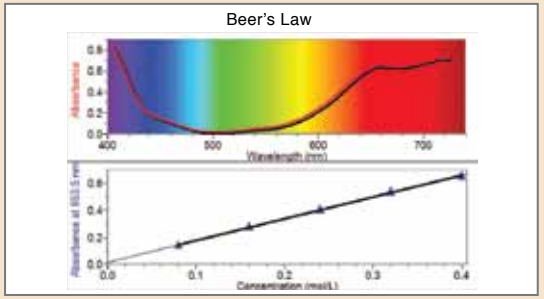
We offer several options for data collection to accommodate different budgets and laboratory setups. To help you decide which interface is right for you, we've included brief descriptions of each interface. Demos and a comprehensive comparison chart are available online at **www.vernier.com/interfaces**



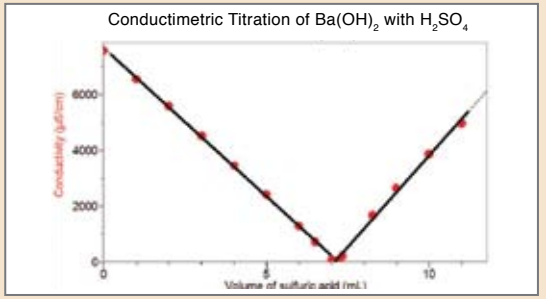
INTERFACES—COMPATIBILITY/PRICE CHART

CHOICES	SUPPORTED PLATFORMS	MAXIMUM SAMPLING RATE	COMPATIBLE VERNIER SENSORS	REMOTE DATA COLLECTION	BUILT-IN COLOR SCREEN	RECHARGEABLE BATTERY	BUILT-IN SENSORS	SUPPORTS MULTIPLE SENSORS	SOFTWARE	LAB INSTRUCTIONS
ⓐ **LabQuest®** SEE PAGE 4-5 $329 ORDER CODE LABQ ONLY **$299** WHEN YOU BUY **8** OR MORE	Standalone or with computers	100,000 per second	66 sensors	Built in	Yes	Yes (or use AC power at lab stations)	Temperature Microphone	Yes	Built-in LabQuest Application Logger *Pro* (not included)	96 Chemistry labs in print
ⓑ **NEW LabQuest® Mini** SEE PAGE 10-11 $149 ORDER CODE LQ-MINI	Computers only	100,000 per second	66 sensors	With a laptop computer	No	No (powered through USB)	None	Yes	Logger *Pro* (not included)	96 Chemistry labs in print
ⓒ **Go!® Link** More details at: www.vernier.com/go $61 ORDER CODE GO-LINK	Computers only	200 per second	58 sensors	With a laptop computer	No	No (powered through USB)	None	No	Logger *Pro* (not included)	96 Chemistry labs in print

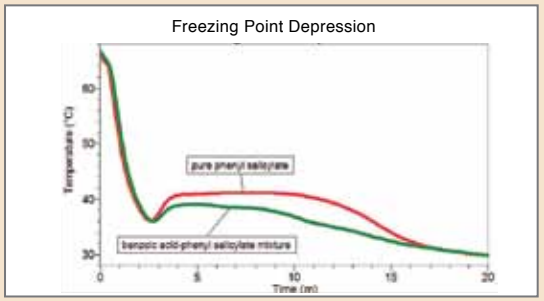
FOR TI CALCULATORS: More details at www.vernier.com/ti



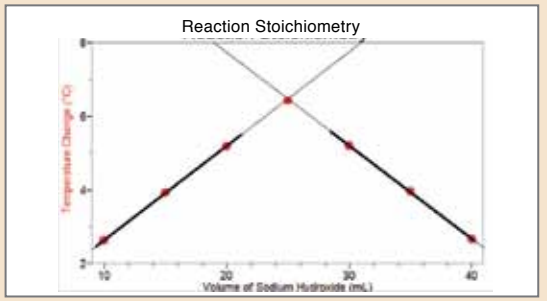
Beer's law determination of the concentration of a copper sulfate solution using a SpectroVis Spectrophotometer



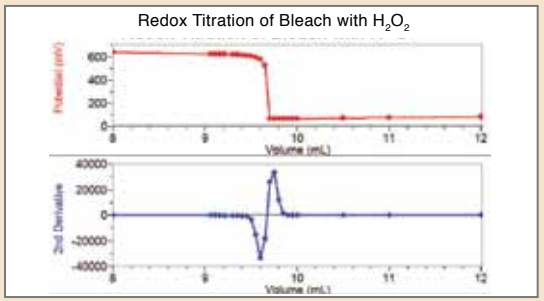
Conductimetric titration of barium hydroxide with sulfuric acid using a Conductivity Probe, Drop Counter, Stir Station, and Microstirrer



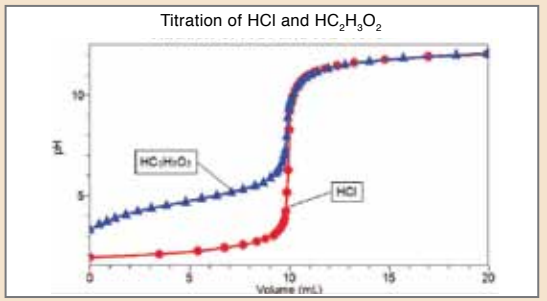
Freezing point depression determination of molecular weight using a Stainless Steel Temperature Probe



Continuous variations method of determining the mole ratios of sodium hydroxide to oxalic acid using a Stainless Steel Temperature Probe



Redox titration of bleach with hydrogen peroxide using an ORP Sensor, Drop Counter, Stir Station, and Microstirrer



Titrations of a strong and a weak acid using a pH Sensor, Drop Counter, Stir Station, and Microstirrer

Logger *Pro*® 3

Real-Time Graphing and Powerful Analytical Tools

- Logger *Pro* is the ideal companion for LabQuest or LabQuest Mini.
- Logger *Pro* is the most popular data-collection program in science education. Why? Instructors tell us that students find our software to be very easy and intuitive to use.
- One program does it all—for only $189—for all of your department's computers AND your students' personal computers. (*Once you have purchased 1 copy of your site license, your college bookstore can purchase student CDs for $2 each for easy distribution: Logger* Pro *5-pack of CDs, order code LP-ST5, $10)*
- Think of Logger *Pro* as the digital data hub of your lab. It can gather data from a variety of sources, including LabQuest, LabQuest Mini, Go! devices, Ohaus balances, Ocean Optics and Vernier spectrometers, GPS receivers, and Vernier Mini GC.

GREAT VALUE

Logger *Pro*

$189 ORDER CODE **LP**

- Logger *Pro* includes a site license for your college department.
- Site license includes personal computers of faculty.
- Site license includes personal computers of students so they can analyze their data away from the lab.
- No need to count computers to satisfy licensing.
- Updates to Logger *Pro* 3 are free.

VERNIER LabQuest®

The freedom to inquire. The technology to excel.

Breakthrough data-collection technology—the Vernier LabQuest®

Presenting the most powerful and intuitive interface for chemistry education. Now you can have a data-collection interface with built-in data processing and analysis at each lab station—with a small lab bench footprint for $329.

Use it as a standalone device or as a computer interface with our award-winning Logger *Pro* software. Created with today's classroom in mind, you will love its durability, vivid color touch screen, and ease of use. And, of course, since it was developed by Vernier, it is backed by comprehensive curriculum, a generous warranty, and legendary support.

$329 ORDER CODE **LABQ**

ONLY **$299** WHEN YOU BUY **8** OR MORE

Collect buttons

Navigation keys
Provides quick access to key features

Built tough. Built to last.
Designed with students in mind, the rubber overmolding and rugged mechanical design provide protection against everyday bumps, falls, and splashes

Built-in microphone
Record voice annotations or collect sound data

- 320 x 240 color graphic display
- LED backlighting provides you with outstanding clarity in the classroom or in the field

Built-in temperature sensor

Fast sampling rate
100,000 samples per second

Rechargeable batteries
High quality, lithium-ion rechargeable battery pack usually lets you go a full lab before recharging.
[Note: some sensors and types of experiments require more charge than others, so a brief mid-day charge may be necessary.]

Six sensor ports
- Provides maximum versatility
- Compatible with your existing Vernier sensors

Computer interface
Connect LabQuest to a Windows or Macintosh computer via USB to collect data in Logger *Pro*.

Stylus

Audio in

Power
Connect to power and recharge LabQuest's built-in battery

Audio out
Use audio out to connect headphones or speakers

SD/MMC card slot

USB Peripherals expansion
Connect to a printer, Flash drive, or other devices using USB

Included with LabQuest: LabQuest unit; power adapter; USB cable; CD containing Logger Lite software, LabQuest reference guide, Flash introduction, LabQuest Emulator Software; Quick-Start Guide; 2 Styluses; Stylus tether

TECHNICAL SPECIFICATIONS

SCREEN SIZE: 7 cm x 5.3 cm

SCREEN RESOLUTION: 320 x 240 color graphic display

WEIGHT: 350 g

INPUT METHOD: Touch screen, on-screen keyboard, attach an external keyboard, or buttons

CPU: 416 MHz Application Processor

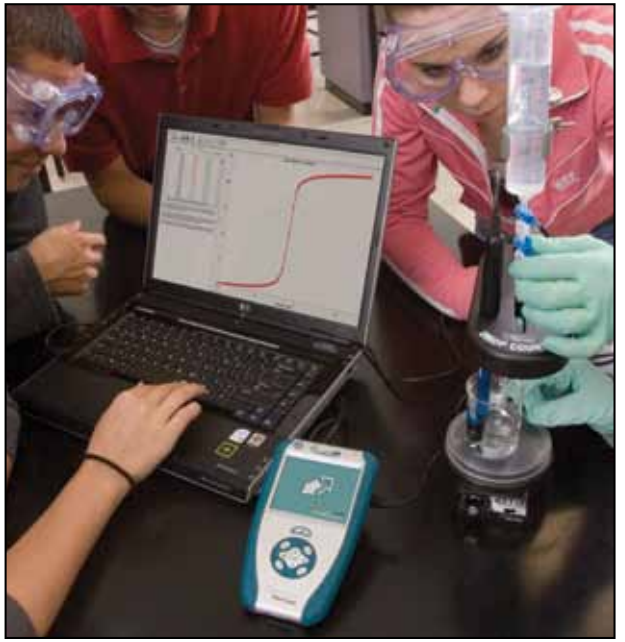
SAMPLING RATE: 100,000 samples/second

STORAGE: 40 MB built-in, SD/MMC card slot for expandability

BATTERY: Lithium-ion rechargeable

DURABILITY: Water resistant and will withstand a fall from a classroom lab bench

MultiMedia & Internet@Schools

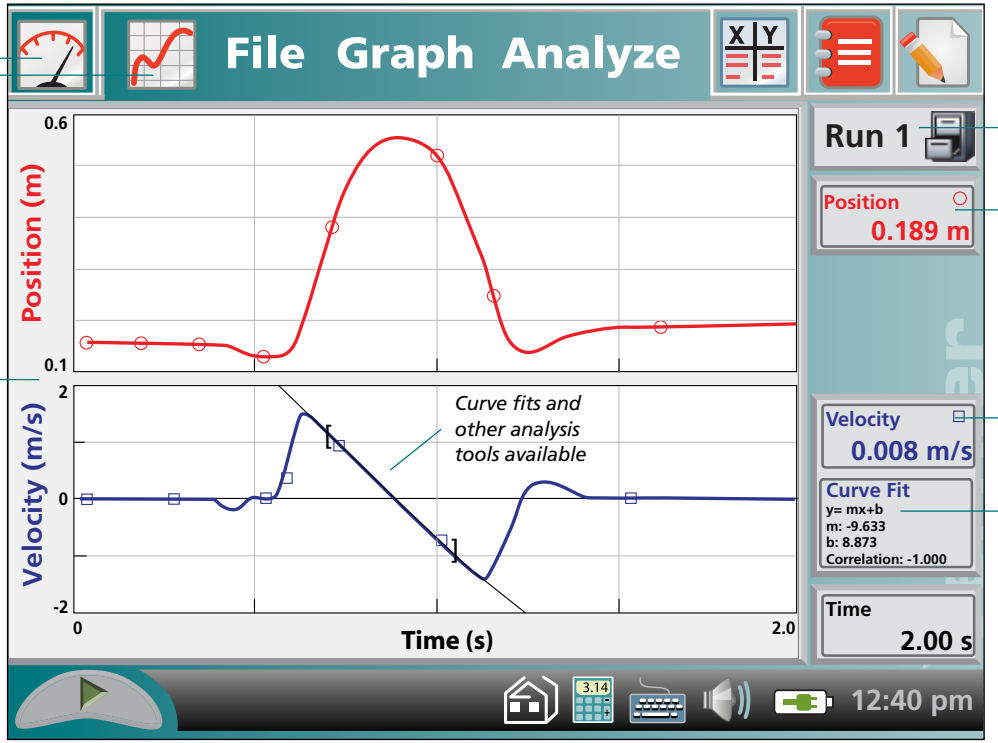


Computer interface

Standalone with SpectroVis Plus

CHEMISTRY SENSORS FOR LABQUEST

SENSOR	CODE	PRICE	SENSOR	CODE	PRICE
CO_2 Gas Sensor	CO2-BTA	$249	pH Sensor	PH-BTA	$79
Colorimeter	COL-BTA	$115	NEW pH Sensor, Tris-Compatible Flat	FPH-BTA	$99
Conductivity Probe	CON-BTA	$95	Radiation Monitor (Digital)	DRM-BTD	$254
Current Probe	DCP-BTA	$39	Spectrometers		
Dissolved Oxygen Probe	DO-BTA	$209	NEW SpectroVis® Plus Spectrophotometer	SVIS-PL	$449
Drop Counter	VDC-BTD	$99	Ocean Optics Spectrometers		
NEW DESIGN Electrode Amplifier	EA-BTA	$40	Vernier Spectrometer	V-SPEC	$1,199
Flow Rate Sensor	FLO-BTA	$129	Red Tide Spectrometer	SPRT-VIS	$1,732
NEW Vernier Mini Gas Chromatograph	GC-MINI	$1,749	Red Tide UV-VIS Spectrometer	SPRT-UV-VIS	$2,887
Gas Pressure Sensor	GPS-BTA	$83	Red Tide Emissions Spectrometer	ESRT-VIS	$1,154
NEW Vernier GPS Sensor	VGPS	$64	Temperature Probes		
Instrumentation Amplifier	INA-BTA	$59	Extra-Long Temperature Probe	TPL-BTA	$72
Ion-Selective Electrodes			Infrared Thermometer	IRT-BTA	$159
Ammonium Ion-Selective Electrode	NH4-BTA	$179	Stainless Steel Temperature Probe	TMP-BTA	$29
Calcium Ion-Selective Electrode	CA-BTA	$179	Surface Temperature Sensor	STS-BTA	$23
Chloride Ion-Selective Electrode	CL-BTA	$179	Thermocouple	TCA-BTA	$59
Nitrate Ion-Selective Electrode	NO3-BTA	$179	NEW Wide-Range Temperature Probe	WRT-BTA	$64
O_2 Gas Sensor	O2-BTA	$188	Turbidity Sensor	TRB-BTA	$112
ORP Sensor	ORP-BTA	$79	Voltage Probe	VP-BTA	$12



Quick access to graphs, tables, and meters

One or two high resolution plots of data are displayed in real time.

Multiple runs can easily be stored and recalled later.

Live display of sensor data

Curve fit statistics are displayed.

Built-In Software

ANALYSIS FEATURES

- Perform linear and curve fits
- Draw a prediction before collecting data
- Display two graphs at once
- Display a tangent line on the graph
- Autoscale
- Integral function
- Statistics

BUILT-IN APPLICATIONS

- Stopwatch
- Periodic table
- On-screen keyboard
- Scientific calculator
- Audio Function Generator
- Power Amplifier (requires Vernier Power Amplifier)

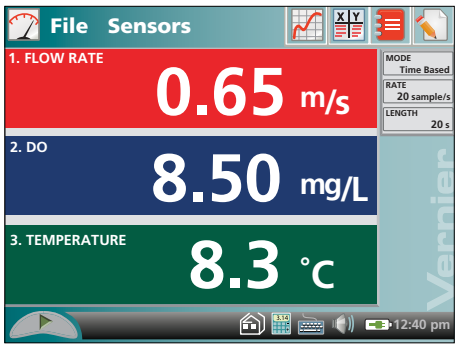
OTHER GREAT FEATURES

- Export data to Logger *Pro*
- More than 100 preloaded lab instructions from Vernier's popular lab books
- Notes field
- Voice annotation with internal microphone
- Find slopes, fit a line to a portion of your data, and display position data and its derivatives

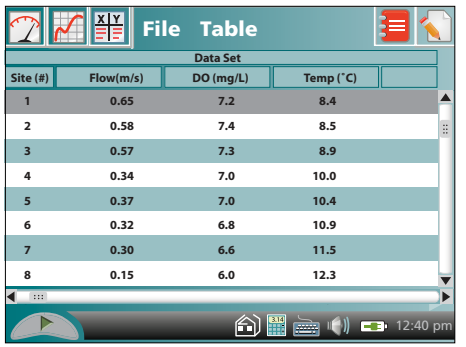
One-Touch Simplicity

The LabQuest Graphing and Analysis Application gives your students real-time graphing capabilities in a handheld device. It's powerful—yet beautifully simple.

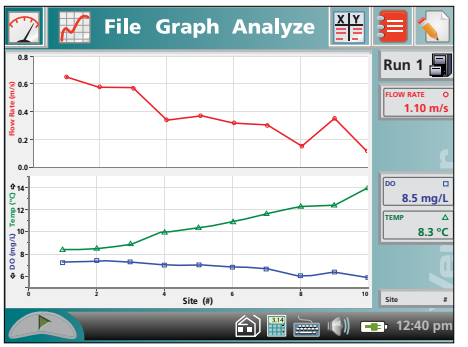
Students can collect data and view them in a **Meter, Data Table,** and **Graph View.**



Meter

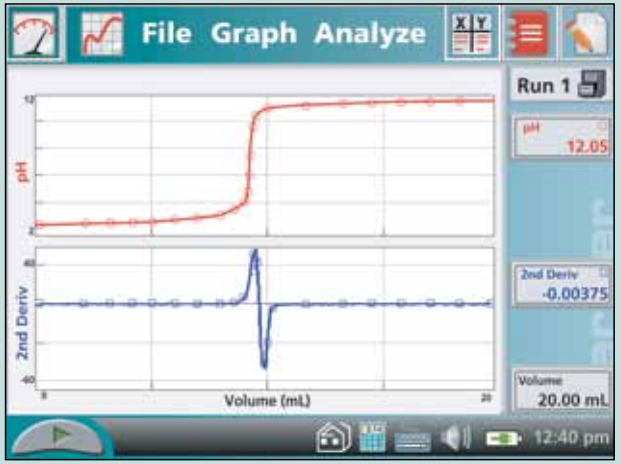


Data table

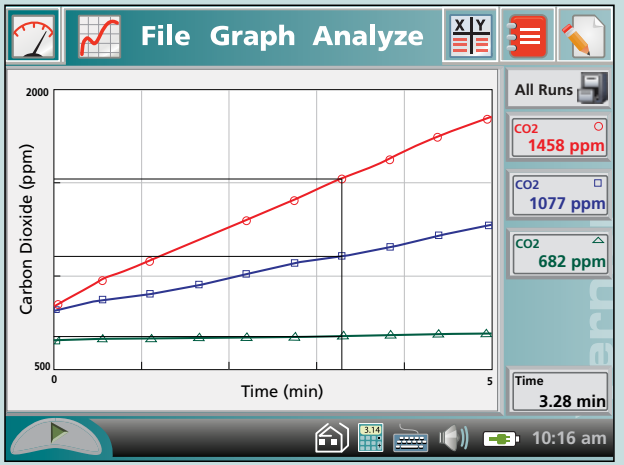


Graph

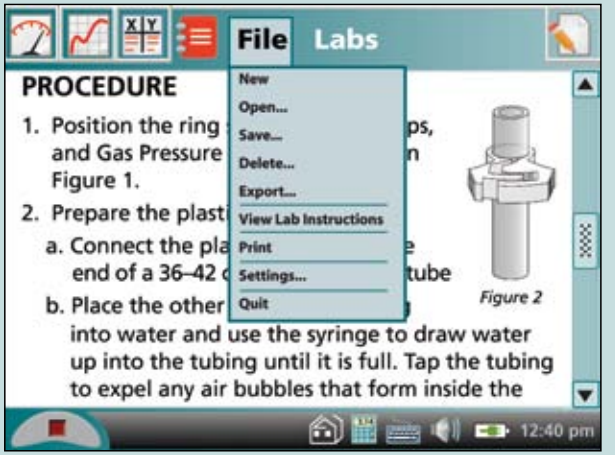
ONE-TOUCH SIMPLICITY—EASY DATA ANALYSIS AT YOUR FINGERTIPS



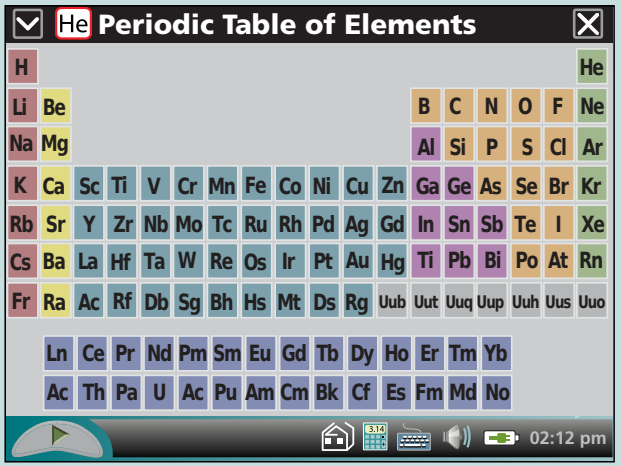
Acid-base titration



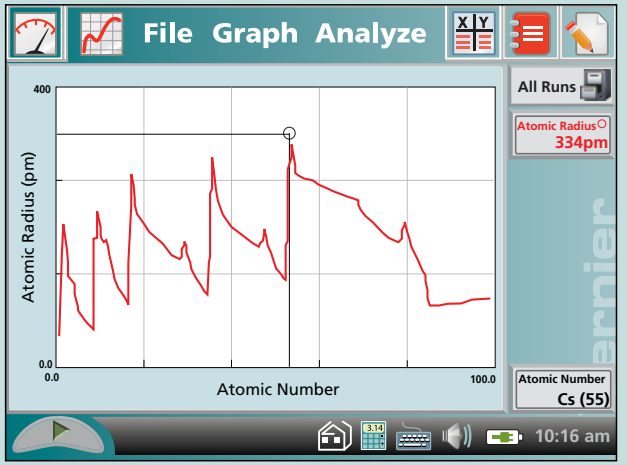
Collect and display data for several sensors or multiple runs on one graph.



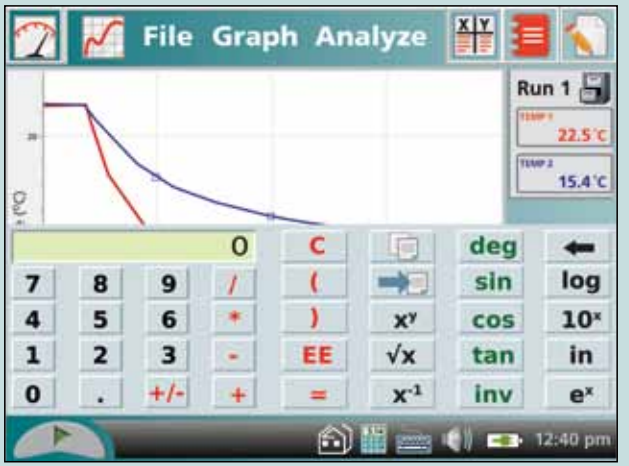
100+ preloaded labs—96 available for Chemistry!
See page 2.



On-board Periodic Table



New! Periodic Table graphing

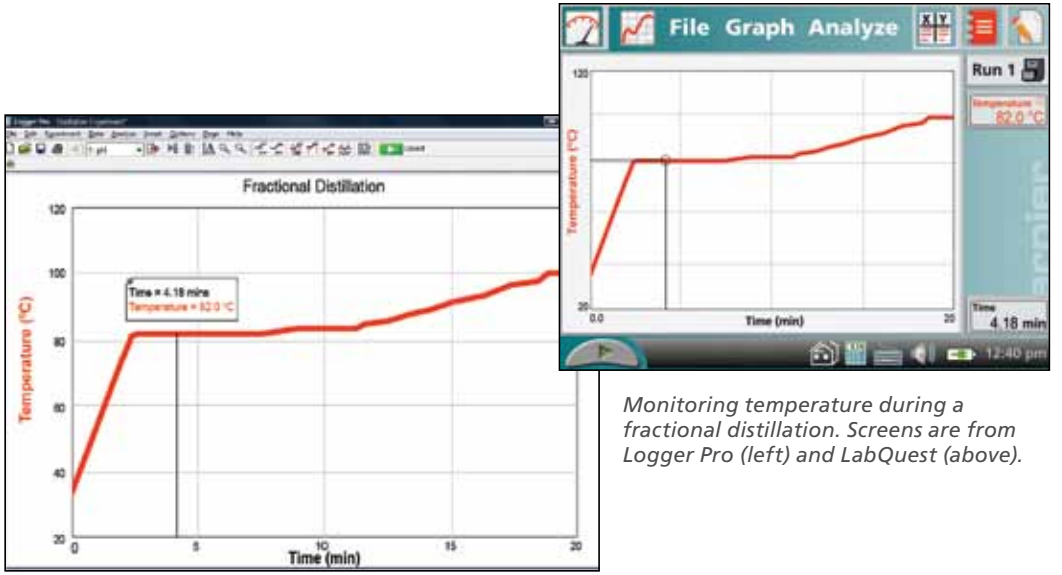


On-board scientific calculator

** Screen shots shown at 300 dpi print quality. Actual screen resolution on the LabQuest is 320 x 240 color graphic display.*

LABQUEST ACCESSORIES

Standalone with a Wide-Range Temperature Probe



Monitoring temperature during a fractional distillation. Screens are from Logger Pro (left) and LabQuest (above).

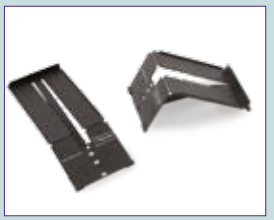
Easily download your data from LabQuest to a computer for further analysis with Logger *Pro* Software.

For more information about Logger *Pro,* see page 3

NEW LabQuest Charging Station

ORDER CODE **LQ-CRG, $99**

Our new charging station holds four LabQuests. Each dock has an individual charging indicator.



LabQuest Stand

ORDER CODE **LQ-STN, $12**

This stand lifts the LabQuest off the workspace, reducing the possibility of damage due to spills.

Print Directly from LabQuest–Or–Print via WiFi

LabQuest can print directly to most HP printers. Simply connect LabQuest to the printer with your HP printer's standard USB cable and choose Print from the File menu. Choose full-color or grayscale, and you'll get a full-size print in moments. See **www.vernier.com/labqprinters** for details.

NEW WiFi USB Adapter

ORDER CODE **WIFI-USB, $59**

Students can print directly from their lab station using WiFi! Add wireless connectivity to your LabQuest with the Vernier WiFi USB Adapter. See our web site **www.vernier.com/labqwifi** for details.

My LabQuest Library

www.vernier.com/mylabquest

LAB CREATOR

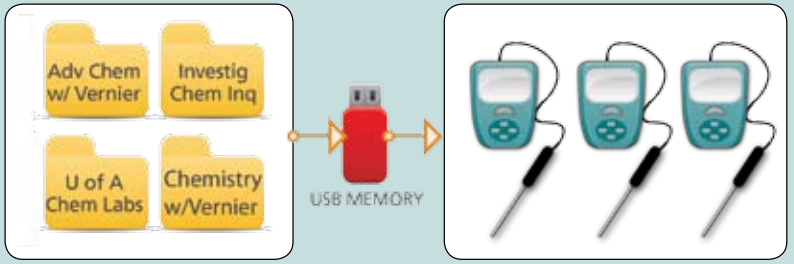
Create your own labs with the Lab Creator

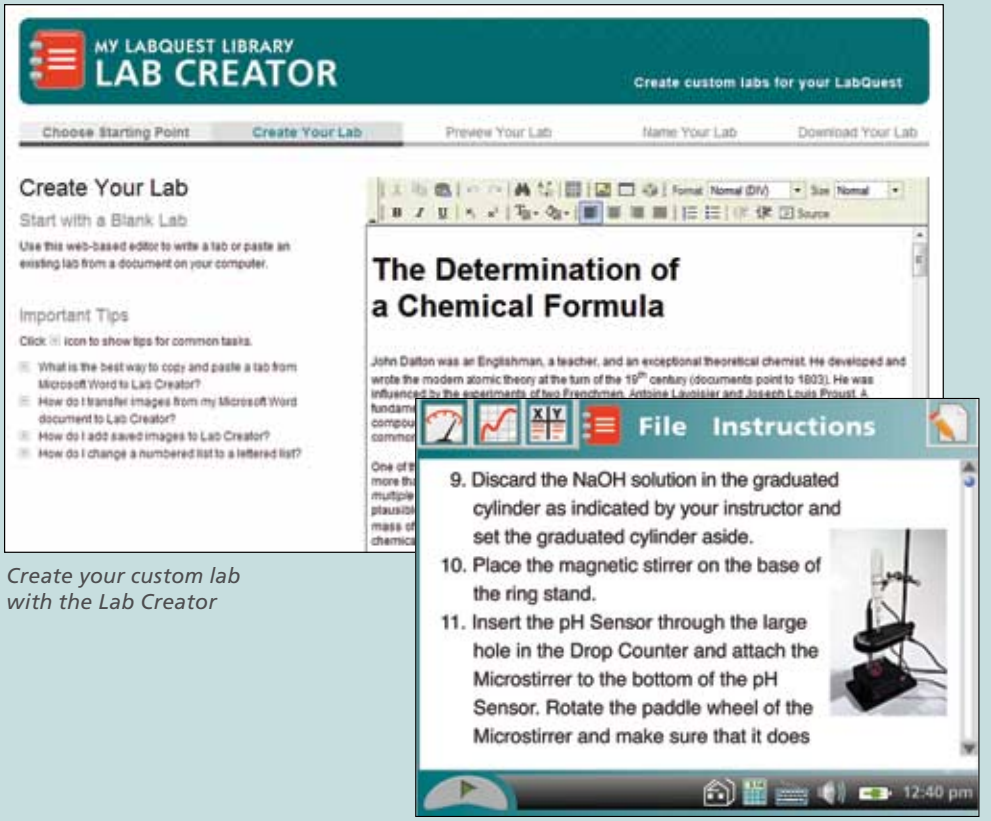
This **FREE** custom application allows you to create and easily upload your labs to LabQuest.

LAB ORGANIZER

Customize your LabQuest with the Lab Organizer

In addition to our 100 most popular labs that are preloaded, more than 96 chemistry experiments from 3 lab books are available for you to upload to your LabQuest units!





Create your custom lab with the Lab Creator

Download it to your LabQuest

Project your lab to the classroom

FREE LabQuest Emulator Software

Looking for a way to project your LabQuest for an entire class to see? Connect your LabQuest to a computer running LabQuest Emulator software and project onto a screen or interactive whiteboard. *Runs on Windows XP, Vista, and Windows 7.*

Included with purchase of LabQuest or as a free download from **www.vernier.com/labquest/emulator**

LabQuest training videos

Watch as our teacher trainers guide you through several Vernier labs. These seasoned experts offer their favorite tips for collecting great data.

Go to **www.vernier.com/videos**

VERNIER LABQUEST® MINI

Powerful. Affordable. Easy to Use.

LabQuest Mini brings the power of Vernier's award-winning LabQuest to your chemistry lab. Students can use LabQuest Mini to collect data on a desktop or laptop computer. LabQuest Mini interfaces with Logger *Pro* software for unparalleled power, analysis, and a small lab-bench footprint.

Key features include:

- 100 kHz maximum sampling rate gives you the unrivaled power of LabQuest
- Five sensor ports give you the flexibility to choose from 54 compatible sensors (plus 12 additional sensors can connect directly to a USB port of the computer).
- LabQuest Mini is powered completely by USB, so no AC Adapter is needed.

NEW
$149 ORDER CODE **LQ-MINI**

Five Total Sensor Ports

Three Sensor Ports
For use with 48 compatible sensors such as temperature, pH, and gas pressure sensors.

Two Digital Sensor Ports
For use with motion detectors, photogates, radiation monitors, rotary motion sensors, and drop counters.

Collecting data exclusively on computers or netbooks?

LabQuest Mini may be perfect for you!

- Looking for more advanced features than Logger Lite provides? Our award-winning Logger *Pro* 3 software provides advanced analytical features including video analysis. See page 3 for additional details.
- Use with over 96 experiments from *Chemistry with Vernier*, *Advanced Chemistry with Vernier*, and *Investigating Chemistry through Inquiry*.

TECHNICAL SPECIFICATIONS

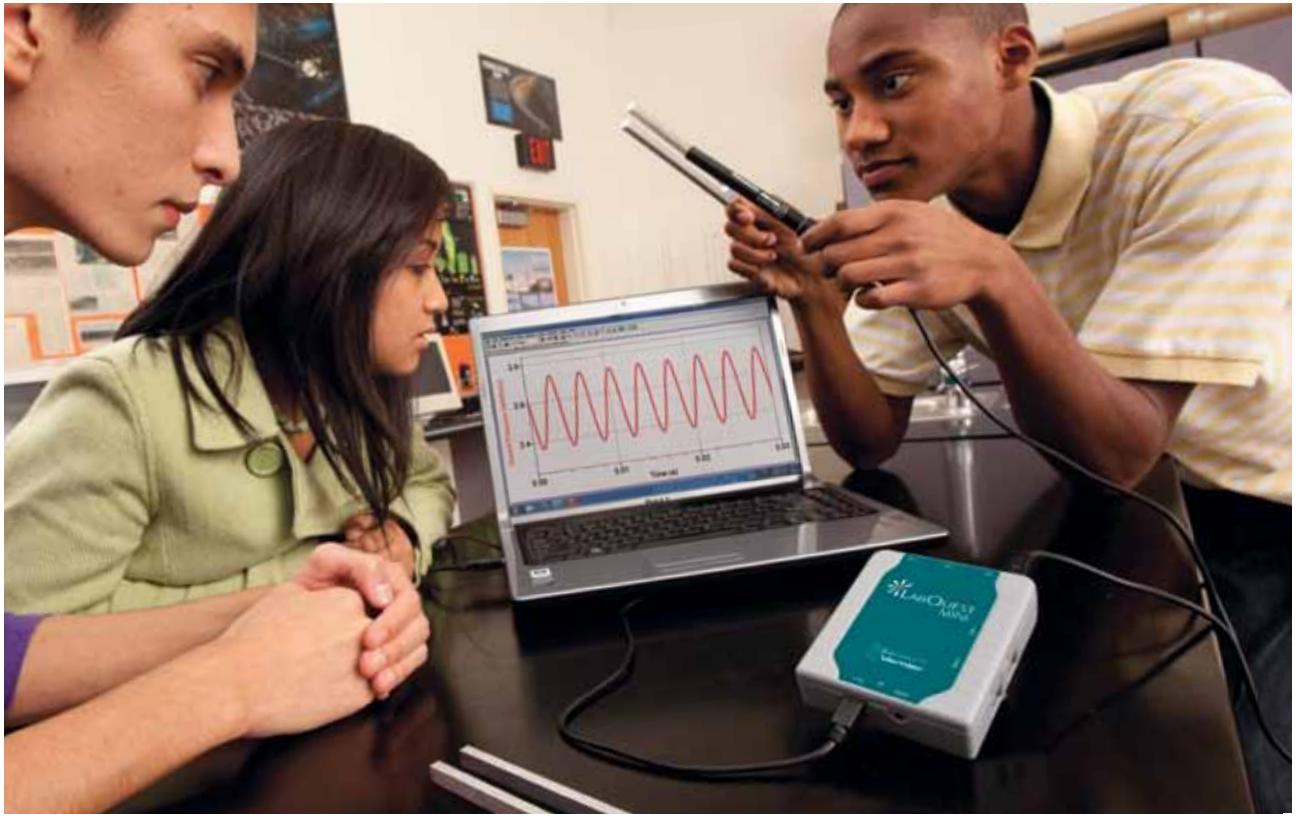
COMPUTER CONNECTION: USB 2.0 Full Speed

SOFTWARE REQUIREMENTS: Logger *Pro* 3.8.2 or newer

ANALOG INPUTS: 3

DIGITAL INPUTS: 2

SAMPLING RATE: 100,000 samples per second



CHEMISTRY SENSORS FOR LABQUEST MINI

SENSOR	CODE	PRICE
CO_2 Gas Sensor	CO2-BTA	$249
Colorimeter	COL-BTA	$115
Conductivity Probe	CON-BTA	$95
Current Probe	DCP-BTA	$39
Dissolved Oxygen Probe	DO-BTA	$209
Drop Counter	VDC-BTD	$99
NEW DESIGN Electrode Amplifier	EA-BTA	$40
Flow Rate Sensor	FLO-BTA	$129
NEW Vernier Mini Gas Chromatograph	GC-MINI	$1,749
Gas Pressure Sensor	GPS-BTA	$83
NEW Vernier GPS Sensor	VGPS	$64
Instrumentation Amplifier	INA-BTA	$59

SENSOR	CODE	PRICE
Ion-Selective Electrodes		
Ammonium Ion-Selective Electrode	NH4-BTA	$179
Calcium Ion-Selective Electrode	CA-BTA	$179
Chloride Ion-Selective Electrode	CL-BTA	$179
Nitrate Ion-Selective Electrode	NO3-BTA	$179
O_2 Gas Sensor	O2-BTA	$188
ORP Sensor	ORP-BTA	$79
pH Sensor	PH-BTA	$79
NEW pH Sensor, Tris-Compatible Flat	FPH-BTA	$99
Radiation Monitor (Digital)	DRM-BTD	$254
Spectrometers		
NEW SpectroVis® Plus Spectrophotometer	SVIS-PL	$449

SENSOR	CODE	PRICE
Vernier Spectrometer	V-SPEC	$1,199
Red Tide Spectrometer	SPRT-VIS	$1,732
Red Tide UV-VIS Spectrometer	SPRT-UV-VIS	$2,887
Red Tide Emissions Spectrometer	ESRT-VIS	$1,154
Temperature Probes		
Extra-Long Temperature Probe	TPL-BTA	$72
Infrared Thermometer	IRT-BTA	$159
Stainless Steel Temperature Probe	TMP-BTA	$29
Surface Temperature Sensor	STS-BTA	$23
Thermocouple	TCA-BTA	$59
NEW Wide-Range Temperature Probe	WRT-BTA	$64
Turbidity Sensor	TRB-BTA	$112
Voltage Probe	VP-BTA	$12

1 LABQUEST INTERFACE AND CHEMISTRY SENSORS

Purchase one set per lab station.

On the next page, you will find a LabQuest or LabQuest Mini sensor set customized for college chemistry. You can also modify this list to create your own custom set.

2 ADD 1 COPY OF LOGGER *PRO*

This award-winning software is the best value around. It includes a site license for all computers in your department, as well as students' personal computers. See page 3 for details.

3 PURCHASE VERNIER LAB BOOKS

For a comprehensive selection of experiments, college instructors should purchase all three of our chemistry lab books.

Advanced Chemistry with Vernier

See page 14 for a detailed table of contents and sensor correlation. ORDER CODE **CHEM-A $48**

Chemistry with Vernier

See page 14 for a detailed table of contents and sensor correlation. ORDER CODE **CWV $48**

Investigating Chemistry through Inquiry

See page 15 for a detailed table of contents and sensor correlation. ORDER CODE **CHEM-I $48**

Buy one copy of a book and duplicate for all of your labs. Once you own the book (1 copy), we give you permission to print any of the experiments (as written or edited) in your general chemistry lab manual. For more great values see page 15.

4 ADD LABWARE

See pp. 10–15 for additional laboratory equipment, including the Stir Station, Ohaus balances and more.

Logger *Pro*® 3

Logger *Pro*

$189 ORDER CODE **LP**

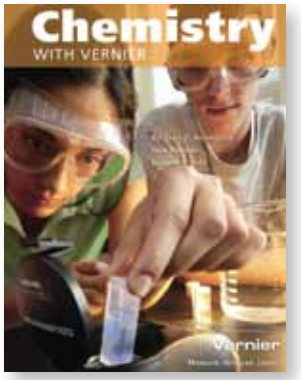
- **Purchase one copy of Logger *Pro*** and it includes a site license for every computer in your college department **and** students' personal computers!
- **Three reasons to purchase:**
  - Data-collection and analysis software for Windows and Macintosh computers.
  - Students can easily upload data collected on a LabQuest into their personal computer.
  - Great manual-entry graphing software for students.
- **For as little as $2 per CD,** your college bookstore can sell student Logger *Pro* installation CDs. (5-pack of CDs, order code LP-ST5, $10)

Vernier Lab Books

The purchase of one copy of each book includes a site license to edit our labs for your classes, and even include them in your college general chemistry lab manual. See pp. 14–15 for more details on each title.

$48 ORDER CODE **CHEM-A**

36 labs



$48 ORDER CODE **CWV**

35 labs

$48 ORDER CODE **CHEM-I**

25 labs

A total of 96 labs when you buy all three!

Advanced Chemistry LabQuest and LabQuest Mini Packages

Purchase one package per lab group (2–4 students) OR BUILD YOUR OWN PACKAGE from the list of recommended sensors below

Standalone or Computer

LabQuest Interface & Sensors		CODE	Colorimeter Deluxe LQ-CHMA-DX	SpectroVis Plus Deluxe LQ-ACSV-DX
Vernier LabQuest Interface		LABQ	$329	$329
Stainless Steel Temperature Probe		TMP-BTA	$29	$29
pH Sensor		PH-BTA	$79	$79
Gas Pressure Sensor		GPS-BTA	$83	$83
Voltage Probe		VP-BTA	$12	$12
Conductivity Probe		CON-BTA	$95	$95
Drop Counter		VDC-BTD	$99	$99
Current Probe		DCP-BTA	$39	$39
ORP Sensor		ORP-BTA	$79	$79
Digital Radiation Monitor		DRM-BTD	$254	$254
CHOOSE ONE	**Colorimeter** or	COL-BTA	$115	—
	SpectroVis Plus	SVIS-PL	—	$449
Package Price			**$1,213**	**$1,547**

VOLUME DISCOUNTS? CALL US FOR A PRICE QUOTATION AT 888.837.6437

You will also need:

***Advanced Chemistry with Vernier* lab book**
ORDER CODE **CHEM-A, $48.** See previous page.

***Chemistry with Vernier* lab book,** ORDER CODE **CWV, $48**
(recommended) See page 30.

Logger *Pro* 3 software, ORDER CODE **LP, $189**
Buy just one copy—site license for ALL school and students' personal computers is included! See page 3 for details.

Computer Only

LabQuest Mini Interface & Sensors		CODE	Colorimeter Deluxe LM-CHMA-DX	SpectroVis Plus Deluxe LM-ACSV-DX
Vernier LabQuest Mini Interface		LQ-MINI	$149	$149
Stainless Steel Temperature Probe		TMP-BTA	$29	$29
pH Sensor		PH-BTA	$79	$79
Gas Pressure Sensor		GPS-BTA	$83	$83
Voltage Probe		VP-BTA	$12	$12
Conductivity Probe		CON-BTA	$95	$95
Drop Counter		VDC-BTD	$99	$99
Current Probe		DCP-BTA	$39	$39
ORP Sensor		ORP-BTA	$79	$79
Digital Radiation Monitor		DRM-BTD	$254	$254
CHOOSE ONE	**Colorimeter** or	COL-BTA	$115	—
	SpectroVis Plus	SVIS-PL	—	$449
Package Price			**$1,033**	**$1,367**

VOLUME DISCOUNTS? CALL US FOR A PRICE QUOTATION AT 888.837.6437

You will also need:

***Advanced Chemistry with Vernier* lab book**
ORDER CODE **CHEM-A, $48.** See previous page.

***Chemistry with Vernier* lab book,** ORDER CODE **CWV, $48**
(recommended) See page 30.

Logger *Pro* 3 software, ORDER CODE **LP, $189**
Buy just one copy—site license for ALL school and students' personal computers is included! See page 3 for details.

College Chemistry Labs

$48 ORDER CODE CHEM-A

***Advanced Chemistry with Vernier* lab book contains the following experiments:**

USING TEMPERATURE PROBES
- Using Freezing-Point Depression to Find Molecular Weight
- The Molecular Mass of a Volatile Liquid
- Molar Volume of a Gas
- Vapor Pressure and Heat of Vaporization
- Rate Determination and Activation Energy
- Synthesis and Analysis of Aspirin
- Exploring the Properties of Gases
- Determining the Mole Ratios in a Chemical Reaction
- Determining the Enthalpy of a Chemical Reaction
- Synthesis and Analysis of Alum
- The Enthalpy of Neutralization of Phosphoric Acid

USING A VOLTAGE PROBE
- Electrochemistry: Voltaic Cells

USING A PH SENSOR
- Standardizing a Solution of Sodium Hydroxide
- Buffers
- Determining the K_{sp} of Calcium Hydroxide
- Determining K_a by the Half Titration of a Weak Acid

USING A PH SENSOR AND DROP COUNTER
- Acid-Base Titration
- Investigating Indicators

USING A COLORIMETER OR SPECTROMETER
- The Determination of an Equilibrium Constant
- Determining the Concentration of a Solution: Beer's Law
- The Rate and Order of a Chemical Reaction
- The Synthesis and Analysis of Aspirin
- Rate Determination and Activation Energy

USING A GAS PRESSURE SENSOR
- The Decomposition of Hydrogen Peroxide
- The Molar Volume of a Gas
- Exploring the Properties of Gases
- Vapor Pressure and Heat of Vaporization

USING A CONDUCTIVITY PROBE AND DROP COUNTER
- Conductimetric Titration and Gravimetric Determination
- The Base Hydrolysis of Ethyl Acetate

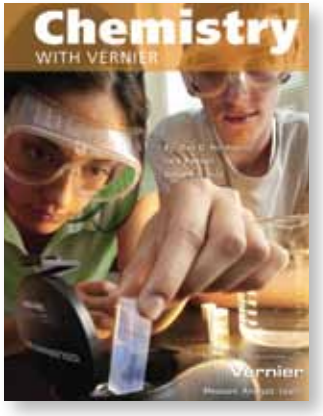
USING AN ORP SENSOR AND DROP COUNTER
- An Oxidation-Reduction Titration: Fe^{2+} and Ce^{4+}
- Potentiometric Titration of Hydrogen Peroxide

USING A CURRENT PROBE
- Electroplating
- Avogadro's Number

USING A RADIATION MONITOR
- Alpha, Beta, and Gamma
- Radiation Shielding
- Half-Life Determination

USING NO SENSOR
- The Determination of a Chemical Formula
- The Determination of the Percent Water in a Compound
- Separation and Qualitative Analysis of Cations
- Liquid Chromatography

Video available online



$48 ORDER CODE CWV

***Chemistry with Vernier* lab book contains the following experiments:**

USING TEMPERATURE PROBES
- Endothermic and Exothermic Reactions
- Freezing and Melting of Water
- Another Look at Freezing Temperature
- Heat of Fusion of Ice
- Pressure-Temperature Relationships
- Fractional Distillation
- Evaporation and Intermolecular Attractions
- Vapor Pressure of Liquids
- Effect of Temperature on Solubility
- Finding Molecular Weight
- Energy Content of Foods
- Energy Content of Fuels
- Hess's Law
- Heat of Combustion: Magnesium

USING A VOLTAGE PROBE
- Micro-Voltaic Cells
- Lead Storage Batteries

USING A PH SENSOR
- Household Acids and Bases
- Acid Rain
- Titration Curves of Acids and Bases
- Acid-Base Titration
- Titration of a Diproctic Acid
- Acid Dissociation Constant, K_a
- Time-Released Vitamin C Tablet
- The Buffer in Lemonade
- Phosphoric Acid Content in Soft Drinks
- Microscale Acid-Base Titration

USING A GAS PRESSURE SENSOR
- Boyle's Law: Gas Pressure and Volume
- Pressure-Temperature Relationship
- Vapor Pressure of Liquids

USING A COLORIMETER OR SPECTROMETER
- Beer's Law
- Finding an Equilibrium Constant, K_c
- Rate Law Determination of the Crystal Violet Reaction
- Chlorine Content of Swimming Pool Water
- Quantity of Iron in a Vitamin Tablet

USING A CONDUCTIVITY PROBE
- Electrolytes and Non-Electrolytes
- The Effect of Concentration
- Using Conductivity to Find an Equivalence Point

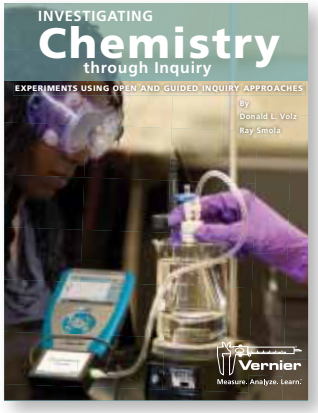
USING A DROP COUNTER *(optional)*
- Acid-Base Titration
- Titration of a Diproctic Acid
- Using Conductivity to Find an Equivalence Point

USING NO SENSOR
- Find the Relationship: An Exercise in Graphical Analysis

Video available online

NEW LOOK FOR TRAINING VIDEOS AT WWW.VERNIER.COM/VIDEOS

Inquiry-Based Labs for College Chemistry



This book takes a unique approach by providing direction for both open inquiry and guided inquiry. It helps students think critically about chemistry experiments, while providing educators with easy-to-use labs.

$48 ORDER CODE **CHEM-I**

NEW *Investigating Chemistry through Inquiry* lab book contains the following experiments:

USING TEMPERATURE PROBES
- Physical Properties of Water
- Baking Soda and Vinegar Investigations
- An Investigation of Urea-Containing Cold Packs
- Investigating the Energy Content of Foods
- Investigating the Energy Content of Fuels
- Evaporation and Intermolecular Attractions
- Enthalpy Changes
- Reaction Stoichiometry
- Colligative Properties of Solutions
- Long Term Water Monitoring
- Vapor Pressure and Heat of Vaporization Investigations
- The Effect of Acid Deposition on Aqueous Systems
- Baking Soda and Vinegar Investigations Revisited
- Reaction Rates
- Enzyme Activity
- Sugar Fermentation by Yeast

USING A PH SENSOR
- Long Term Water Monitoring
- Acid-Base Properties of Household Products
- The Effect of Acid Deposition on Aqueous Systems
- Acid-Base Titrations
- Baking Soda and Vinegar Investigations Revisited

USING A VOLTAGE PROBE
- Investigating Voltaic Cells

USING A COLORIMETER
- Beer's Law Investigations

USING A GAS PRESSURE SENSOR
- Vapor Pressure and Heat of Vaporization Investigations
- Baking Soda and Vinegar Investigations Revisited
- Reaction Rates
- Enzyme Activity
- Sugar Fermentation by Yeast

USING A CONDUCTIVITY PROBE
- Conductivity of Aqueous Solutions
- Long Term Water Monitoring
- Conductimetric Titrations

USING AN ORP SENSOR
- Oxidation-Reduction Titrations

USING A RADIATION MONITOR
- Nuclear Radiation

It's **FREE** to download **ALL** student labs as PDFs for your evaluation at www.vernier.com/labs

Great Value

Purchase any Vernier Lab Book

Vernier lab books are loaded with instructor tips, sample graphs, and more. When you buy the lab book you will receive:

- **A generous site license. Buy one book and duplicate labs for your class. Once you own the book (1 copy) we give you permission to print any of the experiments (as written or edited) in your general chemistry lab manual.**
- Essential instructor information, including instructions for preparing solutions.
- Ready-to-use student versions of Logger *Pro* experiments in print; LabQuest, computer, and calculator versions on CD.
- Easily edit labs to meet your personal style using Microsoft® Word® files for all versions of the experiments on CD.
- Suggested answers, sample data, and graphs.
- Complete equipment and supplies list.

Features listed above are only available when you purchase the lab book. They are not available in the downloadable evaluation PDF.

A TOTAL OF 96 labs WHEN YOU buy all 3 LAB BOOKS!

FEATURED PRODUCTS

NEW
$64 a

$159 b

$83 c

Conducting a distillation using LabQuest and the NEW Wide-Range Temperature Probe

Measuring vapor pressure using LabQuest and a Gas Pressure Sensor

a. NEW Wide-Range Temperature Probe

ORDER CODE **WRT-BTA, $64**

Our newest temperature probe features a wide temperature range, from -20°C to 330°C. The high upper limit of the sensor allows for melting point determinations of many organic compounds. Not only does it have a wider range, but it uses RTD (Resistance Temperature Detection) technology to establish a ±0.1°C accuracy throughout its temperature range, as well as excellent stability and repeatability. Each unit is individually calibrated.

See www.vernier.com/probes/wrt-bta.html for more details.

b. Infrared Thermometer

ORDER CODE: **IRT-BTA, $159**

Non-contact, fast-responding, temperature measuring device. The sensor works by measuring the infrared radiation emitted by objects. You simply point the sensor at the object and read its temperature. This thermometer can be used as a standalone meter, or it can be connected to a data-collection interface to collect and record measurements.

See www.vernier.com/probes/irt-bta.html for more details.

c. Gas Pressure Sensor

ORDER CODE: **GPS-BTA, $83**

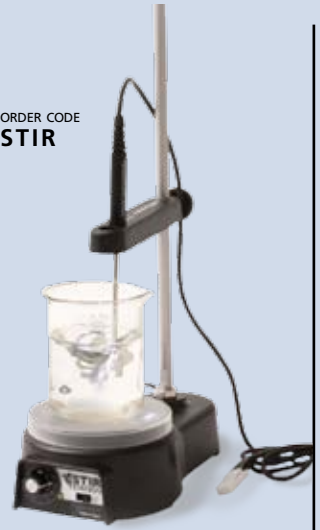
The Gas Pressure Sensor is a great sensor to have in your chemistry toolbox. It is very versatile and easy to use for many experiments, such as the Molar Volume of a Gas, Vapor Pressure, or Heat of Vaporization.

- Includes an accessories kit containing tubing, stoppers, and Luer Lock connectors that make setting up experiments a breeze.
- Great resolution for large and small changes in pressure.

See www.vernier.com/probes/gps-bta.html for more details.

Acid-Base Titration Using a Vernier Drop Counter, pH Sensor, and Vernier Stir Station

$119 ORDER CODE STIR



d

- *Three LEDs light up solutions*
- *Can be used with AC power or four C batteries*

d. Stir Station

ORDER CODE **STIR, $119**

The Stir Station is a high-quality, multi-function magnetic stirrer. It has a stirring capacity of 800 mL in a 1 L beaker. It works efficiently with beakers with a volume as small as 50 mL and with a wide range of sizes and shapes of magnetic stirring bars.

Includes Stir Station, Vernier Microstirrer, magnetic stirring bar, AC power adapter, and removable ring-stand post. Can be used with AC power or batteries.

e. Electrode Support, ORDER CODE ESUP, $10

Our Electrode Support is built to connect to most standard ring-stand posts; its large-handled locking nut keeps your sensors firmly in place. It is perfect for our pH, ISE, Conductivity, and ORP sensors.

e

f. Instrumentation Amplifier

ORDER CODE **INA-BTA, $59**

The Instrumentation Amplifier monitors voltages from 20 mV to 1 V (DC or AC). It has several switch settings to allow you to select the best gain. It is typically used to amplify the chart recorder or analog output of any instrument, such as a third-party gas chromatograph.

f $59

g. pH Sensor

ORDER CODE **PH-BTA, $79**

This high quality, individually calibrated, Ag-AgCl combination electrode has a range of 0 to 14 pH units. Included is a convenient soaking bottle with storage solution. pH Buffer Capsules (order code PHB, $12) and pH Storage Solution (order code PH-SS, $16) are also available.

See www.vernier.com/probes/ph-bta.html for detailed specifications.

g $79

h. Vernier Drop Counter

ORDER CODE **VDC-BTD, $99**

The Vernier Drop Counter allows your students to conduct titrations precisely and effectively in less time.

- Logger *Pro* software allows for easy calibration from drops to volume.
- Vernier chemistry labs are customized for use with our Drop Counter.
- Use with the Vernier pH Sensor for acid-base titrations.
- Use with the Vernier Conductivity Probe for conductimetric titrations.
- Use with the Vernier ORP Sensor for oxidation-reduction titrations.

h $99

DID YOU KNOW?

You can use our Electrode Amplifier with third-party pH electrodes that have BNC connectors, or purchase our pH Replacement Electrode.

Electrode Amplifier order code: EA-BTA, $40

pH Replacement Electrode order code: 7120B, $37

What's Included:

- Vernier Mini GC
- Carrying case
- One high-quality Hamilton syringe
- Two spare septa
- Power supply
- USB cable
- 50+ page lab book
- User's guide

$1,749
ORDER CODE
GC-MINI

Included Labs:

- Using a Gas Chromatograph: Identifying Unknown Compounds
- Verification of Esterification
- Quantifying Substances in a Mixture
- Fractional Distillation
- Investigating Gas Chromatography

Accessories:

GC Septa (pkg 4)
ORDER CODE **GC-SEP, $25**

GC Syringe, 1 µL Hamilton
ORDER CODE **GC-SYR-MIC, $63**

See training video at
www.vernier.com/videos

MORE ONLINE
For more information about the Mini GC, visit **www.vernier.com/gc**

NEW

Vernier Mini GC®

ONLY $1749

Use Room Air as a Carrier Gas

Our advanced MEMS GC chip technology allows you to use room air as a carrier gas. You also have the option of connecting other carrier gases to the Mini GC.

Connect to a Computer or LabQuest via USB

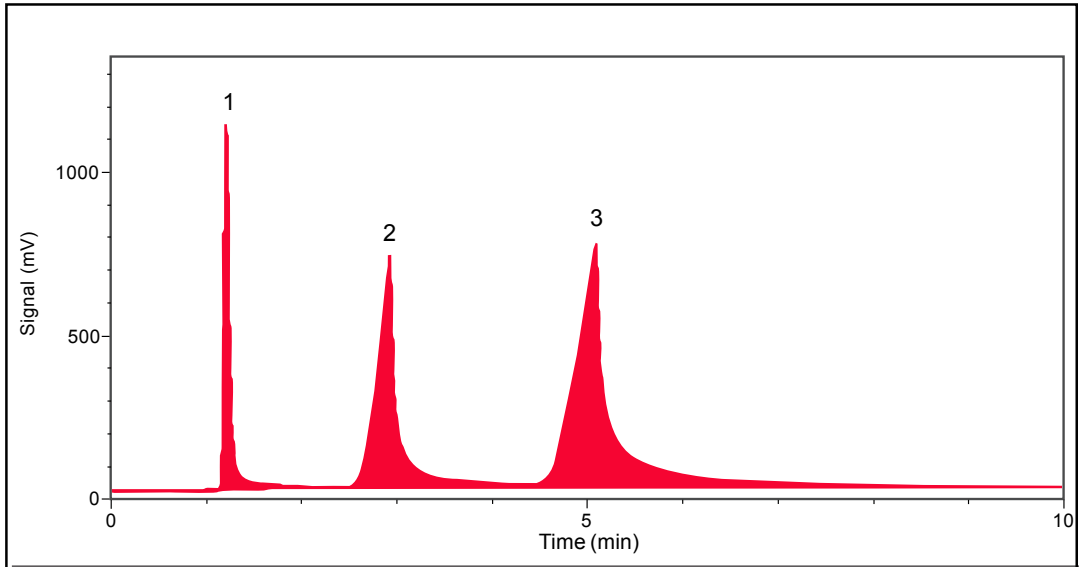
Vernier's Mini GC connects to both Windows and Macintosh computers via a robust USB connection. You can also connect directly to the Vernier LabQuest for real-time data acquisition.

Use Vernier's Award-Winning Software for Analysis

With either Vernier's Logger Pro for computers or Vernier's LabQuest App, peak integration analysis and retention-time determination are built right into the software.

At half the size of a shoe box, Vernier's Mini GC is compact and portable.

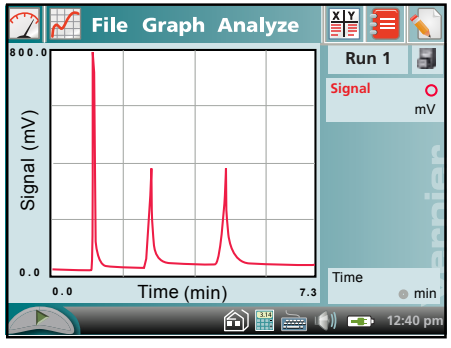
Students analyzing ketones using the Vernier Mini GC and a computer running Logger Pro



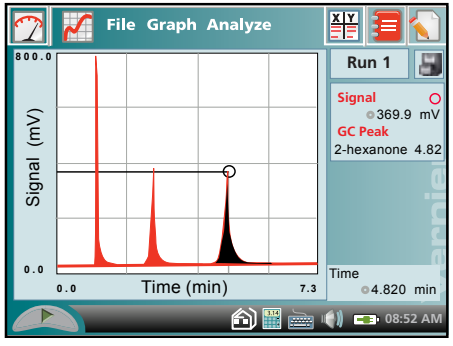
Peak #	Compound	Retention Time (min)	Peak Area	% Area
1	acetone	1.207	83.6	16.1
2	4-methyl-2-pentanone	2.914	132.5	31.3
3	2-hexanone	5.077	273.6	52.6

Logger Pro displays peak retention times and areas as a graph and as a table

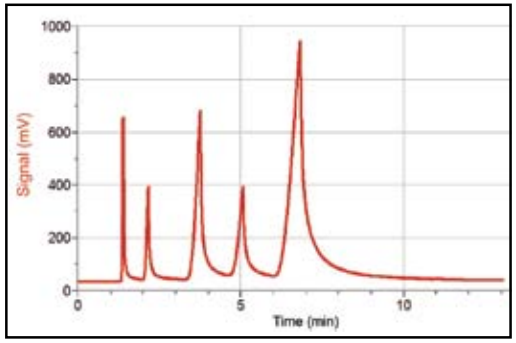
Students analyzing ketones using the Vernier Mini GC and a LabQuest



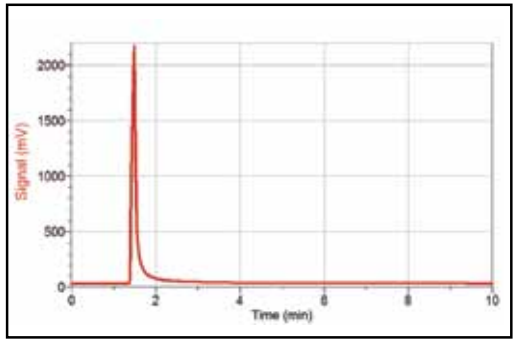
LabQuest: Collect data in real time



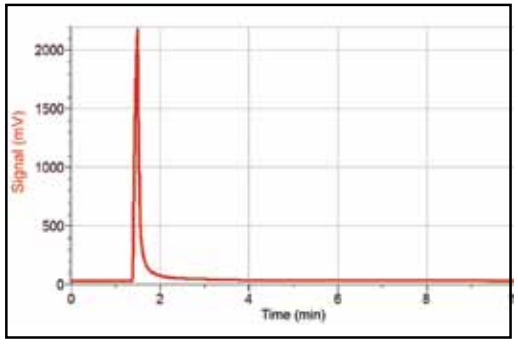
LabQuest: Use the peak integration feature to determine areas and retention times



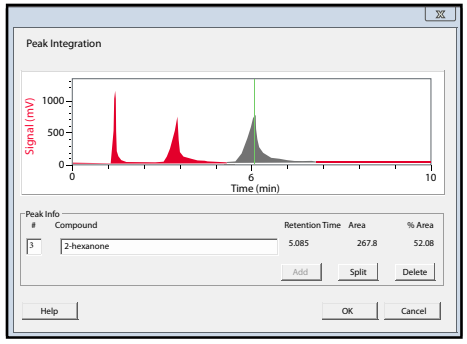
Logger Pro: Mini GC chromatogram of a ketone mixture



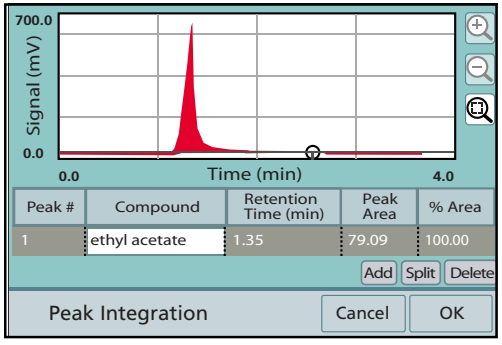
Logger Pro: Mini GC chromatogram of acetone



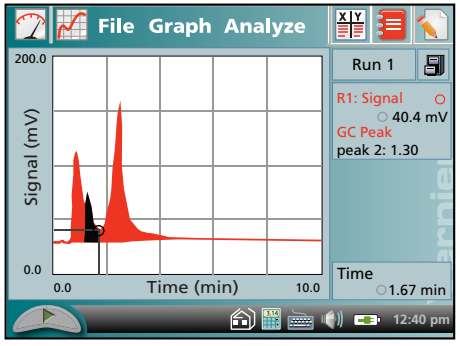
Logger Pro: Mini GC chromatogram of acetone



Logger Pro: Use the peak integration feature to determine areas and retention times



LabQuest: Integrate peaks



LabQuest: The peak integration feature in LabQuest App facilitates peak splitting

Connect to a Computer or LabQuest via USB

Using a Computer

Vernier's Mini GC connects to both Windows and Macintosh computers via a robust USB connection—no interface needed.

Logger *Pro* Software

$189 ORDER CODE LP

- Logger *Pro* includes a site license for your college department.
- Site license includes personal computers of faculty.
- Site license includes personal computers of students so they can analyze their data away from the lab.
- No need to count computers to satisfy licensing.
- Updates to Logger *Pro* 3 are free.

Using a LabQuest

Connect directly to the Vernier LabQuest for real-time data acquisition and analysis. Learn more about LabQuest on pp. 4-9.

LabQuest

$329 ORDER CODE LABQ

ONLY **$299** WHEN YOU BUY **8** OR MORE

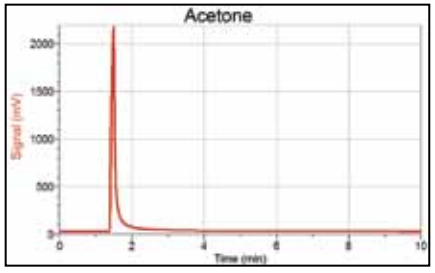
- Rugged mechanical design provide protection against everyday bumps, falls, and splashes
- Use with **over 70 different** Vernier sensors
- Use as a computer interface with Logger *Pro* software or as a standalone device
- On-board graphing and analysis software, LabQuest App

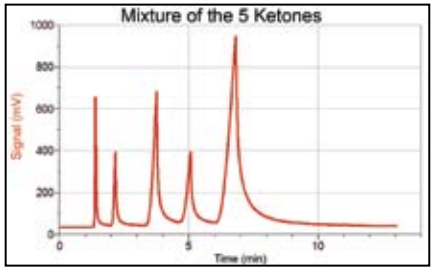
FREE New GC labs from Gas Chromatograph

Each lab comes with extensive instructor information that details preparation of reag

Lab 1: Using a Gas Chromatograph: Identifying Unknown Compounds

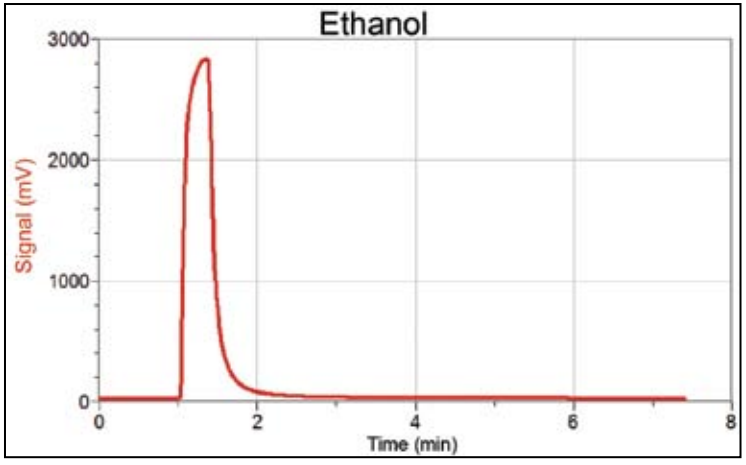
- Measure and analyze the retention time of five ketones and a known mixture of the ketones as they pass through a Vernier Mini GC.
- Measure and analyze the retention time of an unknown mixture of ketones.
- Identify the ketones present in an unknown mixture based on retention times.

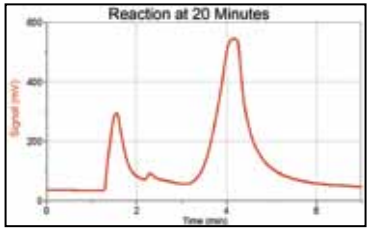


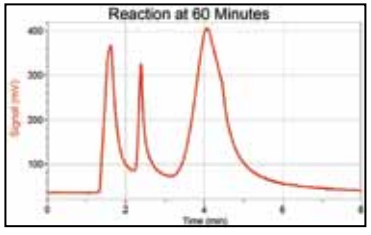


Lab 2: Verification of Esterification

- Conduct an esterification reaction of ethanol and acetic acid, to produce ethyl acetate and water.
- Measure and analyze the GC retention times of the reactants and products involved in synthesizing ethyl acetate.
- Measure and analyze the GC retention times of the reaction mixture to confirm the production of ethyl acetate.

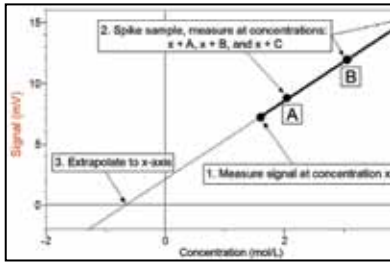


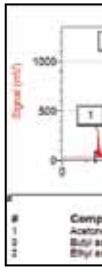


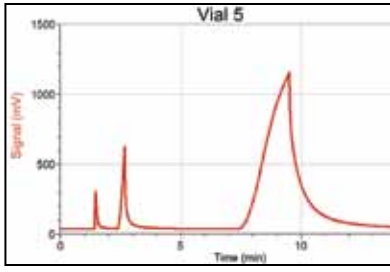


Lab 3: Quantifying Substanc

- Prepare a set of standard mixtures and butyl acetate, starting with a r the esters is unknown.
- Measure and analyze the GC reten mixtures. Analyze the data to dete ethyl acetate and butyl acetate in t
- Analyze the data to determine the acetate and butyl acetate in the or







ny Investigations with the Mini GC lab book

gents, instructor tips, sample data, and sample graphs. Here is a summary of each lab:

es in a Mixture

of two esters, ethyl acetate
mixture whose composition of

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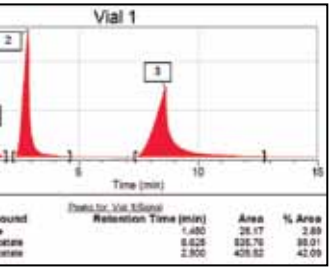
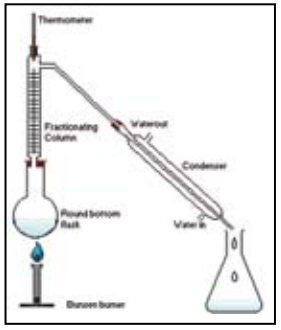
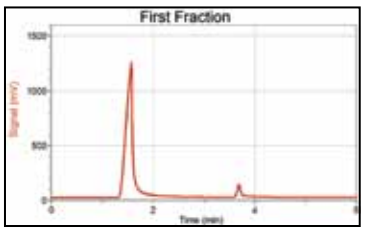
concentrations of ethyl
iginal unknown mixture.

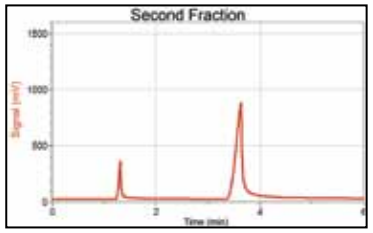


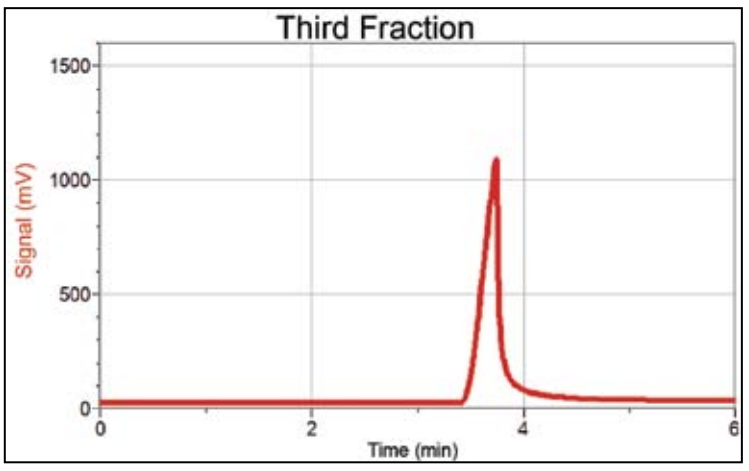


Lab 4: Fractional Distillation

- Measure and analyze the retention time of ethyl acetate and butyl acetate as they pass through a Vernier Mini GC.
- Conduct the fractional distillation of a mixture of ethyl acetate and butyl acetate.
- Measure and analyze the retention time of the fractions.
- Calculate the percent composition of each substance in the mixture.

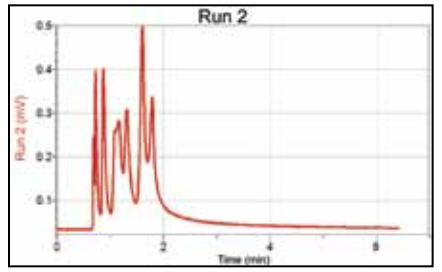


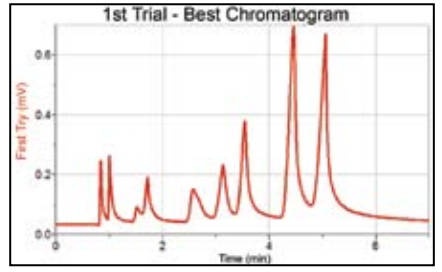




Lab 5: Investigating Gas Chromatography

- Measure and analyze the chromatogram of a mixture of nine compounds as they pass through a Vernier Mini GC.
- Vary the temperature-pressure profile of the Mini GC and observe how the chromatogram is affected by changes in the profile.
- Determine the best temperature pressure profile to obtain the best possible chromatographic separation of the mixture.





MORE ONLINE
Download these labs at
www.vernier.com/gc

Students analyzing ketones using the Vernier Mini GC and a computer running Logger Pro

Specifications

FAMILIES OF COMPOUNDS THAT CAN BE USED IN THE VERNIER MINI GC:

- Alcohols
- Aldehydes
- Aromatic hydrocarbons
- Carboxylic Acids
- Esters
- Ethers
- Ketones
- Nitriles

MEMS DETECTOR

The unique Seacoast Science MEMS Chemi-Capacitive Detector is state-of-the-art technology that allows air to be used as a carrier gas (three existing patents and one patent pending).

COLUMN

High-quality Restek MXT-1 stainless steel capillary column (11 meter)

TEMPERATURE REGULATION

Software-controlled temperature regulation from 30–120°C

COLUMN TEMPERATURE RAMP

- Maximum of 10°C/minute
- Short warm-up time: <10 minute max for most labs

PRESSURE REGULATION

Software-controlled pressure regulation from 1–21 kPa above ambient

INJECTION

- Comes with one high-quality 1 µL Hamilton syringe, 7.3 cm stainless needle with non-coring beveled tip and needle guard, 3.8 cm injectable length
- Injection is direct from syringe to column
- 2 extra septa included with purchase (>150 injections/septa)
- Liquid injection volume: 0.01 to 0.50 µL

WARRANTY

Two-year warranty

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SpectroVis® Plus

An Affordable Spectrophotometer and Fluorometer

$449 ORDER CODE **SVIS-PL**

Having a CCD array spectrometer/fluorometer combination is now affordable for each of your lab stations! Array spectrometer technology allows you to collect a full wavelength spectrum (absorbance, percent transmittance, or intensity) in less than one second. Once the peak wavelength is determined, you can easily determine the concentration of a solution (Beer's law) or monitor rates of reaction.

What's New and Improved with SpectroVis Plus?

- Improved range: 380–950 nm (VIS-NIR)
- 1 nm between reported values (now collects 570 values)
- Improved optical resolution (~2.5 nm)
- New support for fluorescence (two excitation sources centered at 405 nm and 500 nm)

More Features

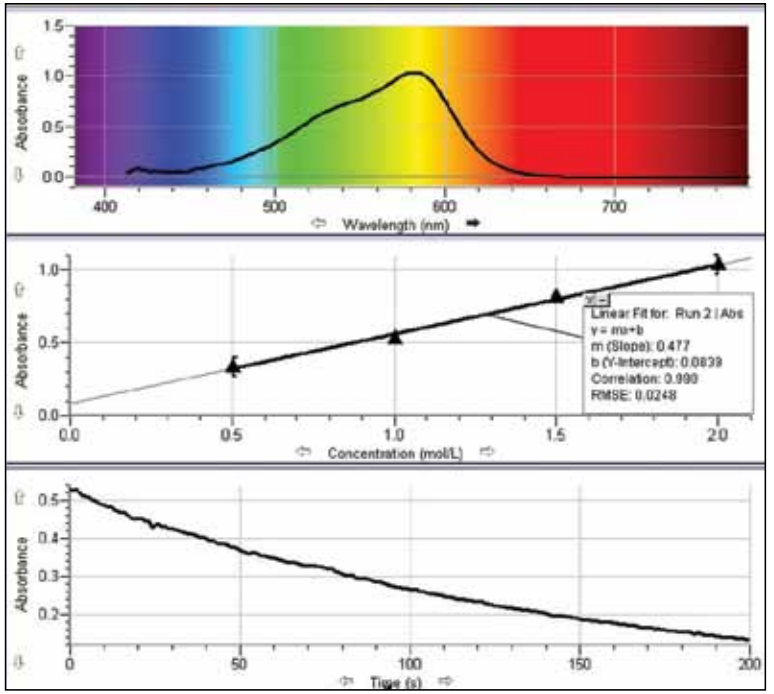
- Portable: 15 cm x 9 cm x 4 cm
- Collect a full spectrum in less than 1 second
- Easy one-step calibration
- Connects directly to LabQuest or to a computer's USB port
- No external power required
- Software required: Logger *Pro* 3.8.2 (or newer) or LabQuest App 1.4 (or newer)

Plastic Cuvettes pkg of 100 (visible range)
ORDER CODE **CUV, $15**
(Use with V-SPEC, SPRT-VIS, SVIS, and SVIS-PL)

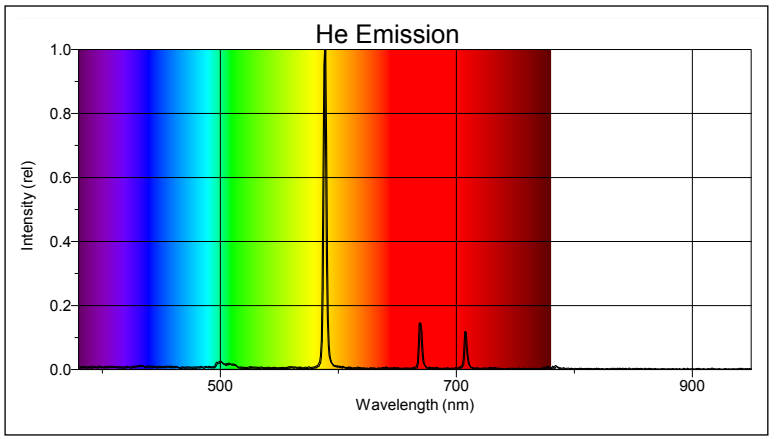
Cuvette Rack
ORDER CODE **CUV-RACK, $9**

SpectroVis Optical Fiber
ORDER CODE **SVIS-FIBER, $69**

Turn your SpectroVis Plus spectrophotometer into an emissions spectrometer using the SpectroVis Optical Fiber insert. Simply insert the unit into the cuvette holder and point the 1 m optical fiber at a light source. Use with SpectroVis and SpectroVis Plus.



Absorbance spectrum of crystal violet

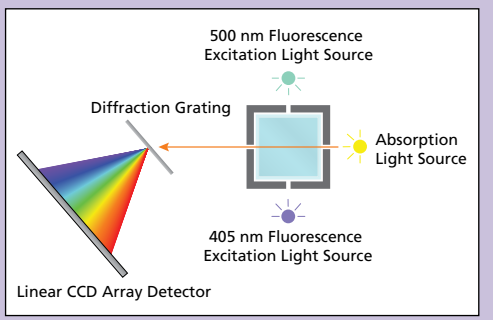


Helium emission spectrum

Uses

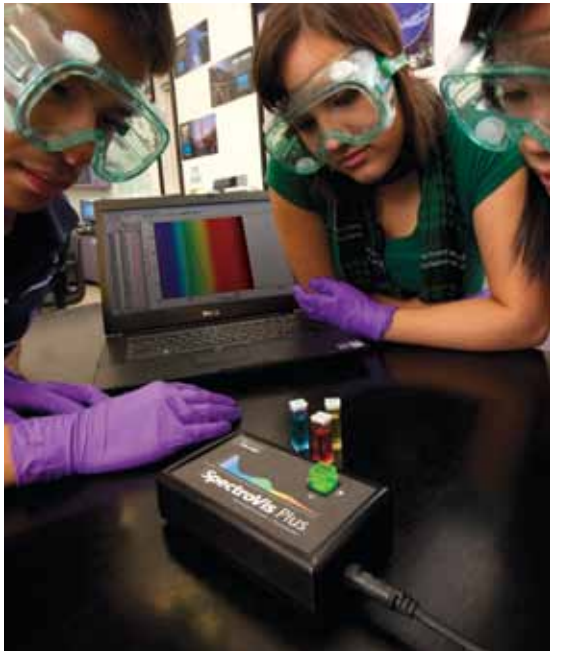
- Measure absorbance, percent transmittance, emissions spectra, or fluorescence
- Conduct Beer's law investigations
- Conduct kinetic studies of absorbance *vs.* time
- Perform equilibrium studies of absorbance *vs.* time or absorbance *vs.* concentration
- Conduct experiments on enzyme kinetics
- Perform colorimetric or fluorescent bioassays
- Measure emissions of gas discharge tubes, flame tests, or other light sources, using the SpectroVis Optical Fiber (not included)

How Does it Work?



Light from our long-lived LED light source passes through a solution. Emerging light goes through a high-quality diffraction grating then the diffracted light is collected and sorted by the CCD array detector.

With its two different excitation wavelengths, SpectroVis Plus can quantitatively measure the fluorescence spectra of many compounds, such as quinine, fluorescein, and chlorophyll.



Ocean Optics™ Spectrometers

	Vernier Spectrometer (Ocean Optics powered)	Ocean Optics Red Tide Spectrometer	Ocean Optics Red Tide UV-VIS Spectrometer
Wavelength Range and Resolution	• 380–950 nm • VIS-NIR • 2 nm between reported values • ~3 nm optical resolution	• 380–950 nm • VIS-NIR • 1 nm between reported values • ~2 nm optical resolution	• 200–850 nm • UV-VIS • 1 nm between reported values • ~2 nm optical resolution
Light Source & Sample Holder	Combination sample holder and LED-boosted tungsten source. The sample holder takes standard 1 cm cuvettes.	Combination sample holder and LED-boosted tungsten source. The sample holder takes standard 1 cm cuvettes.	Combination sample holder and integrated deuterium tungsten halogen light source. The sample holder takes standard 1 cm cuvettes.
Items Included	• Spectrometer • Light source and cuvette holder • USB cable • 15 plastic cuvettes with lids • Connects by USB to a computer or LabQuest interface; no additional power source needed • Software needed: Logger *Pro* or LabQuest App	• Spectrometer • Light source and cuvette holder • USB cable • 15 plastic cuvettes with lids • Connects by USB to a computer or LabQuest interface; no additional power source needed • Software needed: Logger *Pro* or LabQuest App	• Spectrometer • Light source and cuvette holder • USB cable • 15 UV-VIS cuvettes with lids • Power supply • Connects by USB to a computer or LabQuest interface; no additional power source needed • Software needed: Logger *Pro* or LabQuest App
Price	$1,199 ORDER CODE **V-SPEC**	$1,732 ORDER CODE **SPRT-VIS**†	$2,887 ORDER CODE **SPRT-UV-VIS**

Spectrometer Accessories

Cuvettes

Plastic Cuvettes pkg of 100 (visible range)
ORDER CODE **CUV, $15**
(Use with V-SPEC, SPRT-VIS, SVIS, and SVIS-PL)

Plastic UV Cuvettes pkg of 100 (UV-VIS)
ORDER CODE **CUV-UV, $69**
(Use with SPRT-UV-VIS)

Cuvette Rack
ORDER CODE **CUV-RACK, $9**

Optical Fiber

Connects easily to an Ocean Optics or Vernier Spectrometer, 2 m in length, and is used to conduct emission spectrum studies.

VIS-NIR Optical Fiber
ORDER CODE **VIS-NIR, $138**
(Use with V-SPEC, SPRT-VIS, and ESRT-VIS)

UV-VIS Optical Fiber
ORDER CODE **UV-VIS, $138**
(Use with SPRT-UV-VIS)

† If you are going to use your Red Tide Spectrometer exclusively for emissions (and not for absorbance and percent transmittance measurements), you can purchase the Red Tide Emissions Spectrometer separately, for a lower price. Call us for details.

Students conduct and analyze Beer's law with a Vernier spectrometer and LabQuest

Examining the spectrum from a Helium gas discharge tube

Vernier Spectrometer

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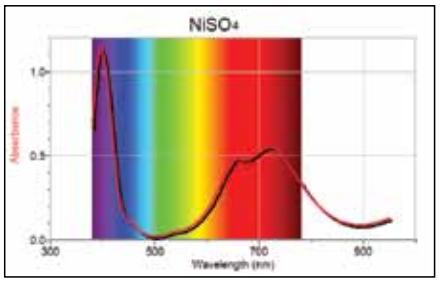
The Vernier Spectrometer is a fully functioning visible light spectrophotometer. It is powered by Ocean Optics™ technology, connects directly to your computer with a standard USB cable, and is controlled by Vernier's award-winning Logger *Pro* software. It also connects directly to our LabQuest®, making it a truly portable lab tool.

USE THE VERNIER SPECTROMETER TO:

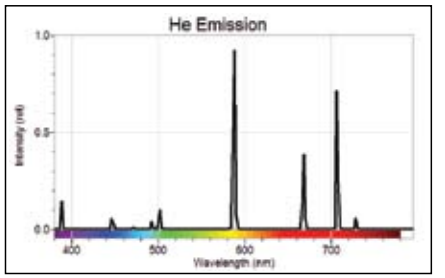
- Measure absorbance spectrum of a liquid
- Conduct Beer's law labs (absorbance *vs.* concentration)
- Conduct kinetic studies of absorbance *vs.* time
- Conduct equilibrium studies of absorbance *vs.* time and/or absorbance *vs.* concentration
- Measure emissions of gas discharge tubes or other light sources using the optical fiber

FEATURES

- Portable: 10 cm x 9 cm x 3 cm
- One-step calibration
- Measures absorbance over a 380 – 950 nm range
- Open cuvette holder allows access to the sample during testing
- Simultaneous data collection with other Vernier sensors
- Powered by computer or LabQuest interface; no additional power source needed
- Software needed: Logger *Pro* 3.5 (or newer) or LabQuest App 1.1 (or newer)



Absorbance spectrum of nickel sulfate



Helium emission spectrum

Free Spectrometer Labs

These labs will introduce your students to the common use of a spectrometer, from the classic Beer's law to emissions from discharge tubes, to a novel look at theatrical lighting filters. More at **www.vernier.com/spectrometer**

training videos online

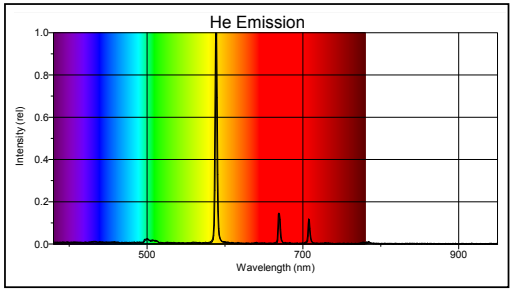
Watch training videos and download FREE activities: go to **www.vernier.com/videos**

Download **FREE** Spectrometer Labs

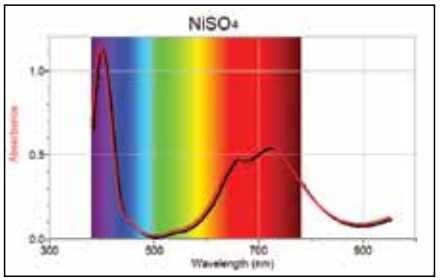
Introduce your students to the common use of a spectrometer, including the classic Beer's law, emissions from discharge tubes, and a novel look at theatrical lighting filters. Downloads available for LabQuest or computers. Includes:

- Beer's Law
- Kinetics of a Bleach Reaction
- Visible Spectra of Commercial Dyes
- Emission Spectra
- Determination of Chlorophyll in Olive Oil
- Transmittance of Theatrical Lighting Filters
- Flame Test

More at www.vernier.com/spectroscopy



Helium emission spectrum

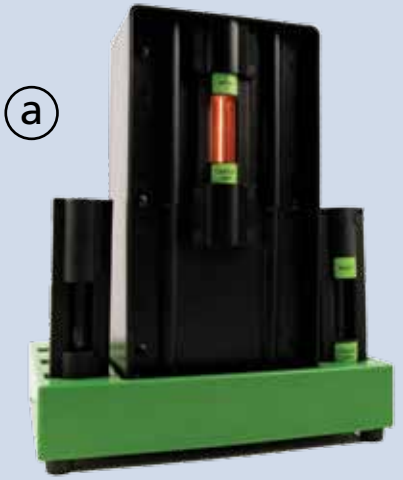


Absorbance spectrum of nickel sulfate

Analyzing gas tube emission spectra

NEW! Spectrum Tube Single Power Supply

$225 ORDER CODE ST-SPS



a. NEW Spectrum Tube Single Power Supply ORDER CODE **ST-SPS, $225**

With ultra-safe design, this spectrum tube power supply will provide a simple means of viewing gas discharge spectral lines with any of our spectrometers. Unlike other designs, this system has no exposed high voltage. The gas tubes are permanently enclosed in plastic carriers that protect the tubes from breakage. There are no through-the-glass electrodes, so the tubes last far longer than older designs. The Power Supply will energize one tube at a time, and includes storage space for an additional six tubes. All tubes sold separately.

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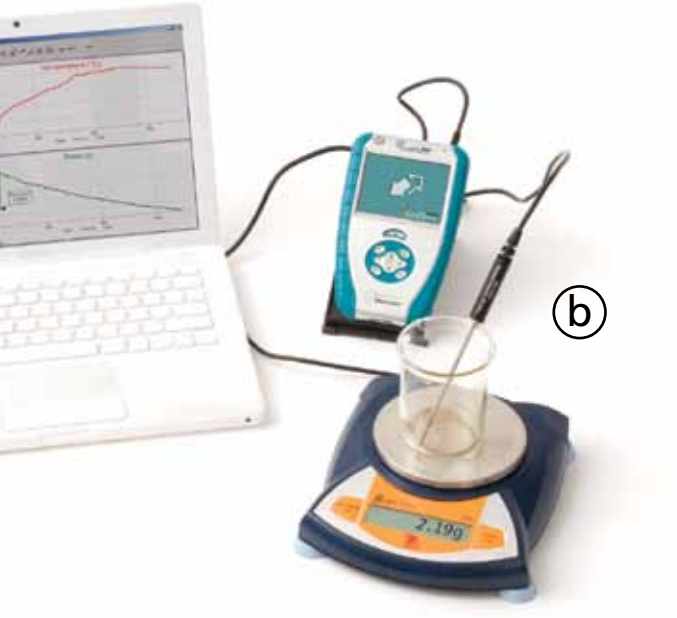
	– Neon	**ST-NE,**	**$36**
	– Carbon Dioxide	**ST-CO2,**	**$36**
	– Air	**ST-AIR,**	**$36**
	– Argon	**ST-AR,**	**$36**



b. Ohaus Scout™ Pro and Adventurer™ Pro Balances

It is easy to collect mass data from an Ohaus Scout Pro or Adventurer Pro balance using our popular Logger *Pro* 3 software. Simply connect a Scout Pro or Adventurer Pro balance to your computer's USB port (Scout Pro requires a connection kit and Adventurer Pro has a built-in USB connection), start the Logger *Pro* software, and you will be collecting real-time data as if the Ohaus balance was just another Vernier sensor!

Scout Pro 0.01 g balance (200 g)*
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Scout Pro 0.01 g balance (400 g)*
ORDER CODE **OHSP-402, $429**

Scout Pro 0.001 g balance (120 g)*
ORDER CODE **OHSP-123, $419**

***Scout Pro USB connection kit** (required)
ORDER CODE **OHSP-USB, $79**

Adventurer Pro 0.001 g balance (300 g) (USB built in)
ORDER CODE **OHAP-313, $1399**

Adventurer Pro 0.0001 g balance (110 g) (USB built in)
ORDER CODE **OHAP-114, $1999**

c. Ion-Selective Electrodes

Great for monitoring four environmentally important ions: Nitrate (NO_3^-), Chloride (Cl^-), Calcium (Ca^{2+}), and Ammonium (NH_4^+).

Nitrate ISE
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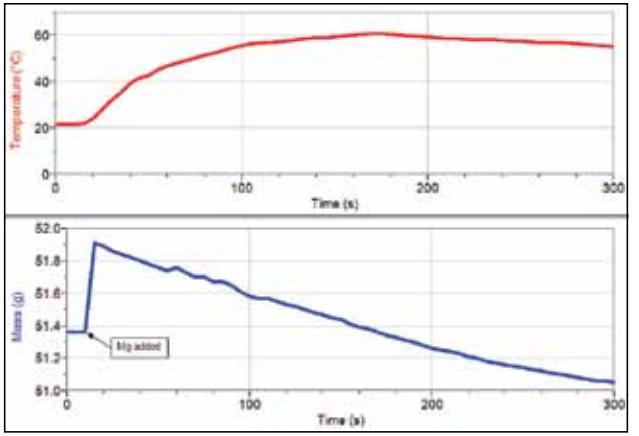
Chloride ISE
ORDER CODE **CL-BTA, $179**

Calcium ISE
ORDER CODE **CA-BTA, $179**

Ammonium ISE
ORDER CODE **NH4-BTA, $179**



Monitoring temperature and mass in the Mg-HCl reaction

Measuring chloride concentration

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TOTAL _____

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ONLY $299 WHEN YOU BUY 8 OR MORE

Key Features:

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page 4 for more information

www.vernier.com/labquest

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FREE Hands-On, Data-Collection Workshops

LabQuest | Computer Data Collection

The workshops include lunch or dinner and lab handouts on CD. Contact us or visit our web site for up-to-date information and registration.

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- Want to evaluate our award-winning, data-collection technology.
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- Want to learn from the experts.

4 HOUR

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1 DAY

Two-Day Chemistry Institutes

College Chemistry

Vernier and Flinn Scientific team up to present this College Chemistry Institute. AP and IB instructors are welcome to attend. As a participant, you will have the opportunity to conduct up to twelve different experiments in the two-day session. You will investigate many important topics in chemistry, including thermodynamics, kinetics, acid-base reactivity, and equilibrium. Your practice with data collection and analysis via computer and LabQuest will lead to an increased understanding of the sensors and software, as well as open your eyes to new and interesting ideas for hands-on activities in your laboratory. In addition, special experiments will be offered that explore spectroscopy and gas chromatography. The $199 registration fee includes a copy of *Advanced Chemistry with Vernier.*

AUGUST
American University Washington, DC

2 DAY

AP*/College Chemistry

Vernier and Flinn Scientific will co-host these AP Chemistry hands-on technology institutes. During these two-day summer workshops, teachers will do many of the 22 experiments recommended by The College Board. These experiments will center around Vernier and Flinn equipment, supplies, and kits, and are from the Vernier-Flinn lab book, *Advanced Chemistry with Vernier*. The $199 registration fee includes a copy of *Advanced Chemistry with Vernier*. For more information, go to **www.vernier.com/workshop/apchemistry.html**

JUNE	JULY
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2 DAY

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