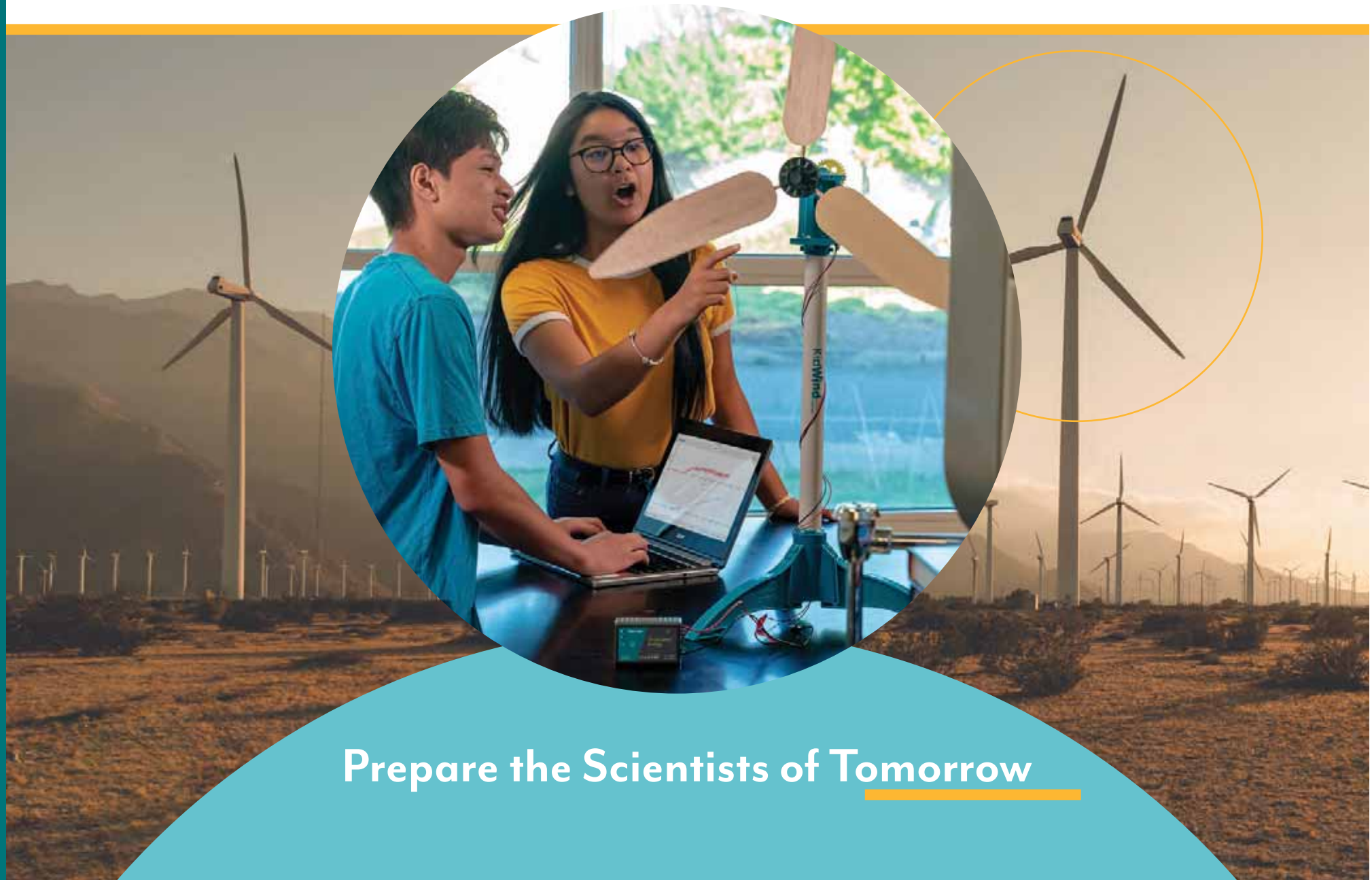
Vernier International

2020 K–12 CATALOG



Prepare the Scientists of Tomorrow

Welcome

We introduced our first Go Direct sensors with Bluetooth® wireless technology and USB connectivity in 2017, and we are excited to say we now have more than 50 Go Direct sensors! The newest additions are Go Direct sensors for Blood Pressure, Weather, and a Structures & Materials Tester, along with a Go Direct Spirometer.

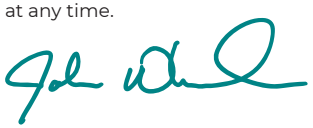
We added many new features to our free Graphical Analysis software in 2019. We encourage you to update to the latest version, if you haven't done so recently.

We are excited to announce 13 new lab books, including *Middle School Explorations: Chemical Reactions*. This book uses the three-dimensional learning approach to support students as they form their own understanding of chemical reactions.

In 2019, we partnered with some great companies to expand possibilities of how hands-on data collection can deepen student understanding of a wide variety of topics. We worked with Microsoft to bring Go Direct sensors into their Hacking STEM world of rich, project-based activities that engage students and challenge them to solve problems. We worked with Google to integrate Go Direct sensor support into the Google Workbench platform. You can now use Go Direct sensors in Google's block-based programming canvas. We have also adapted some of our classroom-proven lessons into their rich, online content environment. Additionally, we are pleased to partner with OpenSciEd, Makeblock, Pivot Interactives, SAM Labs, and LEGO® Education. We have always been excited to work on innovative uses for sensors to bring hands-on exploration to students, and these partnerships help us do just that.

If you get to the Portland, Oregon, area, we encourage you to stop for a tour of our building. We also hold workshops during the summer at our office. Summer is a great time to visit the Pacific Northwest!

We also encourage you to give our products a try on a 30-day (or longer) preview basis. Feel free to contact any of us personally at any time.



John Wheeler
CEO
jwheeler@vernier.com

David and Christine Vernier
Co-Presidents and Co-Founders
dvernier@vernier.com
cvernier@vernier.com

About Vernier Software & Technology

Vernier Software & Technology was co-founded in 1981 by Dave and Christine Vernier. Dave's background as a physics teacher and Christine's knack for business combined to form a company with a deep commitment to education.

Thirty-nine years later, the company is still owned by Christine and Dave, along with nine employee owners who have backgrounds in science and math education, as well as business.

Vernier is proud to be recognized for its philanthropic commitment, environmental policies, steady growth, and as one of the Best 100 Companies to Work For in Oregon for 19 years.

2019 Best Companies to Work For in Oregon

2019 Healthiest Employers of Oregon

2019 Best Green Companies in Oregon

2019 Corporate Philanthropy Award

On the Cover

Students test blade designs and observe energy production data in real time.

Why Vernier?

Instill a Love of Learning in All Students

Your passion and dedication, along with the implementation of high-quality sensors, experiments, and resources in your classroom, enable your students to explore science in new ways.

Our mission is to provide you with the tools you need to encourage scientific curiosity in all students—see what partnering with us can do.

What the Research Says About the Value of Probeware for Science Instruction

In-depth research in our white paper, *What the Research Says About the Value of Probeware for Science Instruction*, supports the following findings:

- Data-collection technology can provide a learning advantage to students.
- Probeware can help deepen student understanding of science concepts.
- Hands-on use of technology tools is recommended in guidelines from influential, national organizations such as ISTE, ASTE, and others.

In addition to the research, the white paper provides a detailed bibliography to support your grant-writing efforts.

Improves test scores*

Creates a deeper understanding

Supports standards

Frees class time

Easy to use

Builds student interest

Backed by exceptional support

Download our free white paper at vernier.com/white-paper

** This study of 49,000 US students shows that students who used probeware to collect and analyze data scored significantly higher on tests than those who did not. Source: 2000 NAEP Science Assessment*

Contents

What's New?

Investigations

OpenSciEd

Our partnership with OpenSciEd gives you access to free, field-tested units that support the three-dimensional learning approach.
Learn more on pp. 19–21.

Middle School Explorations: Chemical Reactions

Your students will enjoy investigating chemical reactions as they build a model to explain what goes on at the molecular level during a chemical reaction.
Learn more on page 21.

Middle School Science E-books

Our new e-books offer classroom-tested experiments that will engage your students while helping them meet the NGSS and state standards.
Learn more on pp. 22–23.

Primary Science E-books

Each new e-book includes a selection of sensor-specific experiments, so you get just what you need for your classroom.
Learn more on pp. 7–10.

Partnerships

Google Workbench

Track progress, access lessons, and keep a living record of work for students through Google Workbench. Free student-ready experiments from Vernier that explore coding, chemistry, biology, physiology, and physics are available through Google Workbench.

Learn more on page 41.

Microsoft Hacking STEM

Enhance your STEM curriculum through the Microsoft® Hacking STEM project. Use sensors from Vernier in an interactive project-based set of investigations.

Learn more on page 41.

Scratch

Engage your students with scientific and computational concepts through hands-on, project-based learning with the popular coding platform from Scratch and Go Direct Force and Acceleration.

Learn more on page 24.

NEW

Sensors and Accessories

Go Direct Weather

The new Go Direct Weather is a wireless, handheld sensor used to measure ambient temperature, humidity, wind speed, barometric pressure, and more.
Learn more on page 63.

Go Direct® Blood Pressure

Go Direct Blood Pressure is an affordable, non-invasive sensor designed to easily measure human blood pressure.
Learn more on page 50.

Go Direct Spirometer

The Spirometer is designed to make human respiratory measurements at rest and during moderate activity.
Learn more on page 50.

Go Direct Structures & Materials Tester

Use our new Go Direct Structures & Materials Tester to evaluate the strength of model bridges and engineered structures by measuring the applied load.
Learn more on page 124.

Go Direct Polarimeter

Our new Go Direct Polarimeter helps students measure the rotation of plane-polarized light caused by optically active substances.
Learn more on page 89.

Go Direct Mini GC

The new Go Direct Mini GC is a small gas chromatograph that can be used to separate and identify both polar and nonpolar compounds.
Learn more on page 88.

Sensor not included

Go Direct Sensor Clamp

The Go Direct Sensor Clamp securely fastens to a wand-style Go Direct sensor, and the included lanyard works as a strap to prevent accidental drops during investigations in the field.
Learn more on page 62.

NEW

Vernier Instrumental Analysis™ (page 88) and Vernier Video Analysis™ (page 39)

Primary School

vernier.com/elementary-school

Why Vernier?

Technology engages young students. Our carefully designed hands-on data-collection technology helps primary school teachers introduce young learners to science and STEM. We've created easy-to-use resources to help you educate and inspire your students.

EASY

Simple for students and teachers to use

AFFORDABLE

Priced to fit school budgets

VERSATILE

Compatible with a variety of devices

> **I can't even imagine all of the amazing things I'll be able to do with the kids with your products. I'm just beyond grateful for companies like yours who give back and help teachers inspire tomorrow's science leaders.**
>
> ***Covey Denton,***
> ***Greenfield School***

Topics

Explore a sampling of our featured experiments by topic to learn how Vernier technology helps your students deepen their understanding of key STEM concepts.

Instill a Lifelong Love of Learning

Young minds are naturally curious; engage your students with fun, interactive lessons that encourage investigation of their world and instill a lifelong love of learning.

New Lessons? They're Now a Breeze

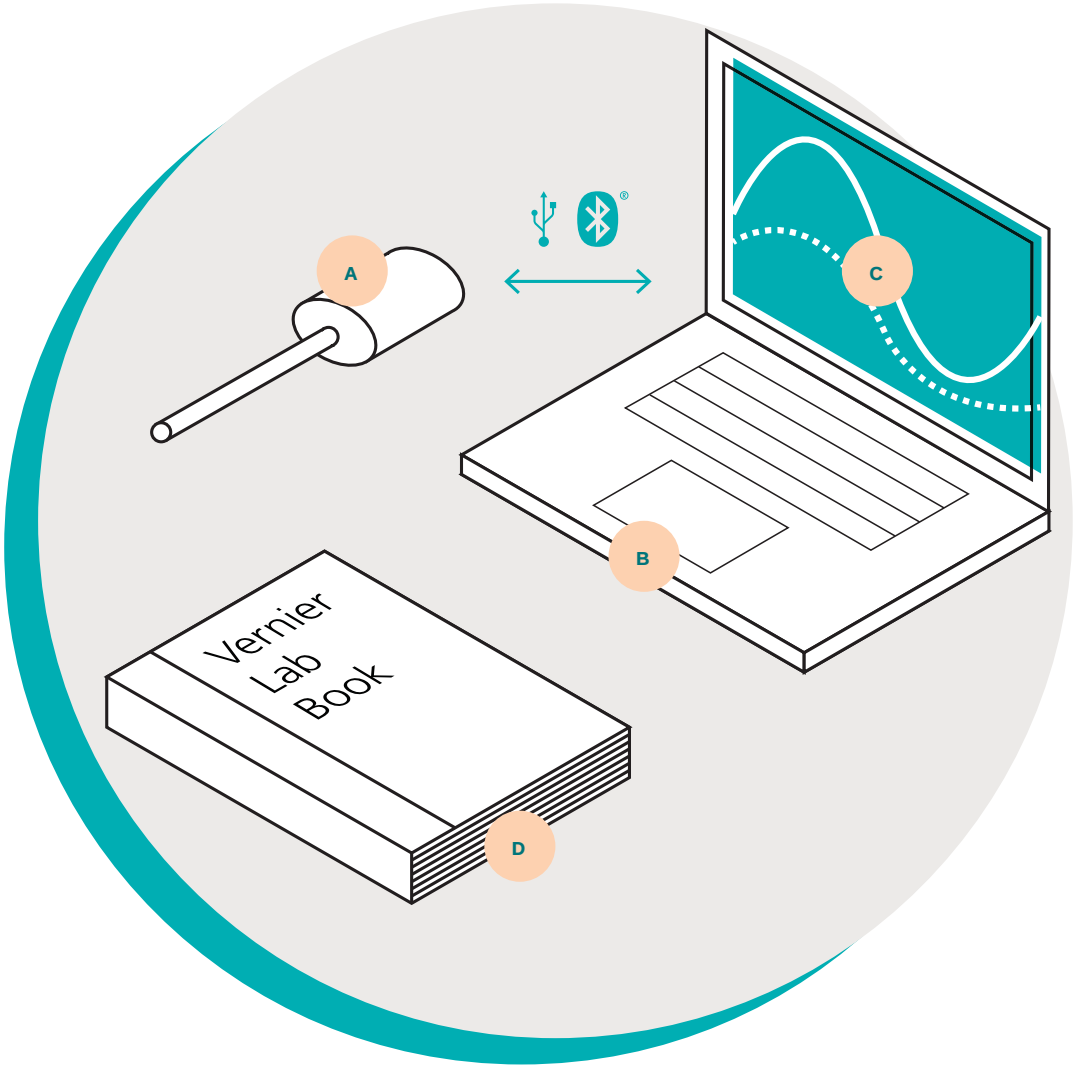
From bubbling bread and baking soda reactions to reflectivity of light and simple motion, we offer a variety of student-ready, easy-to-implement investigations designed to help excite and engage your young learners.

Educational Standards

Helping students meet standards is an important aspect of teaching. Vernier technology helps teachers as they prepare students to meet the NGSS and state standards through investigations that support three-dimensional learning.

vernier.com/standards

Getting Started



What You Need to Get Started

A *Go Direct Sensor*

These versatile sensors connect to your device via Bluetooth® wireless technology or USB.

B *Device*

Go Direct® sensors connect to a wide variety of devices commonly used in classrooms, including Chromebooks, computers, compatible mobile devices, and LabQuest® 2.

C *Graphical Analysis™ 4 App*

Our free data-collection app facilitates student understanding with real-time graphs of experimental data. No additional software purchase is necessary.

D *Lab Book*

Step-by-step instructions at your fingertips save valuable time when integrating probeware into your curriculum. Most of our lab books for primary school provide support for Go Direct sensors and the Graphical Analysis 4 app.

Our lab books come with a generous site license. Purchase once and share files schoolwide.

Next Generation Science Standards

Hands-on learning has been at the core of Vernier's mission for 39 years, and as we create new products—whether it is hardware, software, or written investigations—we work to align to the NGSS, making it easy for teachers and science supervisors to help students meet these standards.

	NGSS DCI Topics			
Vernier Books	**Physical Science**	**Life Science**	**Earth and Space Science**	**Engineering Design**
Investigating Temperature	●			●
Investigating Gas Pressure	●	●		
Investigating Motion	●	●		
Investigating Force	●			
Investigating Light	●		●	
Investigating Magnetism	●			
Investigating Voltage	●			
Elementary Science with Vernier	●	●	●	●
Investigating Wind Energy	●			●
Investigating Solar Energy	●			●
Coding with Codey Rocky: Mission to Mars	●		●	●

Temperature

Investigating Temperature

Watch a video

Download only
ELB-TEMP-E

Download + print
ELB-TEMP

In this book, students investigate topics related to temperature, including melting and freezing of water, insulation design, and chemical reactions.

10 Experiments Included

Physical Science

STRUCTURE AND PROPERTIES OF MATTER

- I'm Melting! Water Changes States
- Solid, Liquid, Gas: Water Can Do It All

ENERGY

- Are We Cool or What?
- Why Do We Need Thermometers?
- Celsius or Fahrenheit: What's the Difference?
- Getting it just Right! Adjusting Water Temperature
- The Temperature Probe Spends the Night
- Hold Everything! Comparing Insulators
- Keeping it Cool! Design Your Own Thermos
- Cool Reaction! The Reaction of Baking Soda and Vinegar (shown above)

Sensor Used

Go Direct Temperature
Students use this rugged, general-purpose sensor to monitor temperature.
GDX-TMP

Teacher pack also available
(includes 8 Go Direct Temperature Probes and a Charge Station)
GDX-TMP-TP

Learn more at vernier.com/elb-temp

Gas Pressure

Investigating Gas Pressure

Download only
ELB-GP-E

Students investigate the behavior of gas pressure when more gas is added or the volume of the container changes.

4 Experiments Included in E-book

- Learning to Use a Pressure Sensor

Life Science

MATTER AND ENERGY IN ORGANISMS AND ECOSYSTEMS

- Bubbles in Your Bread

STRUCTURE, FUNCTION, AND INFORMATION PROCESSING

- Get a Grip! *(shown above)*

Physical Science

FORCES AND INTERACTIONS

- Under Pressure

Products Used

Go Direct® Gas Pressure

Measure the change in gas pressure as variables such as temperature and volume change.

GDX-GP

Gas Pressure Sensor Bulb

GPS-BULB1

Learn more at vernier.com/elb-gp-e

Motion

Investigating Motion

Download only
ELB-MD-E

The motion of a bouncing ball and a toy car are just two examples of the investigations about motion that students will conduct using this e-book.

7 Experiments Included in E-book

- Learning to Use a Motion Detector

Physical Science

FORCES AND INTERACTIONS

- e-Motion!
- Spring into Action
- Air Ball! *(shown above)* also uses Go Direct Gas Pressure.

ENERGY

- Driving with Energy
- Weigh Station—All Trucks Stop!

Life Science

STRUCTURE, FUNCTION, AND INFORMATION PROCESSING

- Batty About Science

Sensor Used

Go Direct Motion

Monitor the position of a moving object using ultrasound.

GDX-MD

Learn more at vernier.com/elb-md-e

Force

Investigating Force

Download only
ELB-FOR-E

Everyday forces, such as the frictional force on a shoe, are investigated in this e-book.

4 Experiments Included in E-book

- Learning to Use a Force Sensor

Physical Science

FORCES AND INTERACTIONS

- Lift the Load!
- What a Drag! *(shown above)*
- Oh! My Aching Back! How Ramps Make Lifting Easier

Sensor Used

Go Direct Force and Acceleration

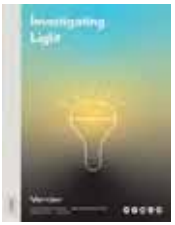
Use this force sensor to measure the force of pushes and pulls in the classroom and outdoors. This sensor can also measure acceleration.

GDX-FOR

Learn more at vernier.com/elb-for-e

Light

Investigating Light



Download only
ELB-LC-E

Students investigate light properties including how light changes with distance, reflects off different colors, and varies with the seasons.

5 Experiments Included in E-book

- Learning to Use a Light Sensor

Physical Science

WAVES: LIGHT AND SOUND

- Sunshine on My Shoulders

Earth and Space Science

EARTH'S SYSTEMS

- Summer and Winter
- Reflectivity of Light *(shown above)*

SPACE SYSTEMS: STARS AND THE SOLAR SYSTEM

- Distance From the Sun

Sensor Used

Go Direct Light and Color

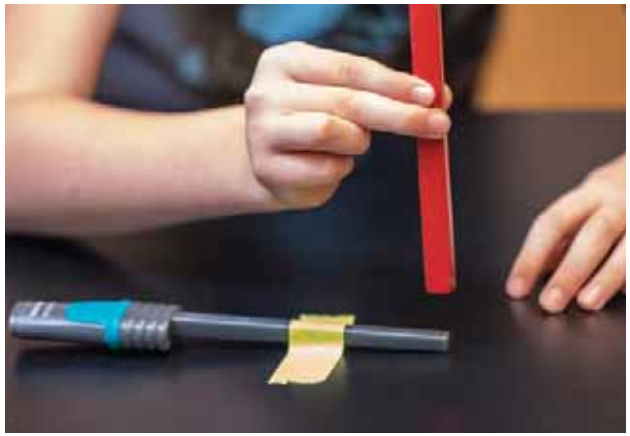
Students use this sensor to measure the brightness of a light bulb or the reflectance of light off of various objects. They can also measure UV light and relative amounts of red, blue, and green light.

GDX-LC

Learn more at vernier.com/elb-lc-e

Magnetism

Investigating Magnetism



Download only
ELB-3MG-E

In this e-book, students investigate the magnetic field of magnets and electromagnets.

4 Experiments Included in E-book

- Learning to Use a Magnetic Field Sensor

Physical Science

FORCES AND INTERACTIONS

- Exploring the Poles *(shown above)*
- Making Magnets
- Electromagnets

Sensor Used

Go Direct® 3-Axis Magnetic Field

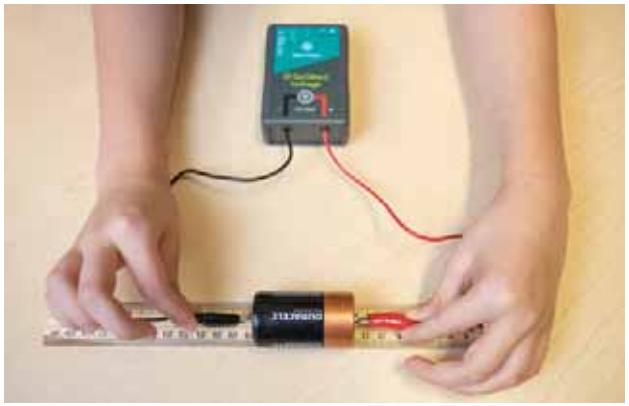
Use this sensor to explore properties of magnets, electromagnets, and the Earth's magnetic field.

GDX-3MG

Learn more at vernier.com/elb-3mg-e

Voltage

Investigating Voltage



Download only
ELB-VOLT-E

Do C-cell batteries provide a higher voltage than AA batteries? Students investigate this type of question in this e-book focused on voltage.

4 Experiments Included in E-book

- Learning to Use a Voltage Probe

Physical Science

ENERGY

- Are All Batteries the Same? *(shown above)*
- Stacked Batteries
- All Worn Out

Sensor Used

Go Direct Voltage

This sensor is an excellent choice for investigating batteries, circuits, and electromagnets.

GDX-VOLT

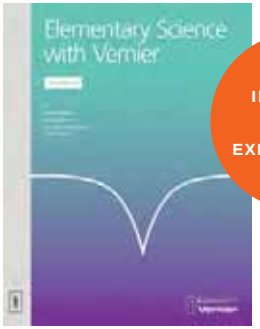
Learn more at vernier.com/elb-volt-e

Elementary Science with Vernier

This collection of experiments for primary students includes the topics of temperature, motion, force, magnetism, light, electricity, and gas pressure.

Includes Experiments from These E-books

- *Investigating Temperature*
- *Investigating Gas Pressure*
- *Investigating Motion*
- *Investigating Force*
- *Investigating Light*
- *Investigating Magnetism*
- *Investigating Voltage*



INCLUDES **43** EXPERIMENTS

Download only
EWV-E

Printed book + download
EWV

Learn more at vernier.com/ewv

Elementary Go Direct Package

8 Products · GDP-EL-DX

This package includes

Go Direct Temperature

Go Direct Light and Color

Go Direct Motion

Go Direct 3-Axis Magnetic Field

Go Direct Gas Pressure

Go Direct Voltage

Go Direct Force and Acceleration

Gas Pressure Sensor Bulb

All sensors work with our free Graphical Analysis™ 4 app, as well as LabQuest® 2.

Learn more at vernier.com/gdp-el-dx

Wind Energy

Investigating Wind Energy

Download only
ELB-WIND-E

Download + print
ELB-WIND

Students investigate wind energy to learn about energy transfer, basic electric circuits, and blade design.

11 Experiments Included

- Introduction to Wind Turbines
- Exploring Wind Energy
- Introduction to the Energy Sensor
- Wind Turbine Output: The Effect of Load *(shown above)*
- Exploring Wind Turbine Blades
- Blade Design: Pitch
- Blade Design: Area
- Blade Design: Quantity
- Blade Design: Mass
- Blade Design: Material
- Project: Power Up! (Engineering Design)

Package Available

Investigating Wind Energy Package GDP-EL-WE

Contains the following products

- Go Direct® Energy
- Vernier Resistor Board
- KidWind MINI Wind Turbine with Blade Design

Learn more at vernier.com/elb-wind

Solar Energy

Investigating Solar Energy

Download only
ELB-SOLAR-E

Download + print
ELB-SOLAR

Solar energy provides a real-world example where students investigate energy transfer, series and parallel circuits, and other factors that affect solar panel output.

11 Experiments Included

- Introduction to Solar Panels
- Exploring Solar Energy
- Introduction to the Energy Sensor
- Making Connections: Circuits
- Solar Panel Output: Effect of Load
- Solar Panel Output: Effect of Shade
- Solar Panel Output: Effect of Angle *(shown above)*
- Pumping Water with Solar Energy
- Exploring Surface Temperature
- Project: Solar Homes (Engineering Design)
- Project: What's Cookin'? (Engineering Design)

Package Available

Investigating Solar Energy Package

Contains the following products

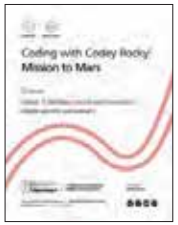
- Go Direct Energy
- Solar Energy Exploration Kit
- Go Direct Surface Temperature
- Vernier Resistor Board

GDP-EL-SE

Learn more at vernier.com/elb-solar

Robotics

Coding with Codey Rocky: Mission to Mars



Download only
MBCR-M2M-E

Students program their Codey Rocky robot to explore, learn about, and survive on Mars.

6 Experiments Included in E-book

- Houston, This is Codey
- Dance of the Martians
- Surviving the Desert of Mars
- Wild, Wild Mars
- Daily Life on Mars
- Surveying Mars

Product Used

Codey Rocky™ by Makeblock®

Easy-to-use robotic hardware combined with block-based programming provides students with the ideal introduction to coding.

Available through your local Make Block dealer

Learn more at vernier.com/mbcr-m2m-e

Coding

Coding with Scratch

Integrate Go Direct Force and Acceleration into your classroom activities with Scratch. Your students can learn coding by applying their skills to fun, collaborative, hands-on coding projects.

Starter Projects

- Frog Band: Shake, push, and toss the sensor to make music.
- Day and Night: Turn the sensor face down to turn day into night.
- Underwater Rocket: Spin and push the sensor to steer and push the ship.

Product Used

Go Direct® Force and Acceleration

With Go Direct Force and Acceleration, your students can make a sprite move in response to spinning, tilting, falling, or applying a force to the sensor.

GDX-FOR

Learn more at vernier.com/engineering/scratch

Featured Products

Go Direct Sensors

Sensor		Order Code
Go Direct® 3-Axis Magnetic Field		GDX-3MG
Go Direct Energy		GDX-NRG
Go Direct Force and Acceleration		GDX-FOR
Go Direct Gas Pressure		GDX-GP
Go Direct Light and Color		GDX-LC
Go Direct Motion		GDX-MD
Go Direct Sound		GDX-SND
Go Direct Surface Temperature		GDX-ST
Go Direct Temperature		GDX-TMP
Go Direct Voltage		GDX-VOLT

Go Direct Charge Station

Accessory		Order Code
Go Direct Charge Station		GDX-CRG

See all our products for primary school science at vernier.com/elementary-school

Additional Products

Product		Order Code
Davis® Weather Stations		vernier.com/weather
Gas Pressure Sensor Bulb		GPS-BULB1
KidWind MINI Wind Turbine with Blade Design		KW-MWTBD
Solar Energy Exploration Kit		KW-SEEK
USB Digital Microscope		BD-EDU-100
Vernier Resistor Board		VES-RB

Lab Books

Title	Order Code
Elementary Science with Vernier	Download only: EWV-E Download + print: EWV
*Investigating Temperature**	Download only: ELB-TEMP-E Download + print: ELB-TEMP
*Investigating Motion**	Download only: ELB-MD-E
*Investigating Light**	Download only: ELB-LC-E
*Investigating Magnetism**	Download only: ELB-3MG-E
*Investigating Gas Pressure**	Download only: ELB-GP-E
*Investigating Force**	Download only: ELB-FOR-E
*Investigating Voltage**	Download only: ELB-VOLT-E
Investigating Solar Energy	Download only: ELB-SOLAR-E Download + print: ELB-SOLAR
Investigating Wind Energy	Download only: ELB-WIND-E Download + print: ELB-WIND
Coding with Codey Rocky: Mission to Mars	Download only: MBCR-M2M-E
Coding with mBot: Self-Driving Vehicles	Download only: MBOT-MSDV-E

** All experiments from this e-book are included in* Elementary Science with Vernier.

See all our products for primary school science at vernier.com/elementary-school

Middle School

vernier.com/middle-school

Why Vernier?

Hands-on learning with technology is ideal for middle school students. Enhance their discovery and understanding of the world around them with the use of Vernier technology. Using our versatile, cutting-edge products and ready-to-go experiments correlated to the NGSS and state standards, you can encourage their curiosity and prepare them for secondary school—and the world beyond.

EASY

Simple for students and teachers to use

AFFORDABLE

Priced to fit school budgets

VERSATILE

Supports a variety of devices and investigations

> **The technology's ease of use and accessibility allows students to really take charge of the learning process as they acquire data; the technology has been a game changer.**
>
> ***Susan Foster,***
> ***Manlius Pebble Hill School***

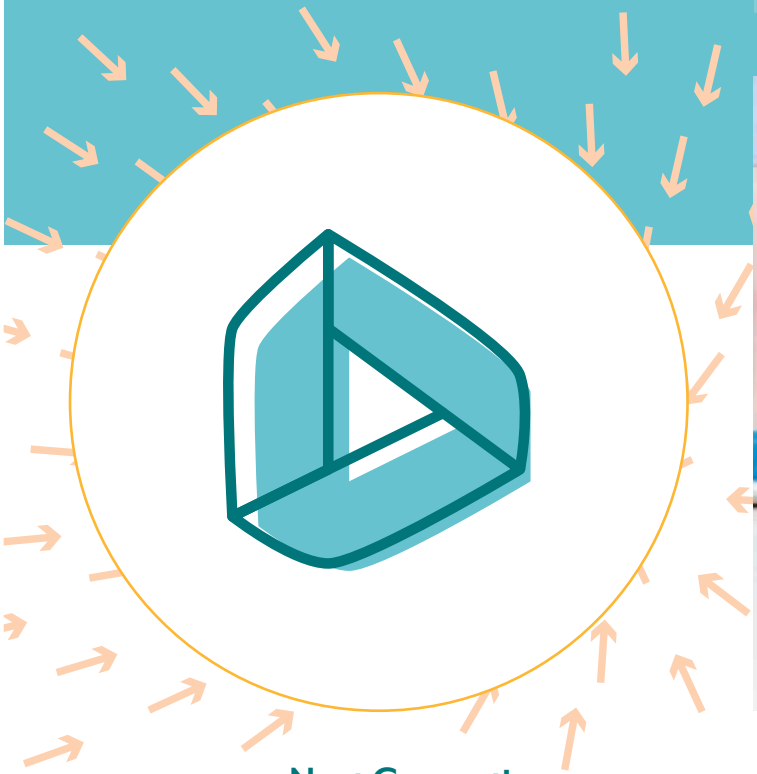
Topics

Explore a sampling of our featured experiments by topic to learn how Vernier technology helps your students deepen their understanding of key STEM concepts.

Getting Started
PAGE 18

Three-Dimensional Learning Approach
PAGE 19

Classic Approach
PAGE 19



Next Generation Science Standards

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Coding and Robotics

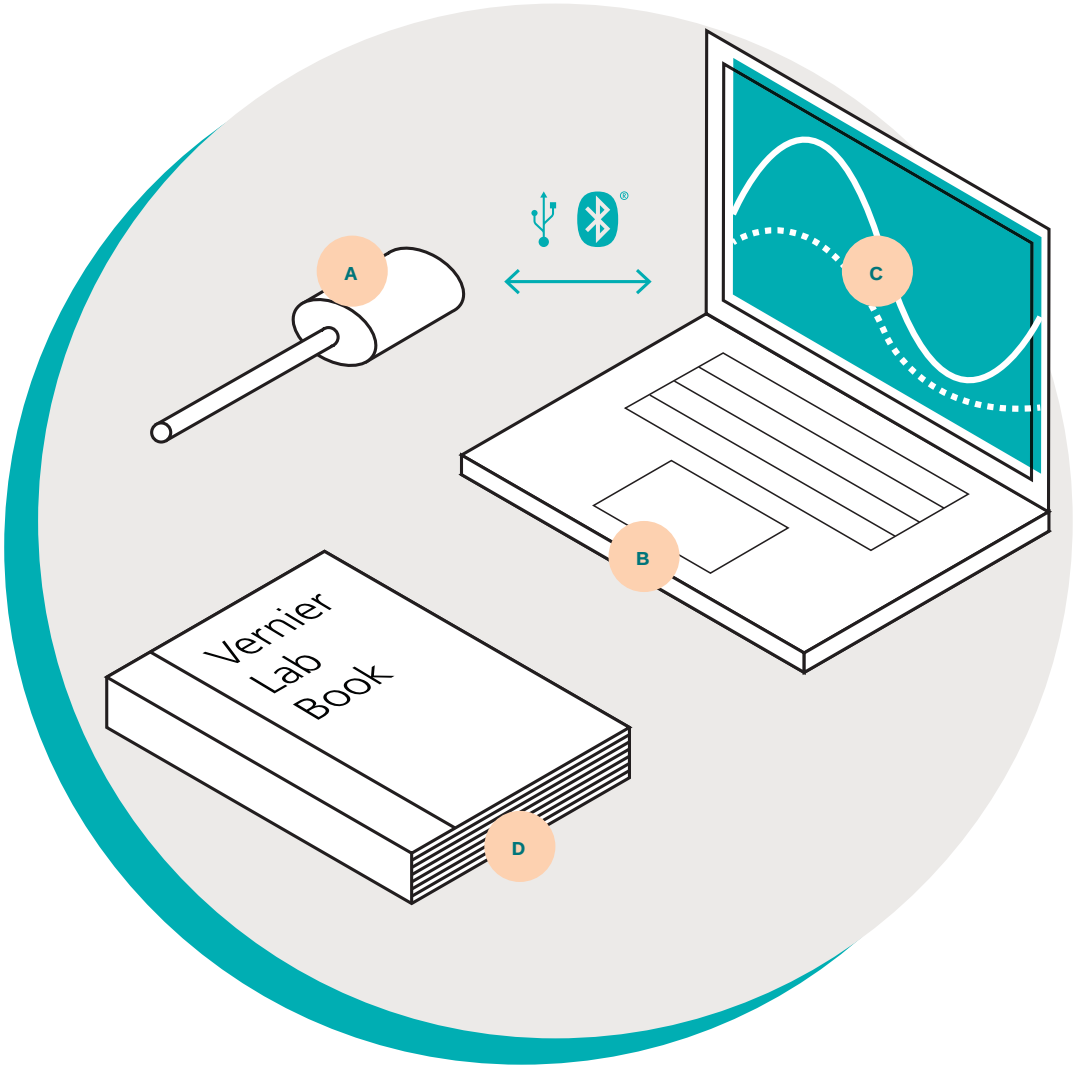
Set up your middle school students for success with cutting-edge products and partnerships that encourage curiosity, develop computational thinking skills, and enhance their understanding of the world around them.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring the use of probeware, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

Getting Started



What You Need to Get Started

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C *Graphical Analysis™ 4 App*

Our free data-collection app facilitates student understanding with real-time graphs of experimental data. No additional software purchase is necessary.

D *Lab Book*

Step-by-step instructions at your fingertips save valuable time when integrating probeware into your curriculum. Most of our lab books for middle school provide support for Go Direct sensors and the Graphical Analysis 4 app.

Our lab books come with a generous site license. Purchase once and share files schoolwide.

Overview

Three-Dimensional Learning Approach

Vernier and OpenSciEd

Vernier knows that science education is not static. Your students need to understand critical scientific concepts, use these concepts to solve problems, and understand how they connect to the real world. These objectives are incorporated into the main pillars of the three-dimensional learning framework developed by the National Research Council. Vernier provides downloadable e-books, shown on the next page, that incorporate the three-dimensional learning approach.

We are proud to partner with OpenSciEd, a provider of high-quality, open-source, science instructional materials. Our partnership gives you access to free, field-tested and EQuiP-approved units that support the three-dimensional learning approach. Vernier is providing free downloadable supplements to these units that integrate data-collection technology. When Vernier technology is paired with OpenSciEd's classroom-tested curriculum, your students establish a deep understanding of critical scientific concepts through data collection.

Learn more at vernier.com/openscied

Overview

Classic Approach

Vernier Lab Books

While the three-dimensional learning approach is valuable, sometimes a more classic approach to instruction is a better fit for your students, teaching style, and resources. In a classic approach, students follow detailed directions to conduct an experiment or investigate a specific science concept, topic, or law.

Vernier supports this more classic approach by providing a robust library of lab books covering most science disciplines. Our lab books provide teacher-created, step-by-step experiments that help your students work toward meeting the NGSS performance expectations and guide students through conducting hands-on experiments in a more structured way.

Learn more at vernier.com/lab-books

Three-Dimensional Learning

OpenSciEd

Vernier Supplement to Thermal Energy

6TH GRADE

FREE DOWNLOAD

Students plan and carry out investigations to systematically test cup systems, tracking the flow of matter and energy into or out of the system as they develop a model of thermal energy.

18 Experiments in Unit, Including

- Why does the temperature of the liquid in some cup systems change more than in others?
- What cup features seem most important for keeping a drink cold?

Sensors Used

Go Direct® Temperature

This is a rugged, general-purpose sensor that students can use to monitor temperature.
GDX-TMP

Teacher pack also available
(includes 8 Go Direct Temperature Probes and a Charge Station)
GDX-TMP-TP

Go Direct Light and Color

Students use this sensor to measure the brightness of a light bulb or the reflectance of light off of various objects. They can also measure UV light and relative amounts of red, blue, and green light.

GDX-LC

Learn more at vernier.com/openscied

Vernier Supplement to Metabolic Reactions

7TH GRADE

FREE DOWNLOAD

In this unit on metabolic reactions, students use a real case study of a middle school student to develop models to explain how the body uses food and how the body's subsystems work together.

14 Experiments in Unit, Including

- What happens to matter when it is burned?
- Does this chemical reaction to burn food happen inside our bodies?

Sensor Used

Go Direct CO_2 Gas

Use this sensor to measure gaseous carbon dioxide concentration levels, air temperature, and relative humidity.

GDX-CO2

Learn more at vernier.com/openscied

OpenSciEd

Physical Science

Vernier Supplement to Sound Waves

8TH GRADE

FREE DOWNLOAD

Students engage in model-based reasoning, argumentation, and computational and mathematical reasoning to develop models to explain what makes a sound, how sound moves through air, and how it makes something move.

14 Experiments in Unit, Including

- How do the vibrations of the sound source compare for louder versus softer sounds?
- How do the vibrations from a sound source compare for higher-pitch versus lower-pitch sounds?

Sensor Used

Go Direct Motion Detector

This sensor uses ultrasound to measure the position, velocity, and acceleration of moving objects.

GDX-MD

Learn more at vernier.com/openscied

Middle School Explorations: Chemical Reactions

Download only
MSB-CR-E

Students investigate various types of chemical reactions as they build a model to explain what goes on at the molecular level during a chemical reaction.

6 Experiments Included in E-book

Students investigate endothermic and exothermic reactions, precipitate formation, conservation of mass, and other reactions.

Sensor Used

Go Direct Temperature

This is a rugged, general-purpose sensor that students can use to monitor temperature.

GDX-TMP

Teacher pack also available
(includes 8 Go Direct Temperature Probes and a Charge Station)
GDX-TMP-TP

Learn more at vernier.com/msb-cr-e

Classic Approach

Physical Science

Exploring Physical Science

Watch a video

Download only
MSB-PS-E

From matter and energy to motion and forces, students explore a wide variety of topics in basic chemistry and physics in this e-book.

22 Experiments Included in E-book

Structure and Properties of Matter

- Fun with Pressure

Chemical Reactions

- Boiling Temperature of Water
- Freezing Temperature of Water
- How Low Can You Go? Freezer Bag Ice Cream

PLUS 2 MORE

Forces and Interactions

- Friction
- First Class Levers
- Pulleys *(shown above)*

PLUS 7 MORE

Energy

- A Hot Hand
- A Good Sock
- Lemon "Juice"

Waves and Electromagnetic Radiation

- Reflectivity of Light
- Mapping a Magnetic Field
- Electromagnets

Package Available

Exploring Physical Science Go Direct® Package GDP-MS-PS

Contains the following Go Direct sensors: Temperature (2), Gas Pressure, Force and Acceleration, Motion Detector, Voltage, 3-Axis Magnetic Field, and Light and Color

Learn more at vernier.com/msb-ps-e

Exploring Motion and Force with Go Direct Sensor Cart

Download only
MSB-CART-E

In this e-book, students explore the force of friction, aspects of motion, and simple machines such as the lever, ramp, and pulley.

7 Experiments Included in E-book

- Investigating Friction
- Levers as Machines
- Pulleys as Machines *(shown above)*
- Ramps as Machines
- Getting Faster
- Crash Test
- Newton's Second Law

Package Available

Exploring Motion and Force with Go Direct Sensor Cart Package GDP-MS-SC

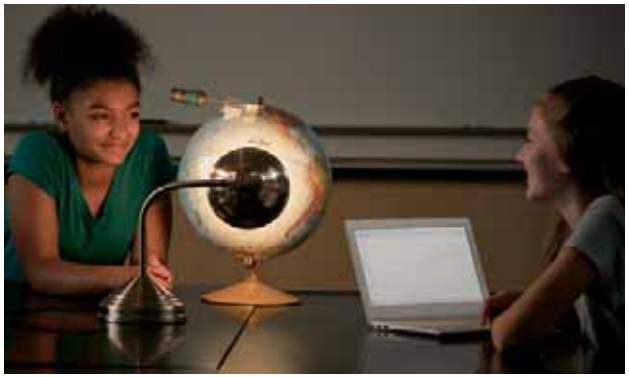
Contains the following Go Direct sensors: Sensor Cart (green) and Sensor Cart (yellow)

Learn more at vernier.com/msb-cart-e

Classic Approach

Earth and Space Science

Exploring Earth and Space Science



Download only
MSB-ESS-E

Weather, soil, and water quality are a few of the Earth science topics students explore in this e-book.

12 Experiments Included in E-book

Earth's Systems

- Soil Study
- Ocean Floor Mapping
- Water Hardness Study
- A Water Field Study

Weather and Climate

- Heating of Land and Water
- The Greenhouse Effect
- Relative Humidity
- Absorption of Radiant Energy
- Reflectivity of Light
- Schoolyard Study
- What Causes the Seasons? *(shown above)*
- Solar Homes (Engineering Design)

Package Available

Exploring Earth and Space Science Go Direct Package GDP-MS-ESS

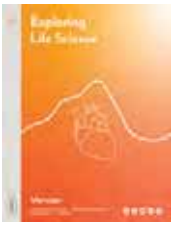
Contains the following Go Direct sensors:
Temperature (2), Light and Color,
Motion Detector, Conductivity, pH

Learn more at vernier.com/msb-ess-e

Classic Approach

Life Science

Exploring Life Science



Download only
MSB-LS-E

From yeast to humans, this e-book provides opportunities for students to learn about life science.

5 Experiments Included in E-book

Structure, Function, and Information Processing

- Get a Grip *(shown above)*
- Heart Rate and Body Position
- Heart Rate and Exercise

Matter and Energy in Organisms and Ecosystems

- Diffusion: How Fast?

Growth, Development, and Reproduction of Organisms

- Yeast Beasts in Action

Package Available

Exploring Life Science Go Direct Package GDP-MS-LS

Contains the following sensors and accessories:
Go Direct Gas Pressure, Go Wireless Heart Rate,
Go Direct Conductivity, Gas Pressure Sensor Bulb

Learn more at vernier.com/msb-ls-e

Engineering, Technology, and Coding

Coding with Scratch

Engage your students with scientific and computational concepts through hands-on project-based learning using the popular coding platform Scratch.

Go Direct® Force and Acceleration brings real-world data into your Scratch project. With this integration, students can learn coding by purposefully and successfully applying their skills to fun, hands-on coding projects. This helps students make natural connections between the digital and physical worlds.

Learn more at vernier.com/scratch

ACTIVITY 6

Driving Outside the Lines

Students write, run, and troubleshoot mBot code to navigate their mBot using dead reckoning; in other words, using time to measure and predict distance traveled and degrees turned.

Products Used in This Activity

mBot™ by Makeblock®

mBot provides students with a fun and tactile way to learn entry-level coding with simple, Scratch-based software.

Available through your local Makeblock dealer

Experiment Source

Coding with mBot: Self-Driving Vehicles

Download only: MBOT-MSDV-E

Learn more at vernier.com/mbot-msdv-e

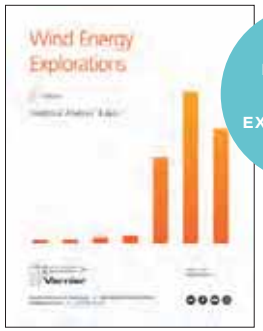
Wind Energy

Wind Energy Explorations

Students gain an understanding of energy, circuits, and loads, as well as practice engineering design as they use this e-book to explore wind energy.

Experiments Included in E-book

- Energy Transformation
- Measuring Wind Energy
- Exploring Wind Turbines
- Wind Turbines: Effect of Load
- Blade Variable: Pitch
- Blade Variable: Quantity
- Blade Variable: Area
- Blade Variable: Shape
- Project: Max Power (Engineering Design)



INCLUDES 9 EXPERIMENTS

Download only
MSB-WIND-E

Wind Energy Explorations Go Direct Packages

Single Station Package *(shown below)*

This package includes

- Go Direct Energy (1)
- Vernier Resistor Board (1)
- KidWind Basic Wind Experiment Kit (1)

GDP-MS-WE

Classroom Package

This package includes

- Go Direct Energy Sensors (3)
- Vernier Resistor Boards (3)
- KidWind Basic Wind Experiment Classroom Pack (includes materials for eight groups of 2 to 4 students each) (1)

GDP-MS-WEC

Learn more at vernier.com/msb-wind-e

Solar Energy

Solar Energy Explorations

Solar energy provides a relevant topic for students to explore energy, temperature, and electrical circuits, culminating in an engineering design project.

Experiments Included in E-book

- Renewable Energy
- Introduction to Solar Panels and Solar Energy
- Measuring Energy
- Making Connections: Circuits
- Solar Panel Output: Effect of Load
- Solar Panel Output: Effect of Shade
- Solar Panel Output: Effect of Angle
- Solar Panel Output: Effect of Temperature
- Project: Build a Solar Car (Engineering Design)

INCLUDES 9 EXPERIMENTS

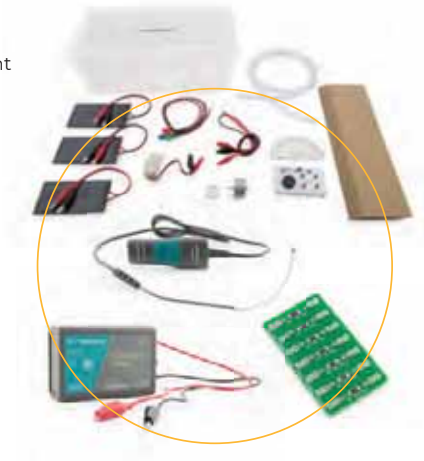
Download only
MSB-SOLAR-E

Solar Energy Explorations Go Direct Package

This package includes 2 sensors, which both work with our free Graphical Analysis® 4 app or LabQuest® 2. It also includes an experiment kit and a resistor board.

- Go Direct Energy
- Solar Energy Exploration Kit
- Go Direct Surface Temperature
- Vernier Resistor Board

GDP-MS-SE



Learn more at vernier.com/msb-solar-e

Featured Products

Go Direct Sensors

Sensor	Order Code
Go Direct® 3-Axis Magnetic Field	GDX-3MG
Carts and Tracks	
Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX
Go Direct Sensor Cart (Green)	GDX-CART-G
Go Direct Sensor Cart (Yellow)	GDX-CART-Y
Go Direct Conductivity	GDX-CON
Go Direct Current	GDX-CUR
Go Direct Energy	GDX-NRG
Go Direct Force and Acceleration	GDX-FOR
Go Direct Gas Pressure	GDX-GP
Go Wireless Heart Rate	GW-HR
Go Direct Light and Color	GDX-LC
Go Direct Motion	GDX-MD
Go Direct Optical Dissolved Oxygen	GDX-ODO
pH Sensors	
Go Direct pH	GDX-PH
Go Direct Tris-Compatible Flat pH	GDX-FPH
Go Direct Sound	GDX-SND
Go Direct Structures & Materials Tester	GDX-VSMT
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Voltage	GDX-VOLT
Go Direct Weather	vernier.com/gdx-wthr

See all our products for middle school science at vernier.com/middle-school

Looking for Replacement Parts?

Visit vernier.com/replacements

Go Direct Charge Station

Accessory		Order Code
Go Direct Charge Station		GDX-CRG

LabQuest 2 Interface and Sensors

Learn more about LabQuest® 2 and sensors at vernier.com/labq2

Additional Products

Products		Order Code
Davis® Weather Stations		vernier.com/weather
pH Storage Solution		PH-SS
KidWind Basic Wind Experiment Kit		KW-BWX
OHAUS® Balances		vernier.com/ohaus
Solar Energy Exploration Kit		KW-SEEK
Vernier Resistor Board		VES-RB

Lab Books

Title	Order Code
Middle School Science with Vernier	Download + print: MSV Download only: MSV-E
Exploring Motion and Force with Go Direct Sensor Cart	MSB-CART-E
*Exploring Physical Science**	MSB-PS-E
*Exploring Life Science**	MSB-LS-E
*Exploring Earth and Space Science**	MSB-ESS-E
Solar Energy Explorations	MSB-SOLAR-E
Wind Energy Explorations	MSB-WIND-E
Coding with mBot: Self-Driving Vehicles	MBOT-MSDV-E
Earth Science with Vernier	Download + print: ESV Download only: ESV-E

See all our products for middle school science at vernier.com/middle-school

* *All experiments from this e-book are included in* Middle School Science with Vernier.

Secondary School

vernier.com/high-school

Encourage your students and build their confidence in pursuing a STEM career path with hands-on experience using data-collection technology from Vernier. Our technology supports you as you set up students for success for standardized testing, as well as preparing them to meet the NGSS and state standards through experiments that support three-dimensional learning.

Contents

Explore a sampling of our featured experiments by topic to learn how Vernier technology helps your students deepen their understanding of key STEM concepts.

Lab Books & Investigations

E-books and Printed Books—the Choice is Yours

Many of our popular, award-winning lab books are available in both e-version and printed formats. When you purchase a printed book, you also receive the electronic version. When you purchase either format, you receive

- Anytime access to the most up-to-date versions of experiments on all supported Vernier software
- Editable student files and complete teacher information files, including sample data and supplies lists
- A generous site license—purchase once and share files with other teachers in your school

Helping You Meet Standards and Learning Objectives

Vernier understands that helping students meet standards is an important part of teaching. As standards change, we are committed to providing you with the most current information. You will find the following alignments and correlations for Vernier lab books at **vernier.com/standards**

- NGSS (Next Generation Science Standards)
- CSTA (Computer Science Teachers Association)
- AP* (Advanced Placement Program)
- IB† (International Baccalaureate Diploma Program)

Ideas for Your Science Classroom

If you are looking for experiments that can help you excite your students about STEM, check out our extensive library of experiments. We make it easy to find ideas from fellow educators and Vernier professionals.

Visit **vernier.com/ideas**

Digital Curriculum

We recognize that you partner with dependable providers you have come to know and trust. We strive to do the same, which is why we are now partnering with other leaders in technology, including Microsoft® and Google Workbench.

Learn more on page 40.

NGSS Aligned

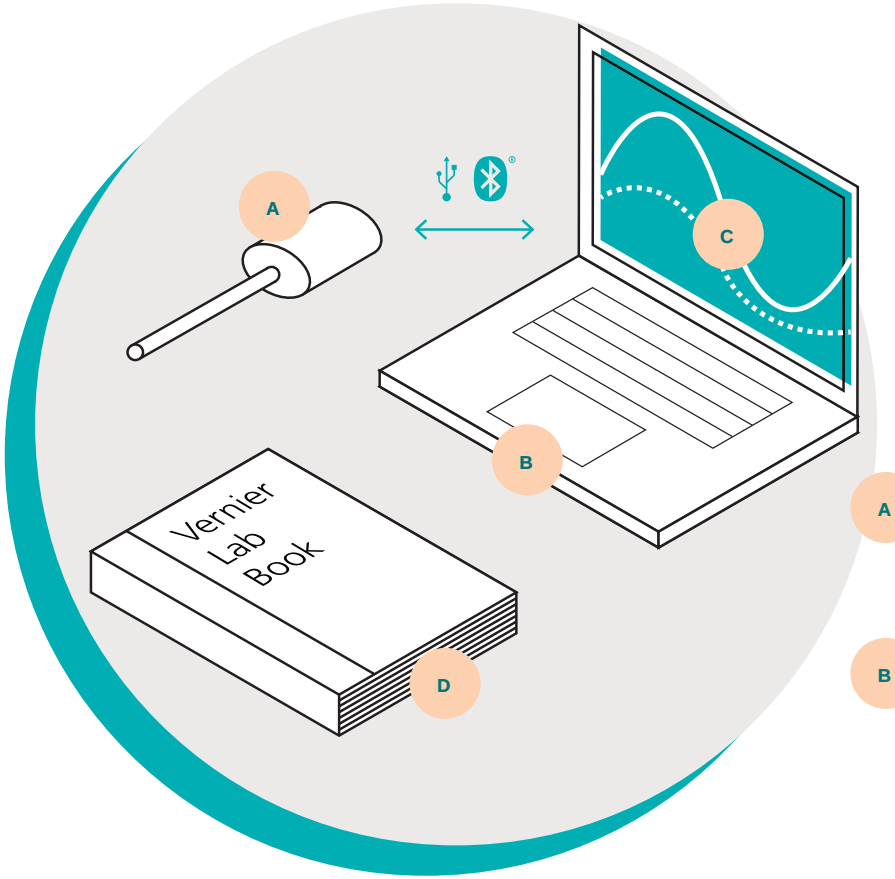
To learn about the Next Generation Science Standards and Vernier, visit vernier.com/ngss

Learn more at vernier.com/lab-books

** AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.*

† The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

Getting Started with Go Direct Sensors



Why Choose Go Direct Sensors?

With over 50 sensors to choose from, our Go Direct® family of sensors offers an affordable solution that includes free software. Go Direct sensors are easy to use—just connect and start collecting data with your device.

What You Need to Get Started

A *Go Direct Sensor*

These versatile sensors connect to your device via Bluetooth® wireless technology or USB.

B *Device*

Go Direct sensors connect to a wide variety of devices commonly used in classrooms, including Chromebooks, computers, compatible mobile devices, and LabQuest 2.

C *Graphical Analysis™ 4 App*

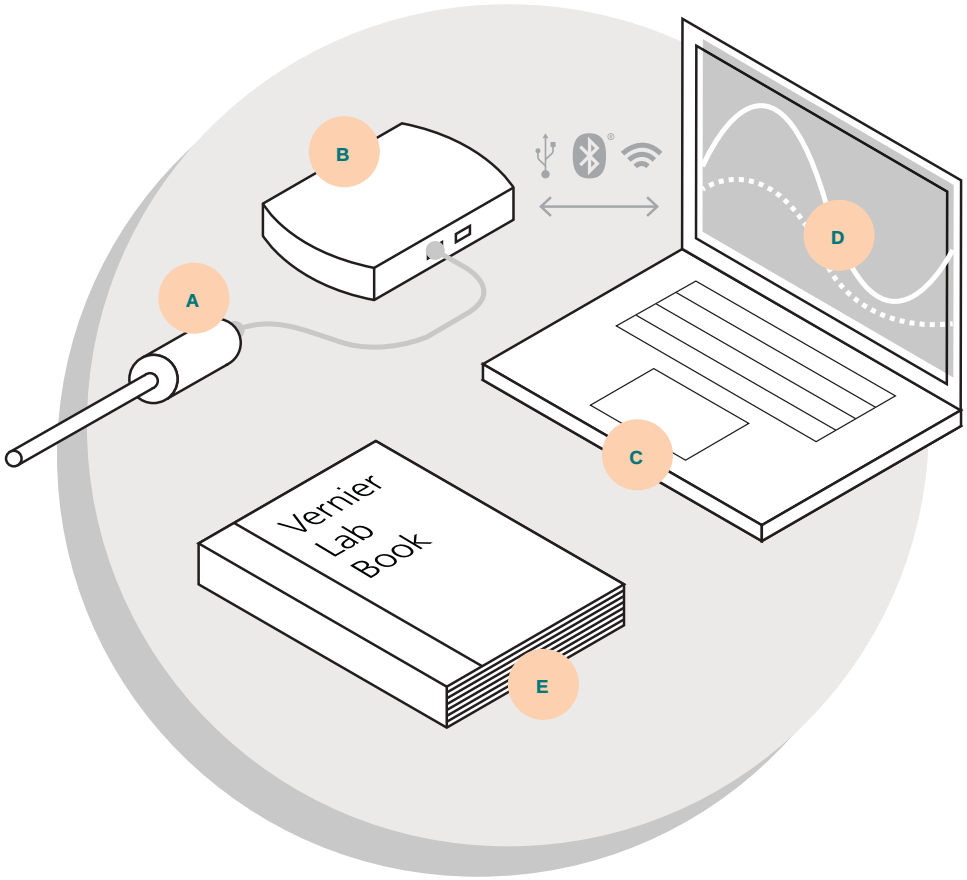
Our free data-collection app facilitates student understanding with real-time graphs of experimental data. No additional software purchase is necessary.

D *Lab Book*

Step-by-step instructions at your fingertips save valuable time when integrating probeware into your curriculum. Many of our lab books provide support for Go Direct sensors and the Graphical Analysis 4 app.

Our lab books come with a generous site license. Purchase once and share files schoolwide.

Getting Started with LabQuest Sensors



Why Choose LabQuest Sensors?

With over 80 sensors to choose from, our LabQuest® family of sensors offers the widest variety of experiments to integrate into your existing curriculum. Connect LabQuest sensors with an interface to your device, or use LabQuest 2 as a standalone device in the field or on the benchtop. With LabQuest 2, you can also transfer data wirelessly via Wi-Fi to one or more devices.

What You Need to Get Started

A *LabQuest Sensor*

LabQuest sensors share data with your device via a wired connection (BTA/BTD) to an interface from the LabQuest family.

B *Interface*

An interface sends information from the sensor to the data-collection and analysis software. The LabQuest family includes LabQuest 2, LabQuest Stream,® and LabQuest Mini.

C *Device*

LabQuest sensors connect to computers, Chromebooks, and compatible mobile devices through a LabQuest interface.

D *Software*

Our LabQuest family of interfaces are supported by our award-winning data-collection and analysis software, including Graphical Analysis 4 and Logger *Pro*® 3.

E *Lab Book*

Our popular, award-winning lab books provide hundreds of well-tested, customizable experiments.

Our lab books come with a generous site license. Purchase once and share files schoolwide.

LabQuest 2

LabQuest 2 is a powerful, connected, and remarkably versatile data-logging solution.

Why? LabQuest® 2 can serve as a standalone data-collection platform that works with all of our sensors. This makes it an excellent choice for you and your students in the lab, in the classroom, and in the field.

LABQ2

Standalone

The most engaging and effective approach to science is interactive, with students collecting and analyzing data to understand and apply core concepts. Graphing and analyzing data is an essential component of the inquiry and learning process. LabQuest 2, with its built-in data collection and analysis app that works with all Vernier sensors, supports hands-on data collection in the classroom, in the lab, and in the field.

- Chromebook cart not available? No problem. LabQuest 2 can do it all—data collection, data analysis, and data sharing.
- Keep your expensive computers safe from spills, drops, and crashes—use LabQuest 2 in the chemistry lab, at the watershed, or next to your bridge tester. LabQuest 2 does not need another device for data collection or analysis.
- With a portable design, LabQuest 2 lets your students take it anywhere they go.
- LabQuest 2 works with all of our sensors—both LabQuest and Go Direct®

One-to-Many Data Sharing

Students can share real-time data with multiple devices for a truly hands-on, collaborative learning environment. Use LabQuest 2 to transfer data wirelessly to one or more computers, Chromebooks, or compatible mobile devices running Graphical Analysis™ 4.

USB Sensor Interface

If you want to collect data on a computer or Chromebook,™ use LabQuest 2 as a conduit between our LabQuest sensors and these computing devices. LabQuest 2 works as a USB sensor interface with our Logger *Pro*® 3 software or Graphical Analysis 4 app.

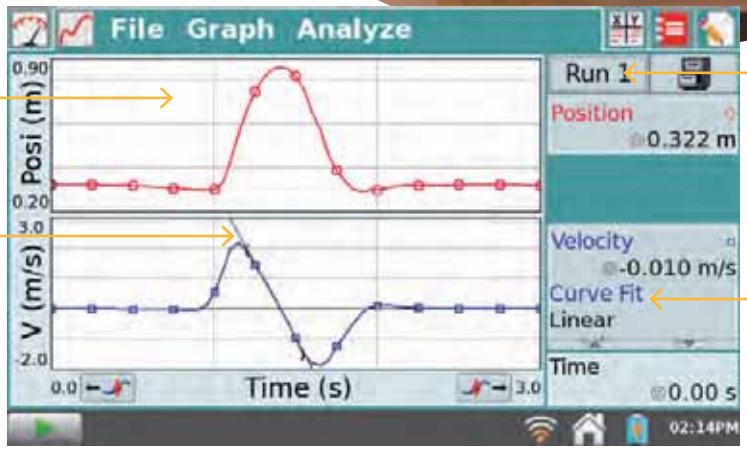
Learn more at vernier.com/labq2

LabQuest App

LabQuest 2's built-in software gives your students real-time graphing capabilities in a handheld device. It's powerful, yet beautifully simple.

- Collect data and view them in a Data Table, Meter, and Graph.
- Perform curve fits.
- Use built-in sensors—GPS, accelerometers, and more.
- Draw a prediction before collecting data.
- Display two graphs at once.
- Display a tangent line or use the Integral function tool.
- Calculate statistics for your data.

Learn more about built-in applications and other great features at **vernier.com/labq2**



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

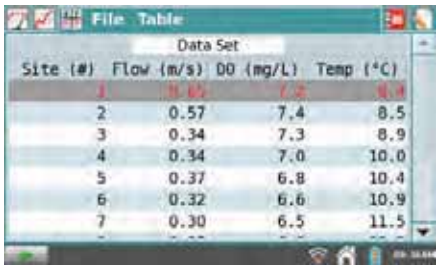
Curve fits and other analysis tools are available.

Easily store and recall multiple runs.

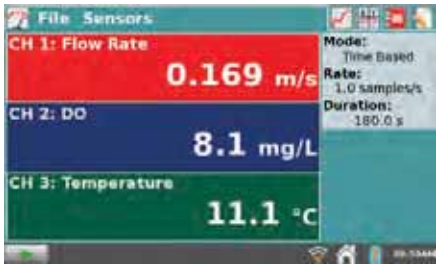
Display curve fit statistics.

One-Touch Simplicity

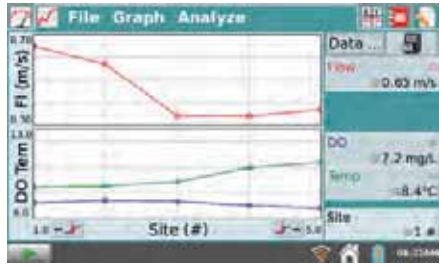
Your students can collect data and view them in a Data Table, Meter, or Graph.



Data Table



Meter



Graph

Learn more at vernier.com/labq2

LabQuest 2

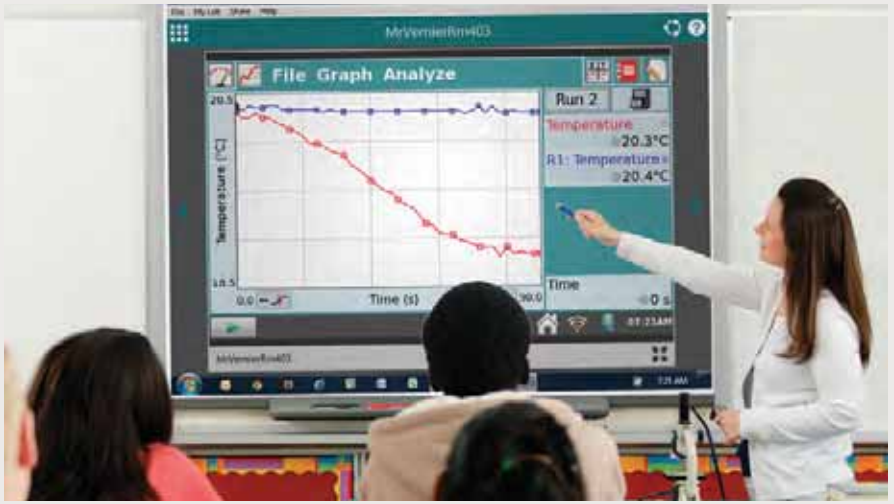
Accessories

Product		Order Code
	LabQuest Charge Station	LQ2-CRG
	LabQuest 2 Lab Armor	LQ2-ARMOR
	LabQuest 2 Stand	LQ2-STN
	LabQuest Power Supply	LQ-PS
	LabQuest Stylus Tether (pkg. of 5)	LQ-TETH-5
	LabQuest Lanyard	LQ-LAN
	LabQuest 2 Battery	LQ2-BAT
	LabQuest Battery Boost 3	LQ-BOOST3
	LabQuest SD Card	LQ-SD
	LabQuest 2 Stylus (pkg. of 5)	LQ2-STYL-5
	Vernier Mini USB Cable	CB-USB-MINI
	Vernier USB Type C to Mini USB Cable	CB-USB-C-MINI

Can't find the accessory you need? Check our complete list of accessories at vernier.com/lq2-accessories

LabQuest 2

LabQuest Viewer App



LabQuest Viewer®

Teach students how to use LabQuest® by projecting your LabQuest screen. Display live images of all LabQuest units in your lab to monitor student progress or compare group data. Compatible with both macOS® and Windows® computers.

Computer software includes a site license for every teacher's computer in your school.

LQ-VIEW

For more information, visit vernier.com/lq-view

LabQuest Viewer for iPad®

Use LabQuest Viewer app for iPad on your classroom iPad to wirelessly view and control LabQuest. When your iPad is used with a projector, you can easily display any LabQuest screen for the entire class to see.

For more information, visit vernier.com/lq-view-ipad

Download on the App Store

LabQuest Mini

LabQuest Mini

LabQuest Mini brings the power of our award-winning LabQuest technology to you when you don't need the versatility of a standalone device. The perfect solution for educators collecting data with a computer or Chromebook,™ LabQuest Mini interfaces with Graphical Analysis™ 4, Logger Lite,® and Logger *Pro*® 3 software.

LQ-MINI

Learn more at vernier.com/lq-mini

LabQuest Stream

LabQuest Stream®

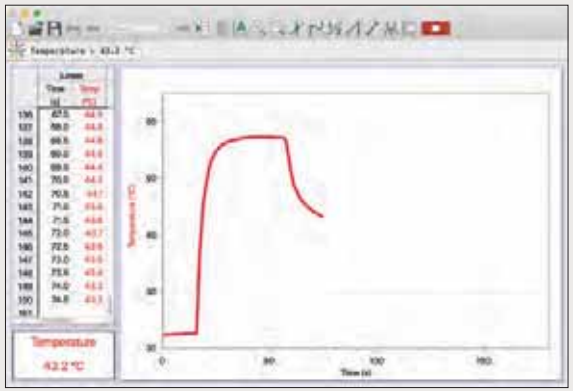
LabQuest Stream brings data collection with LabQuest sensors to even more platforms—computers, Chromebooks, smartphones, and tablets. LabQuest Stream connects via a one-to-one USB or wirelessly via Bluetooth® wireless technology without the need to connect to your school's network. LabQuest Steam is our recommended interface for BYOD classrooms using LabQuest sensors.

LQ-STREAM

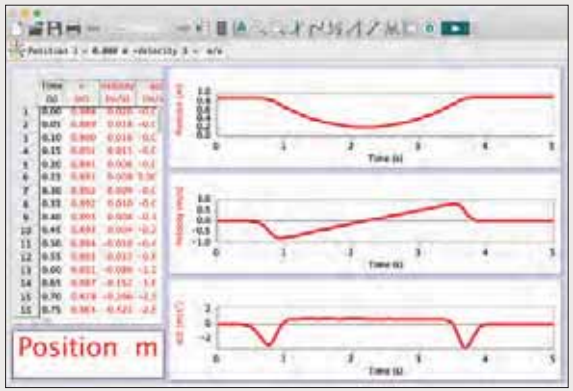
Learn more at vernier.com/lq-stream

Software

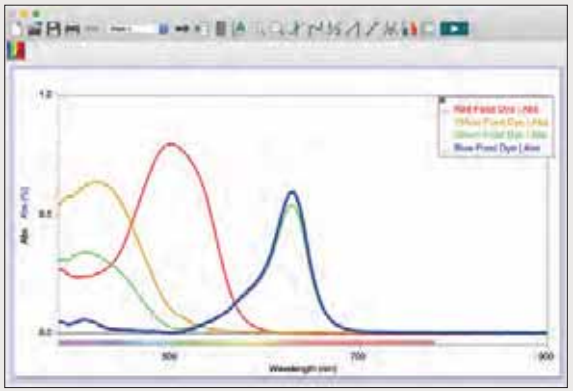
Logger *Pro* 3



After you click Collect, Logger Pro 3 draws the graph in real time, and the data table and digital meter update continuously.



Plot position, velocity, and acceleration data from a Motion Encoder Cart.



Collect absorbance data from Vernier spectrometers, including our Go Direct SpectroVis Plus and Vernier UV-VIS Spectrophotometers.

Real-Time Graphing and Powerful Analytical Tools

Logger *Pro*® 3 is our data-collection and analysis software for LabQuest sensors on Windows® and macOS® computers. With a complete suite of data-collection and analysis tools, Logger *Pro* 3 is suitable for all students, from beginning to advanced.

One program does it all—for all of your school's computers AND your students' personal computers.

Think of Logger *Pro* 3 as the digital data hub of your classroom and lab. It can gather data from a variety of sources, including LabQuest® 2, LabQuest Mini, LabQuest Stream,® Go! Link,® OHAUS® balances, compatible TI graphing calculators, and spectrometers.

Key Features

Logger *Pro* 3 includes a site license for your entire secondary school.

- Site license includes home computers of teachers and students

Logger *Pro* 3 Data Sharing

- This is ideal software for lecture demonstrations. Collect data on your computer and Data Share your data to student devices running our free Graphical Analysis™ 4 app.

Advanced Features

- Import remotely collected data from LabQuest 2 and TI-84 Plus calculators.
- Lay out graphs, tables, and text across multiple pages to describe your experiment.
- Graph data in a variety of ways, including log graphs, double-Y graphs, strip charts, and FFT graphs.
- Model data with user-adjustable functions.
- Extract data from movies using frame-by-frame video analysis.
- Capture video from video cameras or import compatible movie files.
- IB* curriculum support—manual curve fits and error bars

Note: Logger *Pro* 3 cannot be used to collect data with our Go Direct® sensors (other than Go Direct SpectroVis® Plus).

** The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.*

Logger Pro 3

with manual, CD, and download

LP

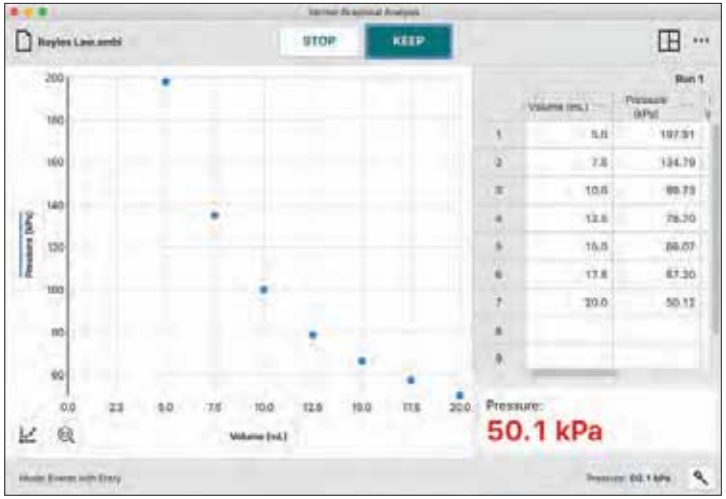
download only

LP-E

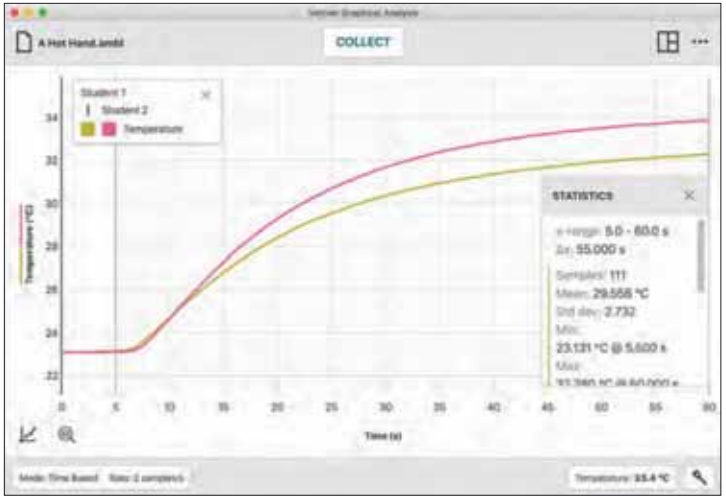
Windows® and macOS® computers only

Learn more at vernier.com/logger-pro

Graphical Analysis 4



View a graph, table, and meter simultaneously.



Use analysis tools, including text annotations and statistics.

Collect, share, and analyze sensor data with our free software for Chrome OS,™ iOS, iPadOS,™ Android,™ Windows, and macOS.

Using Graphical Analysis 4 app, you can collect data from Go Direct sensors or LabQuest sensors connected to a compatible interface.

Enter data manually, copy data saved on your clipboard, or receive data from a Data Sharing source (LabQuest 2 or Logger *Pro* 3) using Wi-Fi.

Key Features

Data Collection

- Collect data from multiple sensors simultaneously.
- Select time-based or event-based data collection, including events with entry.
- Adjust data-collection rate and duration as needed.
- Enter data manually or using the clipboard.
- Draw predictions before data collection.
- Perform graph matching exercises with a Motion Detector.

Data Analysis

- Display one, two, or three graphs as needed.
- Easily select what columns and data sets are plotted on each graph.
- Calculate descriptive statistics and fit lines and curves to some or all of your data.
- View data in a meter, on a graph, in a table, or all three at once.

Download Graphical Analysis 4 for free

available in the chrome web store

Download for Windows and macOS at vernier.com/ga4

Download on the App Store

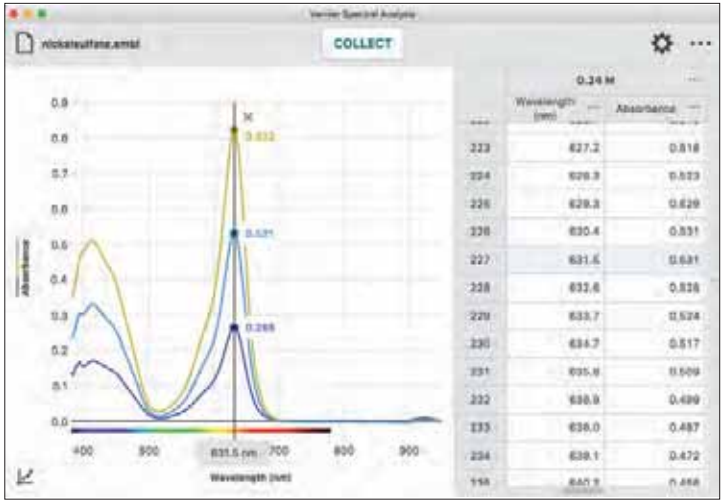
ANDROID APP ON Google Play

Learn more at vernier.com/graphical-analysis

Software

Vernier Spectral Analysis

Create an absorbance vs. concentration graph to study Beer's law using copper sulfate.



Absorbance spectra of green food coloring at different concentrations

Collect, share, and analyze spectrometer data with our free software for Chrome OS,™ Windows,® macOS,® iOS, iPadOS,™ and Android.™

Benefits

The free Vernier Spectral Analysis® app makes it easy to incorporate spectroscopy into your biology, chemistry, and physics experiments. Using the app, students can collect a full spectrum and explore topics such as Beer's law, enzyme kinetics, and plant pigments.

The user-friendly software includes analysis features such as curve fitting and data interpolation.

Features

- Follow on-screen instructions for simplified Beer's law or kinetics data collection.
- Collect full absorbance spectrum or % transmittance data in less than one second.
- Analyze data with built-in analysis tools, including data interpolation and curve fittings.
- Determine the order of kinetics reaction with the calculated columns function.
- Understand color transmission using the color strip shown on full spectrum graphs.
- View a full spectrum of your sample while collecting data for Beer's law or kinetic experiments.
- View spectral lines by collecting intensity *vs.* wavelength data.

Download Vernier Spectral Analysis for free

available in the chrome web store

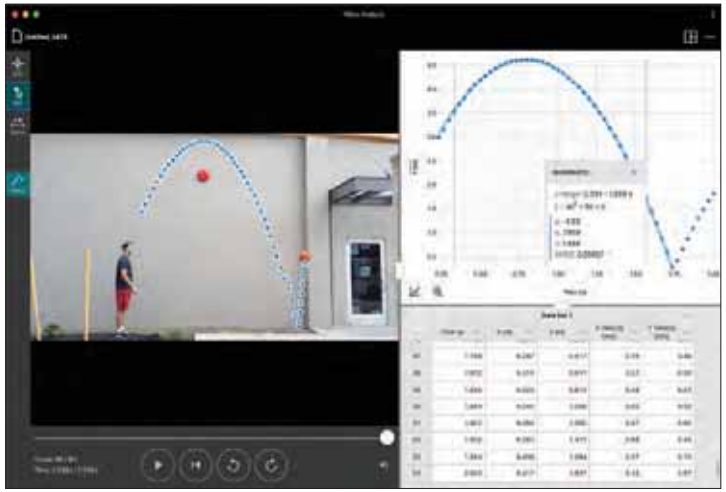
Download for Windows and macOS at vernier.com/spectral-analysis

Download on the App Store

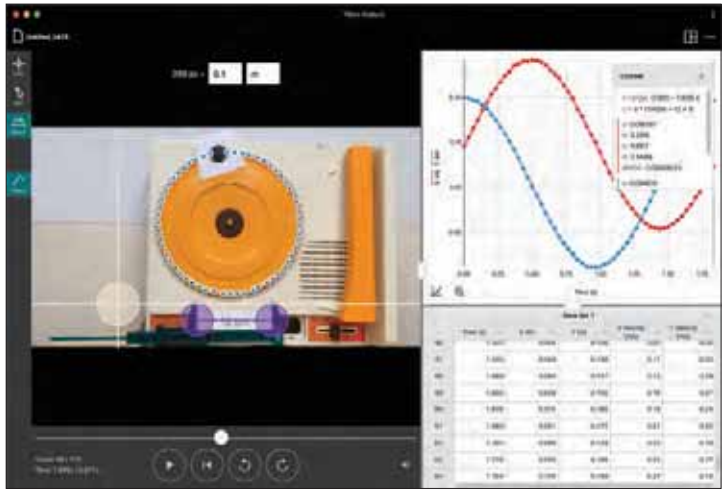
ANDROID APP ON Google Play

Learn more at vernier.com/spectral-analysis

NEW Vernier Video Analysis



Follow the trajectory of a basketball and demonstrate projectile motion.



Show the link between circular motion and simple harmonic motion.

The Vernier Video Analysis app brings video analysis to your students in a dedicated and streamlined application.

Benefits

Students can use their mobile devices in the classroom or out in the field to insert a video with recorded motion, mark points to track the object in motion, and set the scale of the video. Vernier Video Analysis™ generates accurate and visually rich graphs and a data table reflecting the recorded motion.

WORKS ON YOUR CHROMEBOOKS!

Features

- Video Analysis app is compatible with multiple devices and platforms: macOS,® iPadOS,™ iOS, Windows® 10, Chrome OS,™ and Android.™
- Students can use prepared videos, found videos, or collect their own videos for analysis.
- Vernier Video Analysis makes it possible to do experiments that cannot be done with sensors, such as following a basketball in flight.
- Since analysis is rapid and easily repeated, students can immediately analyze and think critically about the collected data.
- No need to purchase other multi-featured apps just to do video analysis—our dedicated app streamlines the work to save time with better results.
- Easy annual site-licensing makes purchasing and renewing quick and easy.
- Upcoming features include auto-tracking, multiple objects, polar coordinate systems, and more.
- Free trial period

Vernier Video Analysis runs in the Chrome,™ Safari,® and Firefox™ browsers.

Browsers can run on Chrome OS, Windows, macOS, Android, and iOS/iPadOS.

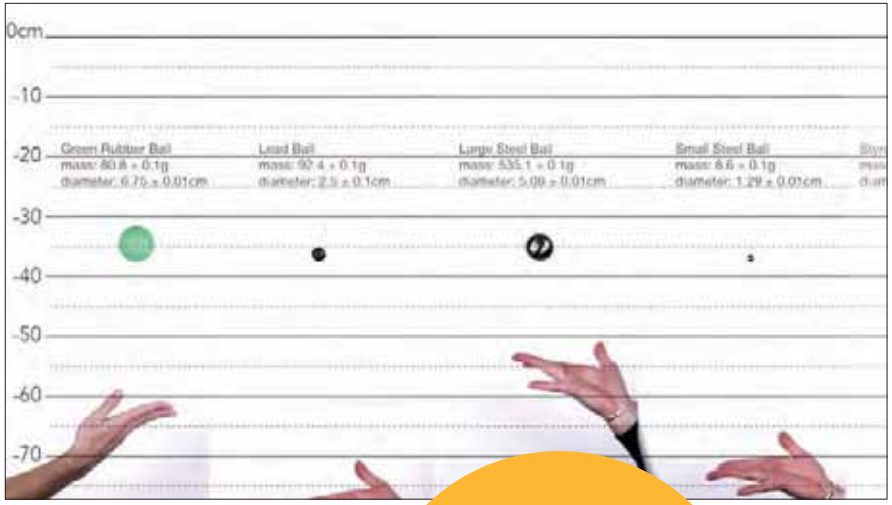
Get a free trial and learn about site license options at vernier.com/video-analysis

Learn more at vernier.com/video-analysis

Digital Curriculum

Pivot Interactives

Students overlay tools onto high-quality videos to make measurements, such as in this activity where torque is calculated.



In this popular activity, students use graphs and video as they learn that objects with different masses have the same freefall acceleration.

pivot interactives

Deepen Student Understanding with Pivot Interactives

Benefits

Pivot Interactives is a powerful supplement to hands-on experimentation, enabling students to vary experimental parameters one at a time to view results from a set of many recordings of the same experiment. These high-quality videos give your students the opportunity to observe and study hard-to-replicate phenomena. Students make measurements and analyze their data directly within the Pivot Interactives online environment.

Features

- Augment hands-on learning with interactive videos to teach concepts in physics and chemistry.
- Use Pivot Interactives for formative and summative assessment.
- Assign pre-made activities to students or author new ones.
- Provide feedback to students through Pivot Interactives.

See Pivot in Action

Watch a video

*Free Trial for Educators**

Try Pivot Interactives free for 30 days. Browse the entire library of videos, explore the analysis tools, and use it with your students.

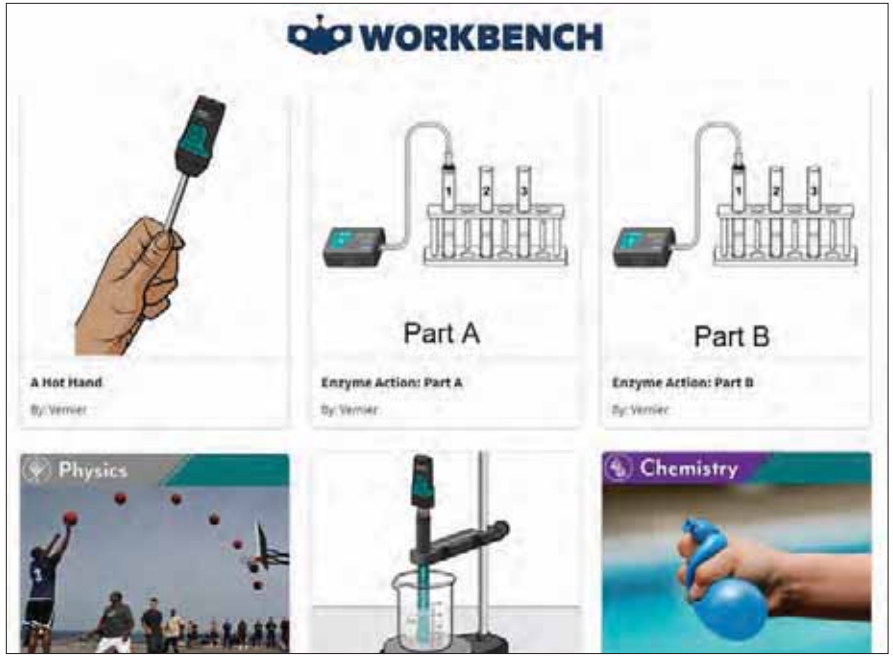
Start a free 30-day trial today at pivotinteractives.com

** Not available in countries subject to GDPR*

Learn more at vernier.com/pivot

Digital Curriculum

Google Workbench



A collection of our NGSS-aligned lessons are now available through the Vernier content channel of Google Workbench. This channel provides the ability to integrate data-collection technology into curriculum. You can easily copy and customize these lessons within Workbench and assign with the built-in Google Classroom integration.

Features

- Built-in Google Classroom integration
- Lessons are customizable
- Lessons align with the NGSS

Learn more at vernier.com/google-workbench

Digital Curriculum

Microsoft Hacking STEM

Vernier Go Direct® sensors now integrate with Microsoft® Excel® Data Streamer to bring real-time data into Excel. The integration enables all Go Direct sensors to stream data into Microsoft Excel.

Two new example Microsoft Hacking STEM lessons, based on this integration, help students understand real-world phenomena using real-time data.

Lessons

- "Understanding Adiabatic Compression and the Ideal Gas Law"
  Uses Go Direct Gas Pressure, Go Direct Surface Temperature
- "Detecting Alpha, Beta, and Gamma Radiation"
  Uses Go Direct Radiation Monitor

Learn more at vernier.com/microsoft-education

Biology

vernier.com/biology

Our biology solutions include high-quality sensors, easy-to-use software, and exceptional technical support to set up you and your students for classroom success.

Topics

Explore our featured experiments by topic to learn how Vernier technology helps your students engage with data-collection technology and deepens their understanding of key biological concepts.

Bring Your Biology Lessons to Life

From cellular biology to ecology to human physiology, get your students excited about biology using Vernier technology. Our sensors, software, and investigations help biology students explore phenomena, develop their understanding of living organisms, and encourage their scientific curiosity. Work with our team to implement high-quality sensors, experiments, and technology solutions in your classroom and set your students up for success in science and beyond.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

Biology

31 Experiments Available

EXPERIMENT 11

Cell Respiration

Students measure cellular respiration in germinating peas and determine what effect temperature has on respiration rate.

Sensor Used

Go Direct® CO_2 Gas

Use Go Direct CO_2 Gas to measure CO_2 gas levels, air temperature, and relative humidity. It's an excellent sensor for measuring fermentation, cell respiration, and photosynthesis.

GDX-CO2

Experiment Source

Biology with Vernier

Download only: BWV-E
Printed book + download: BWV

Learn more at vernier.com/bwv-11b

EXPERIMENT 6

Enzyme Action

Watch a video

Students measure the activity of the enzyme catalase and analyze how different factors (e.g., enzyme concentration, pH, and temperature) influence enzyme activity.

Sensor Used

Go Direct Gas Pressure

Use Go Direct Gas Pressure to monitor gas pressure in a variety of experiments. Easily change the displayed units to any one of seven options. This sensor includes a syringe, tubing, and stoppers to ease experiment setup.

GDX-GP

Experiment Source

Biology with Vernier

Download only: BWV-E
Printed book + download: BWV

Learn more at vernier.com/bwv-6b

EXPERIMENT 1

Energy in Food

Students determine and compare the energy content of different foods using calorimetry.

Sensor Used

Go Direct Temperature

This rugged probe measures the temperature of a variety of substances including air, soil, and water.

GDX-TMP

Experiment Source

Biology with Vernier

Download only: BWV-E
Printed book + download: BWV

Learn more at vernier.com/bwv-1

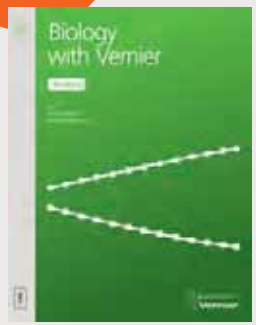
Biology with Vernier

INCLUDES 31 EXPERIMENTS

Biology with Vernier addresses the fundamentals of a secondary school biology course with 31 experiments that include cell respiration, photosynthesis, membrane diffusion, osmosis, human physiology, transpiration, fermentation, and more.

The instructor information section included for each experiment contains reagent preparation information, sample data, and tips for successful completion.

Learn more at vernier.com/bwv



Download only
BWV-E

Printed book + download
BWV

Biology Go Direct Starter Package

This package includes 4 sensors, which all work with our free Graphical Analysis™ 4 app or LabQuest® 2.

- Go Direct Temperature
- Go Wireless Heart Rate
- Go Direct Gas Pressure
- Go Direct CO_2 Gas

GDP-BIO-ST

Learn more at vernier.com/gdp-bio-st

Standard package also available (see page 49)

Biology

31 Experiments Available

EXPERIMENT 25

Primary Productivity

Measuring the effect of light level on net and gross productivity in aquatic ecosystems helps students understand primary productivity.

Sensor Used

Go Direct® Optical Dissolved Oxygen

Use this sensor to measure dissolved oxygen, water temperature, and atmospheric pressure.

GDX-ODO

Accessory Used

Primary Productivity Kit

This kit is an accessory for one of our most popular biology labs, "Primary Productivity." The kit consists of a box of 7 plastic bottles, 7 rubber stoppers, and a set of screens.

PPK

Experiment Source

Biology with Vernier

Download only: BWV-E
Printed book + download: BWV

Learn more at vernier.com/bwv-25

EXPERIMENT 31

Photosynthesis and Respiration (CO_2 & O_2)

Students use a terrestrial plant to measure photosynthesis and cellular respiration.

Sensors Used

Go Direct CO_2 Gas

Measure gaseous carbon dioxide concentration levels, air temperature, and relative humidity using this sensor.

GDX-CO2

Go Direct O_2 Gas

Use this sensor to measure gaseous oxygen concentration levels and air temperature.

GDX-O2

Accessory Used

BioChamber 2000

BC-2000

Experiment Source

Biology with Vernier

Download only: BWV-E
Printed book + download: BWV

Learn more at vernier.com/bwv-31c

Biology Go Direct Standard Package

GDP-BIO-ODX

This package includes 11 sensors, which all work with our free Graphical Analysis™ 4 app or LabQuest® 2. Two sampling chambers are also included.

- Go Direct Temperature
- Go Direct Gas Pressure
- Go Direct O_2 Gas
- Go Direct CO_2 Gas
- Go Direct Colorimeter
- Go Direct Conductivity
- Go Direct EKG
- Go Direct pH
- Go Direct Optical Dissolved Oxygen
- Go Direct Respiration Belt
- Go Wireless Heart Rate
- BioChamber 250
- BioChamber 2000

Learn more at vernier.com/gdp-bio-odx

Starter package also available

Biology Lab Books

Biology with Vernier

Download only BWV-E
Printed book + download BWV

31 Experiments

*Advanced Biology with Vernier**

Download only BIO-A-E
Printed book + download BIO-A

17 Experiments

** Instructions for Graphical Analysis 4 app not yet available*

Investigating Biology through Inquiry

Download only BIO-I-E
Printed book + download BIO-I

22 Investigations

AP† AND IB‡ CORRELATIONS

To see all AP† correlations, visit vernier.com/ap-correlations

† AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.

To see all IB‡ correlations, visit vernier.com/ib-correlations

‡ The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

Human Physiology

14 Experiments Available

EXPERIMENT 8

Introduction to Electrocardiography

After obtaining graphical representations of the electrical activity of the heart, students learn to recognize the different waveforms in an EKG and associate them with events in the heart.

Sensor Used

Go Direct® EKG

The Go Direct EKG measures electrical activity in the heart and electrical signals produced during muscle contractions.

GDX-EKG

Experiment Source

Human Physiology Experiments

Download only: HSB-HP-E
Printed book + download: HSB-HP

Learn more at vernier.com/hsb-hp-8

EXPERIMENT 7

Effect of Exercise on Heart Rate

Observing and measuring how the heart responds to exercise is a fun, hands-on way for students to learn about the cardiovascular system.

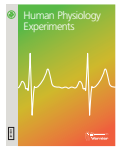
Sensor Used

Go Wireless® Heart Rate

This sensor is ideal for continuously monitoring heart rate before, during, and after exercise or while a person is stationary.

GW-HR

Experiment Source



Human Physiology Experiments

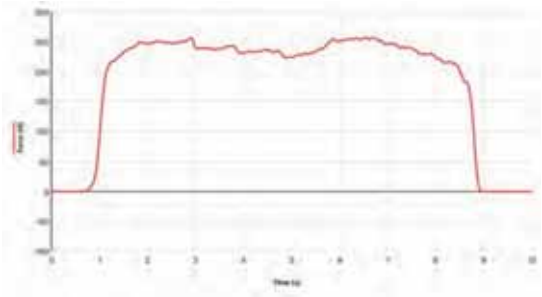
Download only: HSB-HP-E
Printed book + download: HSB-HP

Learn more at vernier.com/hsb-hp-7

EXPERIMENT 2

Limb Position and Grip Strength

Students measure and compare grip strength in both the right and left hands as well as correlate grip strength with arm position and handedness.



Sensor Used

Go Direct Hand Dynamometer

Use this sensor to measure grip strength, pinch strength, and muscle fatigue.

GDX-HD

Experiment Source

Human Physiology Experiments

Download only: HSB-HP-E
Printed book + download: HSB-HP

Learn more at vernier.com/hsb-hp-2

Human Physiology Go Direct Standard Package

This package includes 9 sensors, which all work with our free Graphical Analysis™ 4 app or LabQuest® 2. Two useful accessories are also included.

- Go Direct Blood Pressure
- Go Direct EKG
- Go Direct Force and Acceleration
- Go Direct Hand Dynamometer
- Go Direct O_2 Gas
- Go Direct Respiration Belt
- Go Direct Surface Temperature
- Go Direct Spirometer
- Go Wireless Heart Rate
- Reflex Hammer Accessory Kit
- BioChamber 250

GDP-HP-DX

Learn more at vernier.com/gdp-hp-dx

Starter package also available (see page 45)

PROJECT LEAD THE WAY PLTW

Learn more about PLTW Engineering

See page 128

PLTW Biomedical Science

PLTW Biomedical Science (9–12) inspires students to make an impact on others' lives and empowers them to pursue their life and career goals—whether it's a future in diagnosing, treating, or preventing disease.

Learn more at vernier.com/pltw

Featured Products

NEW Go Direct® Spirometer

This is a multi-channel sensor that reports air pressure, flow rate, volume, and respiration rate. Measuring tidal volumes and other lung function parameters are both simple and easy due to channels that automatically adjust for baseline drift.

Included accessories & parts

- Go Direct Spirometer
- Disposable mouthpieces (3)
- Disposable bacterial filters (3)
- Nose clips (3)
- Micro USB Cable

GDX-SPR

Download free sample experiments at vernier.com/gdx-spr

NEW Go Direct Blood Pressure

Go Direct Blood Pressure is an affordable, non-invasive sensor designed to easily measure human blood pressure. It measures systolic, diastolic, and mean arterial pressure using the oscillometric method. Go Direct Blood Pressure can also report pulse rate and can display both individual pressure pulses and peak-to-peak pulse amplitudes, giving students a few ways to collect data.

GDX-BP

Download free sample experiments at vernier.com/gdx-bp

Reflex Hammer Accessory Kit

The Reflex Hammer Accessory Kit converts your Vernier force sensor into a reflex hammer. Use it to capture the strike of the hammer on a tendon. When using the kit with an EKG sensor to record EMGs, students can study reflexes.

RFX-ACC

vernier.com/rfx-acc

Force sensor not included

Go Direct Respiration Belt

The Go Direct Respiration Belt uses a force sensor and an adjustable nylon strap to measure human respiration rates before, during, and after exercise.

GDX-RB

vernier.com/gdx-rb

Go Direct Surface Temperature

This sensor has an exposed thermistor that results in an extremely rapid response time. The design allows it to be used on skin or in air or water.

GDX-ST

vernier.com/gdx-st

Agricultural Science

EXPERIMENT 13

Transpiration

Students measure the rate of transpiration from a plant and then investigate how different environmental factors influence water transport in plants.

Sensor Used

Go Direct Gas Pressure

Use Go Direct Gas Pressure to monitor gas pressure in a variety of experiments. Easily change the displayed units to any one of seven options. This sensor includes a syringe, tubing, and stoppers to ease experiment setup.

GDX-GP

Experiment Source

Agricultural Science with Vernier

Download only: AWV-E
Printed book + download: AWV

Learn more at vernier.com/awv-13

Featured Products

LabQuest® 2

LabQuest 2 is a powerful, connected, and remarkably versatile data-logging solution.

Why? LabQuest 2 can serve as a standalone data-collection platform that works with all of our sensors. This makes it an excellent choice for teachers and students in the classroom and in the field.

LABQ2

vernier.com/labq2

Go Direct Tris-Compatible Flat pH

Use Go Direct Tris-Compatible Flat pH to measure the pH of a solution or semisolid, such as food or a soil slurry.

GDX-FPH

vernier.com/gdx-fph

Go Direct CO_2 Gas

Use Go Direct CO_2 Gas to measure CO_2 gas levels, air temperature, and relative humidity. An excellent sensor for measuring fermentation, cell respiration, and photosynthesis.

GDX-CO2

vernier.com/gdx-co2

CASE
Curriculum for Agricultural Science Education

Vernier is proud to work with CASE, the Curriculum for Agricultural Science Education. CASE is an ambitious project started by the National Council for Agricultural Education in 2007 and is managed by the National Association of Agricultural Educators. It is committed to the goal of improving educational experiences for agriculture students by empowering agriculture teachers.

Visit the CASE website at case4learning.org

Spectroscopy

18 Experiments Available

INVESTIGATION 14

Plant Pigments

After analyzing the absorbance spectrum of chlorophyll from spinach, students investigate the absorbance spectrum of other pigments commonly found in fruits, vegetables, and other plants.

Free sample experiment available at vernier.com/plant-pigments

INVESTIGATION 4

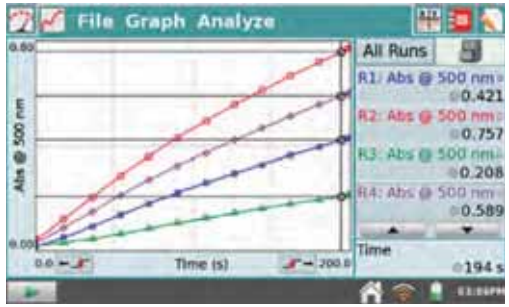
Chemistry of Membranes

After measuring how alcohol damages the cell membranes of beets, students investigate how other compounds can damage cell membranes.

INVESTIGATION 6C

Testing Enzyme Activity

Students measure the enzymatic activity of turnip peroxidase and investigate how different factors (e.g., enzyme concentration, substrate concentration, pH, and temperature) influence enzyme activity.



Investigating Biology through Inquiry

Investigating Biology through Inquiry contains investigations for many fundamental concepts in biology. Each investigation includes a preliminary activity, instructor information, sample researchable questions, and sample data.

Topics covered include

- Cell and Molecular Biology
- Organismal Biology
- Ecology
- Evolution

If you are new to inquiry-based instruction, the extensive Instructor Information sections that accompany each investigation will help guide you through the inquiry-based style of biology instruction.

Learn more at vernier.com/bio-i

INCLUDES 22 INVESTIGATIONS

Download only
BIO-I-E

Printed book + download
BIO-I

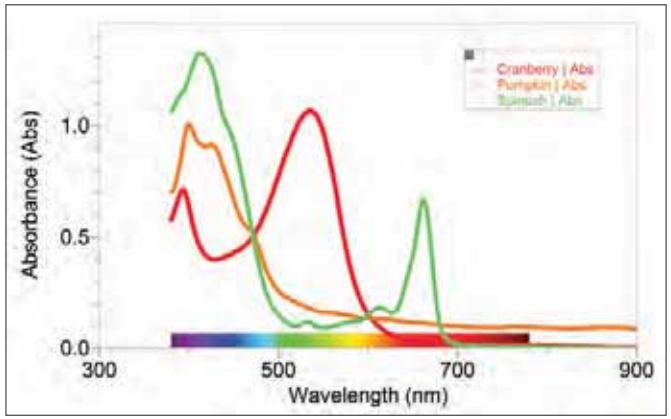
Spectrometers

Go Direct® SpectroVis® Plus

Introduce your students to spectroscopy with our affordable Go Direct SpectroVis Plus. Students can easily collect a full-wavelength spectrum (absorbance, percent transmission, fluorescence, or intensity), study absorbance *vs.* concentration (standard curve), or monitor enzyme activity (kinetics). Collect and analyze data using Vernier Spectral Analysis® app, LabQuest® App, or Logger *Pro*® 3.

GDX-SVISPL

vernier.com/gdx-svispl



Plant pigments spectra

Vernier UV-VIS Spectrophotometer

The Vernier UV-VIS Spectrophotometer is a portable ultraviolet and visible light spectrophotometer. It is ideal for measuring the absorbance spectra of various biochemical compounds, including DNA and proteins.

VSP-UV

vernier.com/vsp-uv

Vernier Fluorescence/ UV-VIS Spectrophotometer

This spectrophotometer measures the fluorescence and absorbance spectra of ultraviolet and visible samples such as quinine sulfate, fluorescein, rhodamine, and DAPI.

VSP-FUV

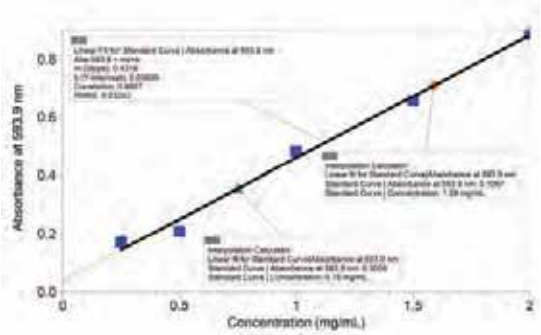
vernier.com/vsp-fuv

Biotechnology

EXPERIMENT 17

Macromolecules: Experiments with Protein

The protein content of milk and protein drinks are measured and analyzed using the Bradford Assay.



Sensor Used

Download free sample experiments at vernier.com/bio-rad-kits

Go Direct SpectroVis Plus

Use the Go Direct® SpectroVis® Plus to collect a full-wavelength spectrum, create standard curves for Bradford and other colorimetric assays, or to monitor enzymatic reactions.

GDX-SVISPL

Experiment Source

Advanced Biology with Vernier

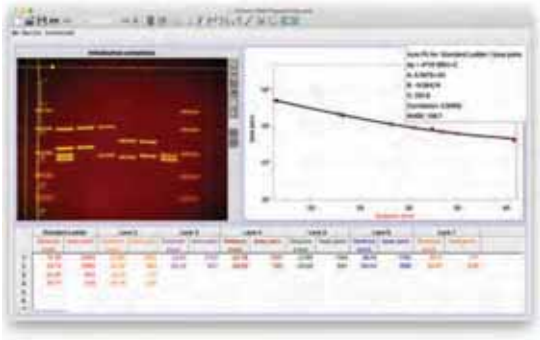
Download only: BIO-A-E
Printed book + download: BIO-A

Learn more at vernier.com/bio-a-17

EXPERIMENT 6B

Forensic DNA Fingerprinting

Students use prepared DNA samples to determine if any of the five "suspects" from a "crime scene" can be excluded as suspects. Gel electrophoresis, DNA staining, and imaging techniques are used to analyze the samples.



Equipment Used

Download free sample experiments at vernier.com/bio-rad-kits

BlueView Transilluminator

Uses super bright blue LEDs to illuminate electrophoresis gels stained with fluorescent dyes (e.g., SYBR Safe). This combination is a safer alternative to ethidium bromide and a UV transilluminator.

BLUE-VIEW

Experiment Source

Advanced Biology with Vernier

Download only: BIO-A-E
Printed book + download: BIO-A

Learn more at vernier.com/bio-a-6b

Key Products for Biotech

Go Direct Conductivity

GDX-CON

Go Direct Tris-Compatible Flat pH

GDX-FPH

Go Direct Temperature

GDX-TMP

Go Direct Drop Counter

GDX-DC

Stir Station

STIR

OHAUS® Balances

vernier.com/ohaus

BIO-RAD

Vernier and Bio-Rad®

Bio-Rad combines high-quality supplies, equipment, and curricula with outstanding customer service and technical support—things we believe are important to teachers. Vernier and Bio-Rad enhance classroom experiences with joint experiments and curricula for biotechnology.

Download free sample experiments at vernier.com/bio-rad-kits

Imagers

USB Digital Microscope

This 5 megapixel camera connects to a computer or Chromebook™ via USB. It features 10–300× magnification with manual focus and an adjustable LED light source.

BD-EDU-100

vernier.com/bd-edu-100

Celestron Digital Microscope Imagers

Celestron® Digital Microscope Imagers turn your traditional compound or stereo microscope into a high-resolution digital imager using a personal computer or Chromebook.

CS-5MP
CS-DMI

vernier.com/cs-dmi

Featured Products

Go Direct Sensors

Sensor		Order Code
Go Direct® Blood Pressure		GDX-BP
Go Direct CO_2 Gas		GDX-CO2
Go Direct Colorimeter		GDX-COL
Go Direct Conductivity		GDX-CON
Go Direct EKG		GDX-EKG
Go Direct Ethanol Vapor		GDX-ETOH
Go Direct Force and Acceleration (for use with Reflex Hammer Accessory Kit)		GDX-FOR
Go Direct Gas Pressure		GDX-GP
Go Direct Hand Dynamometer		GDX-HD
Heart Rate Monitors		
Go Wireless Exercise Heart Rate		GW-EHR
Go Wireless Heart Rate		GW-HR
Go Direct O_2 Gas		GDX-O2
Go Direct Optical Dissolved Oxygen		GDX-ODO
pH Sensors		
Go Direct pH		GDX-PH
Go Direct Tris-Compatible Flat pH		GDX-FPH
Go Direct Respiration Belt		GDX-RB
Go Direct Spirometer		GDX-SPR
Go Direct SpectroVis® Plus		GDX-SVISPL
Temperature Probes		
Go Direct Surface Temperature		GDX-ST
Go Direct Temperature		GDX-TMP

Accessories

Accessory		Order Code
Go Direct Charge Station		GDX-CRG
Reflex Hammer Accessory Kit		RFX-ACC

See all our products for biology at vernier.com/biology

LabQuest Sensors

Sensor	Order Code
25-g Accelerometer	ACC-BTA
Blood Pressure Sensor	BPS-BTA
CO_2 Gas Sensor	CO2-BTA
Colorimeter	COL-BTA
Conductivity Probe	CON-BTA
EKG Sensor	EKG-BTA
Ethanol Sensor	ETH-BTA
Gas Pressure Sensor	GPS-BTA
Goniometer	GNM-BTA
Hand Dynamometer	HD-BTA
Heart Rate Monitors	
Exercise Heart Rate Monitor	EHR-BTA
Hand-Grip Heart Rate Monitor	HGH-BTA
O_2 Gas Sensor	O2-BTA
Optical DO Probe	ODO-BTA
PAR Sensor	PAR-BTA
pH Sensors	
pH Sensor	PH-BTA
Tris-Compatible Flat pH Sensor	FPH-BTA
Qubit Sensors	
Qubit EKG/EMG Sensor	Q-S207
Qubit GSR Sensor	Q-S222
Soil Moisture Sensor	SMS-BTA
Spirometer	SPR-BTA
Temperature Probes	
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA

Spectrophotometers

Equipment	Order Code
Go Direct SpectroVis Plus	GDX-SVISPL
Vernier Fluorescence/UV-VIS Spectrophotometer	VSP-FUV
Vernier UV-VIS Spectrophotometer	VSP-UV

Digital Microscopes

Equipment	Order Code
Celestron® Digital Microscope Imager	CS-DMI
5MP Celestron Digital Microscope	CS-5MP
ProScope™ 5MP Microscope Camera	BD-PS-MC5UW
USB Digital Microscope	BD-EDU-100

Lab Books*

Title	Order Code
Biology with Vernier	BWV
Investigating Biology through Inquiry	BIO-I
Advanced Biology with Vernier (LabQuest sensors only)	BIO-A
Human Physiology Experiments (Go Direct sensors only)	HSB-HP
Human Physiology with Vernier (LabQuest sensors only)	HP-A
Agricultural Science with Vernier (LabQuest sensors only)	AWV

** Includes printed book and download; also available as a download only*

Looking for Replacement Parts?

Visit vernier.com/replacements

See all our products for biology at vernier.com/biology

For more information, and to see all our products, visit vernier.com

Environmental Science

vernier.com/environmental-science

Help your students see that the environmental science concepts discussed in the classroom have serious implications on the world around them. Our hands-on investigations and data-collection technology help students form a better understanding of phenomena.

Topics

Explore a sampling of our featured experiments by topic to learn how Vernier technology helps your students engage with data-collection technology and deepen their understanding of key environmental science concepts.

Show Students How To Investigate Their World

From soil studies to wind energy investigations, the study of environmental science helps students understand how to interact with the natural world. Our easy-to-use sensors support you as you help your students understand key environmental science concepts. Our lab books include ready-to-go investigations to help students establish a deep understanding of key scientific concepts.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

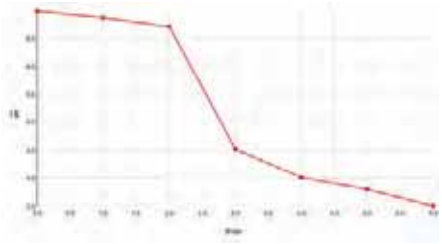
Environmental Science

34 Investigations Available

INVESTIGATION 31

The Effect of Acid Deposition on Aquatic Ecosystems

Investigate acid deposition by measuring the magnitude of the change in pH levels in an aquatic environment when dilute acid is introduced dropwise.



Sensors Used

Go Direct® Tris-Compatible Flat pH

The flat glass, double-junction design makes this sensor a good choice for environmental science.

GDX-FPH

Go Direct Conductivity

Determine the ionic content of an aqueous solution by measuring its electrical conductivity.

GDX-CON

Accessories Used

Electrode Support

ESUP

Stir Station

STIR

Investigation Source

Investigating Environmental Science through Inquiry

Download only: ESI-E
Printed book + download: ESI

Learn more at vernier.com/esi-31

INVESTIGATION 26

Fossil Fuel Energy

Students calculate the amount of heat transferred from a burning candle to a known volume of water. They also design an experiment to investigate fossil fuels.

Sensor Used

Go Direct Temperature

This is a rugged, general-purpose sensor that students can use to monitor temperature.

GDX-TMP

Investigation Source

Investigating Environmental Science through Inquiry

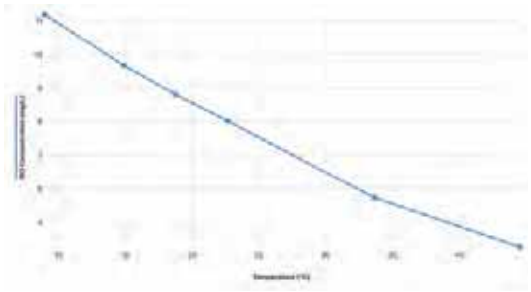
Download only: ESI-E
Printed book + download: ESI

Learn more at vernier.com/esi-26

INVESTIGATION 3

Investigating Dissolved Oxygen

Students analyze the effect temperature has on dissolved oxygen in water by measuring the concentration of dissolved oxygen in different temperatures of water.



Sensor Used

Go Direct Optical Dissolved Oxygen

This optical sensor makes it easy to measure dissolved oxygen in water, atmospheric pressure, and water temperature.

GDX-ODO

Investigation Source

Investigating Environmental Science through Inquiry

Download only: ESI-E
Printed book + download: ESI

Learn more at vernier.com/esi-3

INCLUDES 34 INVESTIGATIONS

*Investigating Environmental Science through Inquiry**

Investigating Environmental Science through Inquiry contains 34 inquiry-based environmental science investigations.

Topics include

- Earth systems and resources (air, water, and soil)
- The living world
- Global change and population
- Energy resources and consumption
- Pollution

Learn more at vernier.co/esi

Download only
ESI-E

Printed book + download
ESI

** Instructions for Graphical Analysis 4 app not yet available*

Environmental Science Go Direct Starter Package

This package includes 4 sensors, which all work with our free Graphical Analysis™ 4 app or LabQuest 2.

- Go Direct Temperature
- Go Direct Tris-Compatible Flat pH
- Go Direct Conductivity
- Go Direct Optical Dissolved Oxygen

GDP-EV-ST

Learn more at vernier.com/gdp-ev-st

Water Quality

TEST 12

Total Dissolved Solids

Students measure the total dissolved solids of a sample from a local body of fresh water.

Sensor Used

Go Direct® Conductivity

Determine the ionic content of an aqueous solution by measuring its electrical conductivity.

GDX-CON

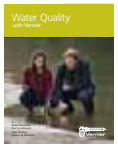
Accessories Used

Water Quality Bottles

This box of 8 plastic bottles with stoppers is for general water quality use. They could also be used as replacements for the bottles and stoppers in the Primary Productivity Kit. See page 46.

WQ-BOT

Experiment Source



Water Quality with Vernier

Download only: WQV-E
Printed book + download: WQV

Learn more at vernier.com/wqv-12

*Water Quality with Vernier**

CONTAINS 18 TESTS

With the 18 tests in *Water Quality with Vernier*, students investigate the water quality of a body of water by testing pH, total dissolved solids, dissolved oxygen, BOD, and more. A comprehensive introduction is included for each test, providing important background information for your students. All nine tests in the Water Quality Index (WQI) are supported.

Learn more at vernier.com/wqv

Download only
WQV-E

Printed book + download
WQV

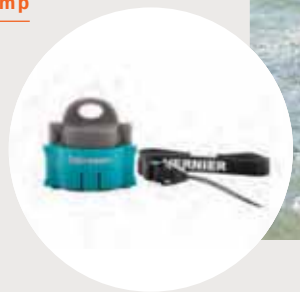
** Instructions for Graphical Analysis™ 4 app not yet available*

Go Direct Sensor Clamp

The Go Direct Sensor Clamp securely fastens to a wand-style Go Direct sensor, and the included lanyard works as a strap to prevent accidental drops during investigations in the field. Sensors are sold separately.

GDX-CLAMP

Learn more at vernier.com/gdx-clamp



GLOBE® & Vernier

The GLOBE Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process as well as contribute meaningfully to our understanding of the Earth system and global environment. Use Vernier sensors to collect GLOBE data.

To learn more about Vernier and GLOBE, see **vernier.com/globe**

Weather

NEW Go Direct Weather

Easily monitor a wide variety of environmental factors with just one sensor. Go Direct Weather is an affordable, wireless, handheld sensor used to measure ambient temperature, humidity, wind speed, wind chill, dew point, barometric pressure, and more.

Available Spring 2020

Learn more at vernier.com/gdx-wthr

Davis® Vantage Vue Weather Station

The wireless Vantage Vue Weather Station provides accurate, reliable weather monitoring in a self-contained, easy-to-install system. The sensor suite measures

- Temperature
- Humidity
- Barometric Pressure
- Wind Speed and Direction
- Dew Point
- Rainfall

Choose to view weather data streamed live on the internet via Wi-Fi, on a dedicated console in your classroom, or both!

Available Bundles	Stream Live Data on the Internet via Wi-Fi	View Data on Console	Order Code
Davis Vantage Vue Wireless Weather Station (with console)		●	DWVUE
Davis Vantage Vue + WeatherLink™ (without console)	●		DWVUE-LWOC
Davis Vantage Vue + WeatherLink (with console)	●	●	DWVUE-LWC

For accessories and weather station options, visit vernier.com/davis-weather-station

Renewable Energy

Strengthen students' critical thinking skills by introducing them to alternative energy solutions to real-world problems.

The KidWind Project and Vernier have teamed up to provide the technology, resources, and support you need for your students to investigate renewable energy.

- Engage your students as they watch power output and energy production data develop in real time.
- Inspire creativity as your students build and test prototypes, test solutions to engineering problems, and optimize designs.
- Measure voltage and current, and calculate power, without using a multimeter.
- Set up activities quickly and easily, creating more time for instruction and exploration.

Recommended Classroom Setup for Wind Energy

3 Test Stations

6 to 10 Groups of 2 to 4 Students

We recommend three test stations for a classroom with 6 to 10 groups of 2 to 4 students.

Each test station should have

- Box fan
- Wind turbine tower with nacelle and generator
- Go Direct® Energy (GDX-NRG)
- Vernier Variable Load (VES-VL)

Each student group needs

- Blade Pitch Protractor
- Wind Turbine Hub
- Blade consumables

KidWind Accessories & Replacement Parts

Part Name	Order Code
Balsa Blade Sheets (100 Pack)	KW-BBS10
Basic Turbine Building Parts	KW-BTPART
Blade Design Consumables Classroom Pack	KW-BDC
Blade Pitch Protractor	KW-BPP
Chipboard Sheets (50 Pack)	KW-CB50
Dowels (25 Pack)	KW-D25
Dowels (100 Pack)	KW-D100
Gear Set	KW-GEAR
High Torque Generator with Wires	KW-HIGEN
KidWind Airfoil Balsa Blade Sheets	KW-ABBS10
Power Output Board	KW-POBD
Wind Turbine Generator (10 Pack)	KW-GEN10
Wind Turbine Hub (3 Pack)	KW-WTH3

Learn more at vernier.com/renewable-energy

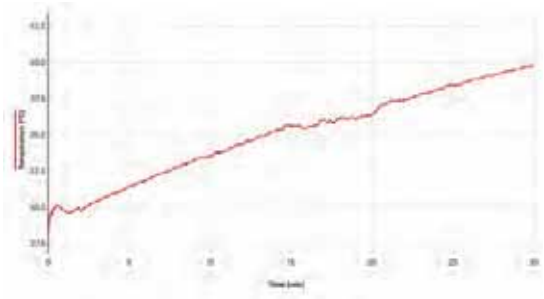
Featured Experiments

26 Experiments Available

EXPERIMENT 24

Exploring Solar Collectors

Students measure the temperature change produced when using a solar collector. Students then design an experiment to test the impact a changed variable will have on a solar collector.



Sensors Used

Go Direct Surface Temperature

Use this sensor in situations in which low thermal mass or flexibility is required.

GDX-ST

Go Direct Light and Color

Students use this sensor to measure the brightness of a light bulb or the reflectance of light off of various objects.

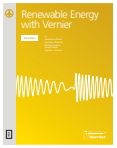
GDX-LC

Accessory Used

Solar Thermal Exploration Kit

KW-STXK

Experiment Source



Renewable Energy with Vernier

Download only: REV-E
Printed book + download: REV

Learn more at vernier.com/rev-24

EXPERIMENT 17

Exploring Solar Panels

Investigate different variables and how they impact electricity production with a solar panel. Students also calculate the efficiency of power production with the solar panel.

Sensors Used

Go Direct Energy

This sensor quantifies the voltage, current, power, and energy output of small wind turbines and solar panels, such as those used in our KidWind Experiment Kits.

GDX-NRG

Go Direct Light and Color

Students use this sensor to measure the brightness of a light bulb or the reflectance of light off of various objects.

GDX-LC

Accessories Used

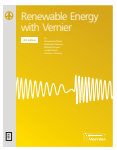
KidWind 2V/400mA Solar Panel

KW-SP2V

Vernier Variable Load

VES-VL

Experiment Source



Renewable Energy with Vernier

Download only: REV-E
Printed book + download: REV

Learn more at vernier.com/rev-17

Featured Experiments

EXPERIMENT 8

Exploring Wind Turbines

Students investigate different variables that affect how a wind turbine moves and produces electricity.

Sensor Used

Go Direct® Energy

This sensor quantifies the voltage, current, power, and energy output of small wind turbines and solar panels, such as those used in our KidWind Experiment Kits.

GDX-NRG

Accessories Used

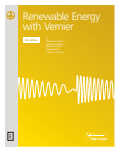
KidWind Advanced Wind Experiment Kit

KW-AWX

Vernier Variable Load

VES-VL

Experiment Source



Renewable Energy with Vernier

Download only: REV-E
Printed book + download: REV

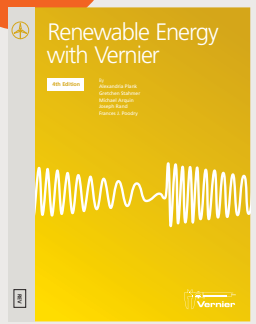
Learn more at vernier.com/rev-8

Renewable Energy with Vernier

The *Renewable Energy with Vernier* lab book features 26 experiments in wind and solar energy. The book contains a combination of explorations, classic experiments, inquiry investigations, engineering projects, and more.

Learn more at vernier.com/rev

INCLUDES
26
EXPERIMENTS



Download only
REV-E

Printed book + download
REV

KidWind Competitions—Putting the "E" in STEM

Challenge students to compete in a wind turbine design competition with peers in a supportive environment at local and national events.

To see our recommendations and to get started, visit kidwindchallenge.org

Featured Products

KidWind Advanced Wind Experiment Kit

Discover advanced concepts of wind turbine technology, including gearboxes and generator construction (with the optional KidWind simpleGEN). Students use the blades they design to generate electricity, lift weights, and pump water. This kit is recommended for use with our lab book *Renewable Energy with Vernier.*

KW-AWX

KidWind Advanced Wind Experiment Kit Classroom Pack

KW-AWXC

Learn more at vernier.com/kw-awx

KidWind simpleGEN

The simpleGEN is an easy-to-build AC generator that students can use to demonstrate Faraday's law, light LEDs, and perform experiments that explore how coils, magnets, and rotation affect power generation.

KW-SGEN

Learn more at vernier.com/kw-sgen

Solar Energy Exploration Kit

Explore solar energy with this innovative science kit designed to help students investigate energy transformations. Experiment with basic circuits and learn about important factors in photovoltaic systems.

KW-SEEK

Learn more at vernier.com/kw-seek

KidWind GENPack

Using the parts in the GENPack, students can construct their own electrical generator and perform experiments with electricity and magnetism. Changing variables in the generator design affects current and voltage output.

KW-GP

Learn more at vernier.com/kw-gp

Featured Products

Go Direct Sensors

Sensor		Order Code
Go Direct® CO_2 Gas		GDX-CO2
Go Direct Colorimeter		GDX-COL
Go Direct Conductivity		GDX-CON
Go Direct Current		GDX-CUR
Go Direct Energy		GDX-NRG
Go Direct Ethanol Vapor		GDX-ETOH
Go Direct Light and Color		GDX-LC
Ion-Selective Electrodes		
Go Direct Ammonium Ion-Selective Electrode		GDX-NH4
Go Direct Calcium Ion-Selective Electrode		GDX-CA
Go Direct Chloride Ion-Selective Electrode		GDX-CL
Go Direct Nitrate Ion-Selective Electrode		GDX-NO3
Go Direct O_2 Gas		GDX-O2
Go Direct Optical Dissolved Oxygen		GDX-ODO
pH Sensors		
Go Direct pH		GDX-PH
Go Direct Tris-Compatible Flat pH		GDX-FPH
Go Direct SpectroVis® Plus		GDX-SVISPL
Temperature Probes		
Go Direct Surface Temperature		GDX-ST
Go Direct Temperature		GDX-TMP
Go Direct Voltage		GDX-VOLT

Go Direct Accessories

Accessory		Order Code
Go Direct Charge Station		GDX-CRG
Go Direct Sensor Clamp		GDX-CLAMP

See all our products for environmental science at vernier.com/environmental-science

LabQuest Sensors

Sensor		Order Code
Anemometer		ANM-BTA
Barometer		BAR-BTA
Conductivity Probe		CON-BTA
Flow Rate Sensor		FLO-BTA
Optical DO Probe		ODO-BTA
pH Sensor		PH-BTA
Tris-Compatible Flat pH		FPH-BTA
Relative Humidity Sensor		RH-BTA
Salinity Sensor		SAL-BTA
Soil Moisture Sensor		SMS-BTA
Turbidity Sensor		TRB-BTA

Digital Microscopes

Equipment	Order Code
Celestron® Digital Microscope Imager	CS-DMI
USB Digital Microscope	BD-EDU-100

Lab Equipment

Equipment	Order Code
KidWind Advanced Wind Energy Kit	KW-AWX
KidWind Basic Wind Energy Kit	KW-BWX
Primary Productivity Kit	PPK
Solar Energy Exploration Kit	KW-SEEK
Water Depth Sampler	WDS
Water Quality Bottles	WQ-BOT

Lab Books

Book Title	Order Code
Investigating Environmental Science through Inquiry	Printed book + download: ESI Download only: ESI-E
Water Quality with Vernier	Printed book + download: WQV Download only: WQV-E
Renewable Energy with Vernier	Printed book + download: REV Download only: REV-E

Looking for Replacement Parts?

Visit vernier.com/replacements

See all our products for environmental science at vernier.com/environmental-science

For more information, and to see all our products, visit vernier.com

Earth Science

vernier.com/earth-science

When you use Vernier technology to teach Earth science you can count on our affordable sensors, intuitive software, and creative solutions to help your students understand key Earth science concepts.

Earth Science Helps Students Understand Their World

The study of Earth science helps you give students a means to understand the world around them. Your students can explore seafloor spreading, the effect of acid rain on soil, the changing of the seasons, and more with Vernier sensors, software, and experiments.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

Earth Science with Vernier

In addition to the 33 experiments in *Earth Science with Vernier**, the six projects in this book engage students as they learn about the world around them.

Topics include

- Geology
- Soil analysis
- Water quality tests
- Hydrology/Oceanography
- Meteorology
- Energy

Learn more at vernier.com/esv

** Instructions for Graphical Analysis™ 4 app are not yet available.*

INCLUDES 33 EXPERIMENTS

Download only
ESV-E

Printed book + download
ESV

NEW Go Direct Weather

Easily monitor a wide variety of environmental factors with just one sensor. Go Direct® Weather is an affordable, wireless, handheld sensor used to measure ambient temperature, humidity, wind speed, wind chill, dew point, barometric pressure, and more.

Available Spring 2020

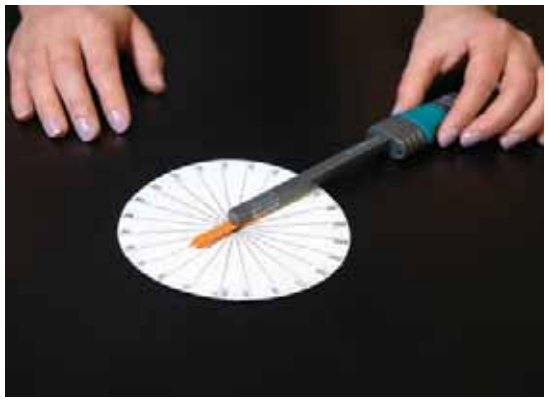
Learn more at vernier.com/gdx-wthr

Earth Science

EXPERIMENT 3

Where is North?

Magnetic north is often not the same direction as true north. In this experiment, students measure the Earth's magnetic field to determine magnetic north at their location.



Sensor Used

Go Direct 3-Axis Magnetic Field

Useful for topics in geology, this sensor can determine the magnitude and direction of a magnetic field at any point in space.

GDX-3MG

Experiment Source

Earth Science with Vernier

Download only: ESV-E
Printed book + download: ESV

Learn more at vernier.com/esv-3

Earth Science

33 Experiments Available

EXPERIMENT 6

Soil pH

Soil pH is one factor that determines which nutrients are available to plants. In this experiment, students make a slurry of soil and distilled water to measure its pH.

Sensor Used

Go Direct® Tris-Compatible Flat pH

The flat glass, double-junction design makes this sensor the best choice for measuring the pH of soils.

GDX-FPH

Experiment Source

Earth Science with Vernier

Download only: ESV-E
Printed book + download: ESV

Learn more at vernier.com/esv-6

EXPERIMENT 29

Seasons and Angle of Insolation

In this experiment, students model how the angle of light from the sun striking various places on Earth is one factor that causes seasons.

Sensor Used

Go Direct Temperature

This rugged probe measures the temperature of a variety of substances including air, soil, and water.

GDX-TMP

Experiment Source

Earth Science with Vernier

Download only: ESV-E
Printed book + download: ESV

Learn more at vernier.com/esv-29

Featured Products

Looking for Replacement Parts?

Visit vernier.com/replacements

Go Direct Sensors

Sensor	Order Code
Go Direct 3-Axis Magnetic Field	GDX-3MG
Go Direct CO_2 Gas	GDX-CO2
Go Direct Conductivity	GDX-CON
Go Direct Current	GDX-CUR
Go Direct Energy	GDX-NRG
Go Direct Light and Color	GDX-LC
Go Direct Motion	GDX-MD
Go Direct O_2 Gas	GDX-O2
Go Direct Optical Dissolved Oxygen	GDX-ODO
pH Sensors	
Go Direct pH	GDX-PH
Go Direct Tris-Compatible Flat pH	GDX-FPH
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Voltage	GDX-VOLT

Go Direct Accessories

Accessory	Order Code
Go Direct Charge Station	GDX-CRG
Go Direct Sensor Clamp	GDX-CLAMP

LabQuest Sensors

Sensor	Order Code
Anemometer	ANM-BTA
Barometer	BAR-BTA
Flow Rate Sensor	FLO-BTA
Magnetic Field Sensor	MG-BTA
Salinity Sensor	SAL-BTA
Soil Moisture Sensor	SMS-BTA
Stainless Steel Temperature Probe	TMP-BTA
Tris-Compatible Flat pH Sensor	FPH-BTA
Turbidity Sensor	TRB-BTA

Accessories & Lab Equipment

Product	Order Code
Davis® Weather Stations	vernier.com/davis-weather-station
Electrode Support	ESUP
KidWind 2V/400mA Solar Panel	KW-SP2V
KidWind Basic Wind Experiment Kit	KW-BWX
Solar Energy Exploration Kit	KW-SEEK
Vernier Resistor Board	VES-RB

Lab Books

Title	Order Code
Earth Science with Vernier	Printed book + download: ESV Download only: ESV-E
Water Quality with Vernier	Printed book + download: WQV Download only: WQV-E

See all our products for Earth science at vernier.com/earth-science

Chemistry

vernier.com/chemistry

Vernier chemistry resources cover an array of key concepts to help prepare your students for what lies ahead. From gas laws to spectroscopy, our products are backed by an extensive collection of experiments and unparalleled technical support.

Topics

Explore a sampling of our featured experiments by topic to learn how Vernier technology helps your students engage with data-collection technology and deepen their understanding of key chemistry concepts.

Make Your Chemistry Classes More Elemental

Whether you are teaching Beer's law or exploring how humans use food for energy, Vernier technology and investigations will help your students better understand important chemistry concepts. Give your students insight into this vital subject with interactive learning opportunities from Vernier.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

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General Chemistry

36 Experiments Available

EXPERIMENT 2

Freezing and Melting of Water

Students measure the temperature of water as it changes from a liquid to a solid. The data are analyzed to make predictions about the freezing patterns of other substances.

Sensor Used

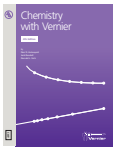
Go Direct® Temperature

Students can use this rugged, general-purpose sensor to monitor temperature.

Range: –40 to 125°C

GDX-TMP

Experiment Source



Chemistry with Vernier

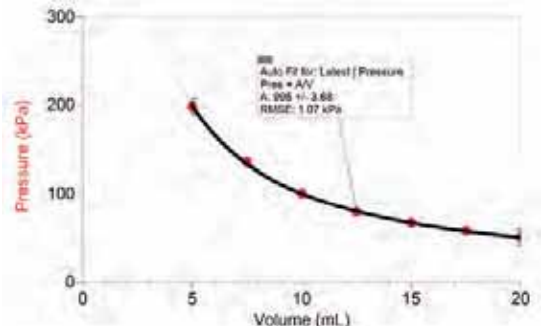
Download only: CWV-E
Printed book + download: CWV

Learn more at vernier.com/cwv-2

EXPERIMENT 6

Boyle's Law: Pressure-Volume Relationship in Gases

Determine the mathematical relationship between pressure and volume of a gas.



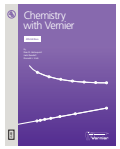
Sensor Used

Go Direct Gas Pressure

Explore pressure changes and gas laws with this sensor that measures the absolute pressure of a gas.

GDX-GP

Experiment Source



Chemistry with Vernier

Download only: CWV-E
Printed book + download: CWV

Learn more at vernier.com/cwv-6

EXPERIMENT 21

Household Acids and Bases

Students investigate the pH scale by measuring the pH of household solutions using different methods.

Sensor Used

Go Direct pH

This general-purpose pH sensor is used to monitor pH of aqueous solutions.

GDX-PH

Accessories Used

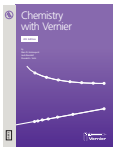
Electrode Support

ESUP

Stir Station

STIR

Experiment Source



Chemistry with Vernier

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Printed book + download: CWV

Learn more at vernier.com/cwv-21

Chemistry with Vernier

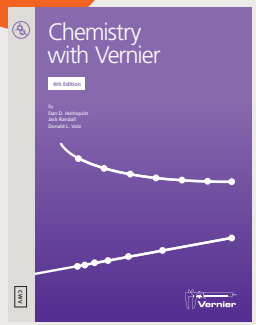
INCLUDES 36 EXPERIMENTS

Combine *Chemistry with Vernier* with the Starter Package (shown below) to teach students the essentials in chemistry. This lab book contains ready-to-use student experiments and instructor information, including sample data.

Topics include

- Thermochemistry
- Gas laws
- Acid-base reactions
- Equilibrium
- Electrochemistry
- Electrolytes
- States of matter

Learn more at vernier.com/cwv



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Chemistry Go Direct Starter Package

This package includes 4 sensors, which all work with our free Graphical Analysis™ 4 app or LabQuest® 2.

- Go Direct Temperature (2)
- Go Direct Gas Pressure
- Go Direct pH

GDP-CH-ST

Learn more at vernier.com/gdp-ch-st

Standard package also available (see page 81)

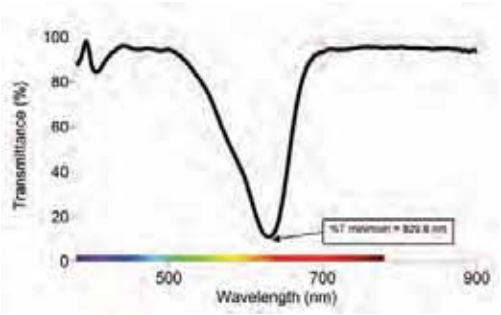
AP* Chemistry

16 Investigations Available

INVESTIGATION 1

Investigating Food Dyes in Sports Beverages

Use spectroscopy to examine the relationship between % transmittance and concentration of a solution to determine the amount of food dye in a sports drink.



Sensor Used

Go Direct® SpectroVis® Plus

This spectrophotometer quickly measures a full-wavelength spectrum (380 nm–950 nm).

GDX-SVISPL

Recommended Accessories

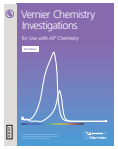
100 Plastic Cuvettes (Visible Range)

CUV

Cuvette Rack

CUV-RACK

Investigation Source



Vernier Chemistry Investigations for Use with AP* Chemistry

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Printed book + download: APCHEM

Learn more at vernier.com/apchem-1

INVESTIGATION 8

Determining the Percent Hydrogen Peroxide in a Commercial Product

Test a bottle of commercial hydrogen peroxide and determine the concentration using a potentiometric titration.

Sensors Used

Go Direct ORP

Measure the ability of a solution to act as an oxidizing or reducing agent.

GDX-ORP

Go Direct Drop Counter

As an alternative to using a buret, the drop counter precisely records the number of drops of titrant added during a titration and then automatically converts it to volume.

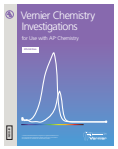
GDX-DC

Accessory Used

Stir Station

STIR

Investigation Source



Vernier Chemistry Investigations for Use with AP* Chemistry

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Learn more at vernier.com/apchem-8

INVESTIGATION 9

Investigating the Components of a Commercial Tablet

A pain medication tablet chips and cracks due to contamination or an incorrect tablet formula. Students use melting point to investigate these two theories.

Sensor Used

Go Direct Melt Station

Accurately determine the melting temperature of solid substances.

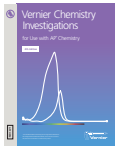
GDX-MLT

Recommended Accessory

Melt Station Capillary Tubes

MLT-TUBE

Investigation Source



Vernier Chemistry Investigations for Use with AP* Chemistry

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Learn more at vernier.com/apchem-9

Vernier Chemistry Investigations for Use with AP Chemistry*

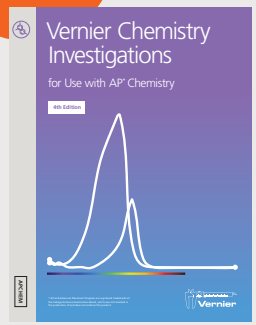
This lab book provides AP* Chemistry students with 16 inquiry-based laboratory experiments aligned with the investigations published by the College Board.

Topics include

- Spectroscopy
- Titrations
- Intermolecular forces and properties

Learn more at vernier.com/apchem

INCLUDES 16 INVESTIGATIONS



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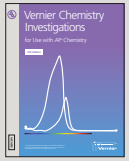
Chemistry Lab Books with AP* Correlations



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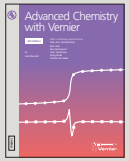
16 Investigations



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35 Experiments

Investigating Chemistry through Inquiry

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25 Investigations

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Advanced Chemistry

35 Experiments Available

EXPERIMENT 10

The Determination of an Equilibrium Constant

Determine the concentration of ions present in an equilibrium system using spectroscopy. Students calculate the equilibrium constant, K_{eq}, for the reaction.

Sensor Used

Go Direct® SpectroVis® Plus

This spectrophotometer quickly measures a full-wavelength spectrum (380 nm–950 nm).

GDX-SVISPL

Recommended Accessories

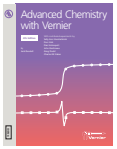
100 Plastic Cuvettes (Visible Range)

CUV

Cuvette Rack

CUV-RACK

Experiment Source



Advanced Chemistry with Vernier

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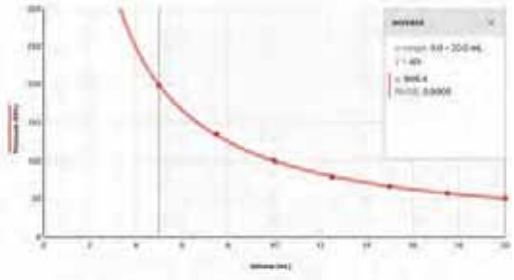
Learn more at vernier.com/chem-a-10

EXPERIMENT 30

Exploring the Properties of Gases

Students conduct a set of experiments, each of which illustrates a gas law such as Boyle's law, shown here. Use the results to derive a single mathematical relationship that relates pressure, volume, temperature, and number of molecules.



Sensors Used

Go Direct Gas Pressure

Explore pressure changes and gas laws with this sensor that measures the absolute pressure of a gas.

GDX-GP

Go Direct Temperature

Students can use this rugged, general-purpose sensor to monitor temperature.

Range: –40 to 125°C

GDX-TMP

Accessories Used

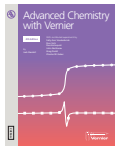
Electrode Support

ESUP

Stir Station

STIR

Experiment Source



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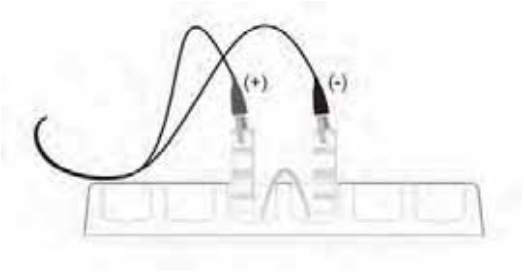
EXPERIMENT 20

Electrochemistry: Voltaic Cells

Construct voltaic cells to explore oxidation-reduction reactions. Use the measured potentials to identify unknown metal electrodes and create concentration cells for understanding the Nernst equation.



Sensor Used

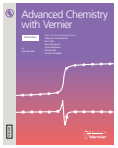
Go Direct Voltage

This sensor has a wide input voltage and high precision making it an excellent choice for investigating the basic principles of electrochemical cells.

Range: ±20 V

GDX-VOLT

Experiment Source



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INCLUDES **35** EXPERIMENTS

Advanced Chemistry with Vernier

The *Advanced Chemistry with Vernier* lab book expands students' skills with experiments appropriate for second year, honors, and AP* Chemistry students.

Topics include

- Redox reactions
- Colligative properties
- Equilibrium

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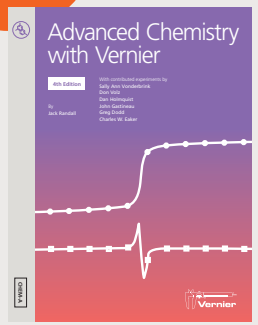

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This package includes 8 sensors, which all work with our free Graphical Analysis™ 4 app or LabQuest® 2.

- Go Direct Temperature (2)
- Go Direct Gas Pressure
- Go Direct pH
- Go Direct Voltage
- Go Direct Conductivity
- Go Direct Colorimeter
- Go Direct Drop Counter

GDP-CH-DX

Learn more at vernier.com/gdp-ch-dx

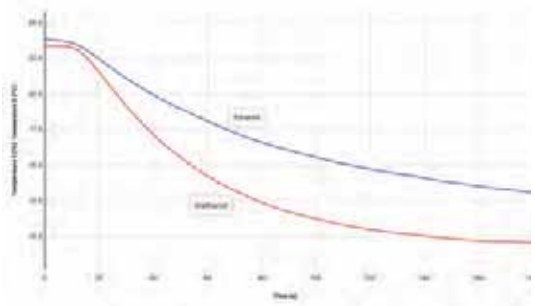
Inquiry Chemistry

25 Investigations Available

INVESTIGATION 8

Evaporation and Intermolecular Attractions

Students study temperature changes caused by the evaporation of different liquids and relate the temperature changes to the strength of intermolecular forces of attraction.



Sensor Used

Go Direct® Temperature

Students can use this rugged, general-purpose sensor to monitor temperature.

Range: –40 to 125°C

GDX-TMP

Investigation Source

Investigating Chemistry through Inquiry

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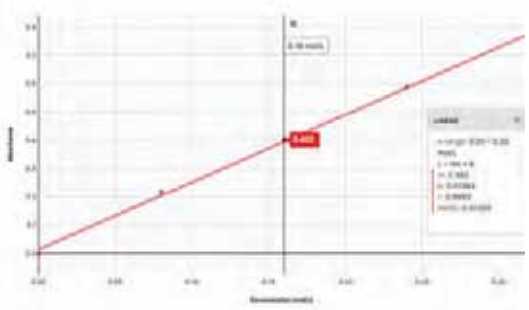
INVESTIGATION 11

Beer's Law Investigations

Beer's law states that the concentration of a chemical is directly proportional to the absorbance of a solution. Students apply this relationship to determine the concentration of an unknown.



Sensor Used

Go Direct Colorimeter

The 4-wavelength (430 nm, 470 nm, 565 nm, 635 nm) Go Direct Colorimeter measures absorbance or % transmittance of a liquid sample.

GDX-COL

Investigation Source

Investigating Chemistry through Inquiry

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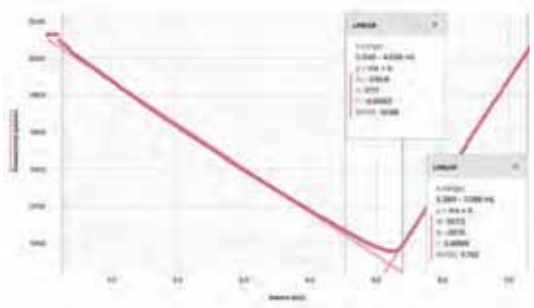
INVESTIGATION 18

Conductimetric Titrations

Monitor changes in conductivity and analyze a precipitation reaction to determine the equivalence point. Support the answer with a gravimetric analysis.



Sensor Used

Go Direct Conductivity

Determine the ionic content of an aqueous solution by measuring its electrical conductivity.

Range: 0 to 20,000 µS/cm

GDX-CON

Recommended Accessories

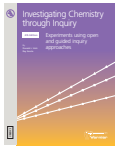
Electrode Support

ESUP

Stir Station

STIR

Investigation Source



Investigating Chemistry through Inquiry

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Investigating Chemistry through Inquiry

The *Investigating Chemistry through Inquiry* lab book supports both open and guided inquiry experiments. Instructors can help students devise their own researchable questions or choose from a list provided in each experiment.

Topics include

- Chemical kinetics
- Acids and bases
- Thermochemistry

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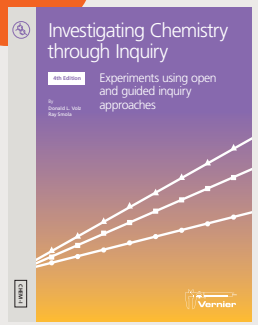
INCLUDES 25 INVESTIGATIONS



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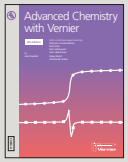
Chemistry Lab Books with IB† Correlation



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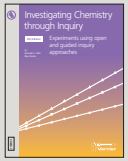
35 Experiments



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25 Investigations

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Chemistry Go Direct Starter Package

4 Sensors · GDP-CH-ST

This package includes

Go Direct® Temperature (2)

Go Direct Gas Pressure

Go Direct pH

All sensors work with our free Graphical Analysis™ 4 app, as well as LabQuest® 2.

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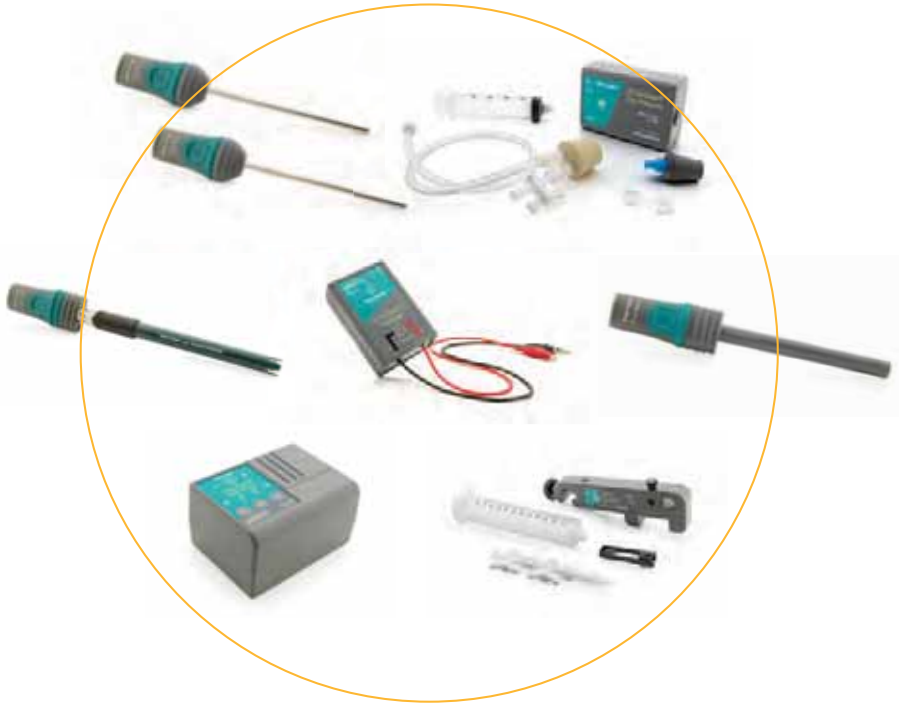
Chemistry Go Direct Standard Package

8 Sensors · GDP-CH-DX



This package includes

Go Direct Temperature (2)

Go Direct Gas Pressure

Go Direct pH

Go Direct Voltage

Go Direct Conductivity

Go Direct Colorimeter

Go Direct Drop Counter

All sensors work with our free Graphical Analysis 4 app, as well as LabQuest 2.

Learn more at vernier.com/gdp-ch-dx

Featured Products

pH Sensor Comparison

Sensor	Features
Go Direct pH GDX-PH 	**Recommended for General Use** Go Direct pH is an important and versatile sensor for lab and field activities alike. Conduct acid-base titrations, monitor pH changes during chemical reactions, and investigate household acids and bases. The wireless connection makes it easier to do field-based studies such as testing the pH of surface water. **Go Direct pH Teacher Pack** GDX-PH-TP Includes 8 Go Direct pH Sensors and a Go Direct Charge Station
Go Direct Tris-Compatible Flat pH GDX-FPH 	Go Direct Tris-Compatible Flat pH is a double-junction electrode for measuring pH in Tris buffers and solutions containing proteins or sulfides. The flat glass shape makes it easy to clean and useful for measuring the pH of semisolids such as soil slurries and certain foods.
Go Direct Glass-Body pH GDX-GPH 	Go Direct Glass-Body pH can be used with non-aqueous solutions and solutions containing solvents, strong acids, and strong bases.

Learn more at vernier.com/ph-sensors

Temperature Sensor Comparison

Sensor	Range	Features and Applications
Go Direct Temperature GDX-TMP 	–40°C to 125°C	**Recommended for General Use** • Conduct endothermic and exothermic reactions. • Determine the physical properties of water. • Measure the energy content of foods. • Investigate intermolecular forces. **Go Direct Temperature Teacher Pack** GDX-TMP-TP Includes 8 Go Direct Temperature Probes and a Go Direct Charge Station
Go Direct Surface Temperature GDX-ST 	–25°C to 125°C	• Use this sensor in situations in which low thermal mass or flexibility is required. • The exposed thermistor provides an extremely rapid response to temperature changes. • Use this sensor in air and water only.
Go Direct Wide-Range Temperature GDX-WRT 	–20°C to 330°C	• Determine the melting point of caffeine or the boiling point of different vegetable oils. • RTD (Resistance Temperature Detector) technology establishes a ±0.5°C accuracy.

Learn more at vernier.com/temperature-sensors

Featured Products

Go Direct Constant Current System

Determine Avogadro's number and perform various electroplating and electrolysis experiments. This system combines a DC power source with a built-in current sensor to eliminate the need for a separate power supply. It can deliver up to 0.6 A at 5 V DC.

GDX-CCS

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Go Direct Melt Station

Teach students the visual detection capillary method of melting point determination with Go Direct Melt Station. It accurately measures melting temperatures of a solid (up to 260°C), and the real-time graphing provides a unique perspective of the melting process.

GDX-MLT

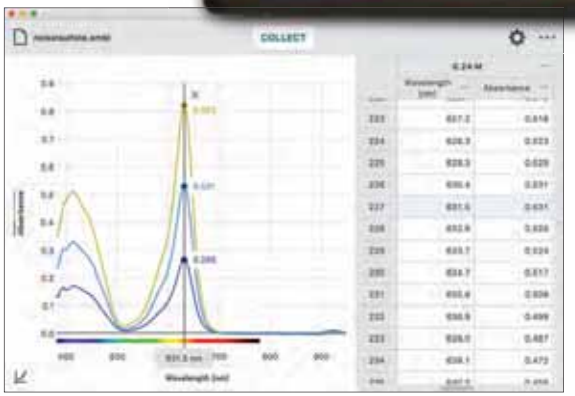
vernier.com/gdx-mlt

Go Direct® SpectroVis® Plus

Introduce your students to spectroscopy with the affordable Go Direct SpectroVis Plus Spectrophotometer. With a range of 380 to 950 nm, students can easily collect a full-wavelength spectrum (absorbance, percent transmission, fluorescence, or intensity), study absorbance *vs.* concentration (Beer's law), or monitor rates of reaction (kinetics). Collect and analyze data using Vernier Spectral Analysis,® LabQuest® App, or Logger *Pro*® 3.

GDX-SVISPL

vernier.com/gdx-svispl



Absorbance spectra of green food coloring at different concentrations

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Pivot Interactives is a powerful supplement to hands-on experimentation, allowing students to vary experimental parameters one at a time to view results from a set of many recordings of the same experiment.

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Spectrometer Comparison

Spectrometer	*Go Direct SpectroVis Plus*	*Vernier UV-VIS Spectrophotometer*	*Vernier Fluorescence/UV-VIS Spectrophotometer*
			
Description	The Go Direct SpectroVis Plus Spectrophotometer quickly measures a full-wavelength spectrum. Connect directly to your device via Bluetooth® wireless technology or via USB.	The Vernier UV-VIS Spectrophotometer generates a full spectrum, Beer's law graph, and kinetics traces of ultraviolet and visible-absorbing samples such as aspirin, DNA, proteins, and NADH.	The Fluorescence/UV-VIS Spectrophotometer measures the fluorescence and absorbance spectra of ultraviolet and visible samples such as quinine sulfate, fluorescein, rhodamine, and DAPI.
Wavelength Range	380 to 950 nm	220 to 850 nm	220 to 850 nm
Light Source	Visible: LED-boosted tungsten Fluorescence: built-in LEDs for excitation at 405 nm and 500 nm	Visible: LED-boosted tungsten UV: Deuterium	Visible: LED-boosted tungsten UV: Deuterium Fluorescence: exchangeable LEDs for excitation at 375 nm, 450 nm, and 525 nm (additional wavelengths sold separately)
Warranty	5 years (1 year on battery, 3 years on lamp, none on consumables)	5 years (1 year on lamp, none on consumables)	5 years (1 year on lamp, none on consumables)
More Information	Innovative use ideas available at vernier.com/gdx-svispl	Download free experiments at vernier.com/vsp-uv	Download free experiments at vernier.com/vsp-fuv
Order Code	GDX-SVISPL	VSP-UV	VSP-FUV
Optical Fiber Accessory	Vernier Spectrophotometer Optical Fiber This is an optical fiber accessory designed exclusively for emission spectrum experiments with Vernier-branded spectrophotometers, as listed above. It has a wavelength range from 350 to 900 nm. VSP-FIBER		

Learn more at vernier.com/spectrometers

Lab Equipment

OHAUS Balances

It is easy to collect mass data from an OHAUS® balance using our popular Logger *Pro*® 3 software or LabQuest® App. Simply connect a supported balance to the USB port using the OHAUS Scout® USB Cable, start the software, and collect real-time data as if the OHAUS balance were just another Vernier sensor!

OHAUS Scout 120 g

0.001 g precision
OHS-123

OHAUS Scout 220 g

0.01 g precision
OHS-222

OHAUS Scout 420 g

0.01 g precision
OHS-422

All three balances require an OHAUS Scout USB Cable for data collection.

OHAUS Scout USB Cable
OHS-USB

Learn more at vernier.com/ohaus

Electrode Support

Our Electrode Support is a great complement to the Vernier Stir Station, as well as a perfect holder for many sensors. It is built to connect to all standard ring-stand posts and its large-handled locking nut keeps your sensors firmly in place.

ESUP

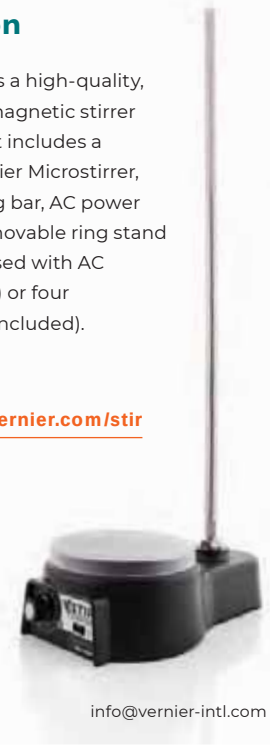
Learn more at vernier.com/esup

Stir Station

The Stir Station is a high-quality, multi-function magnetic stirrer and ring stand. It includes a Stir Station, Vernier Microstirrer, magnetic stirring bar, AC power adapter, and removable ring stand post. It can be used with AC power (included) or four C batteries (not included).

STIR

Learn more at vernier.com/stir



NEW Go Direct Mini GC

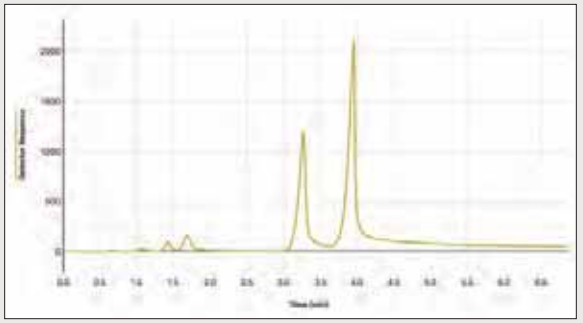
Teach students chromatography with an affordable, portable gas chromatograph that detects polar and nonpolar compounds. With the easy-to-use Go Direct® Mini GC™ and the free Vernier Instrumental Analysis™ app, students can separate, analyze, and identify substances contained in a volatile liquid or gaseous sample. Go Direct Mini GC uses Bluetooth® wireless technology or USB to connect to your device.

GDX-GC

NEW Vernier Instrumental Analysis App

With our free Vernier Instrumental Analysis™ app, students can collect and analyze data from our Go Direct Mini GC and other advanced instrumentation using computers, Chromebooks, or other mobile devices.

FREE DOWNLOAD



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Organic Chemistry

Polarimeters

Our polarimeters measure chiral properties of optically active samples such as sugars and amino acids. Students no longer have to determine the optical maximum with their eyes but have a graph that shows a clear change in the light's polarization.

NEW *Go Direct Polarimeter*

GDX-POL

*Polarimeter**

CHEM-POL

Learn more at vernier.com/polarimeters

Melt Stations

Melting point is a physical method of analysis to identify an unknown and purity by its melting temperature. The melt stations accurately measure melting temperatures of a solid (up to 260°C), and the real-time graphing provides a unique perspective of the melting process.

Go Direct Melt Station

GDX-MLT

*Melt Station**

MLT-BTA

Learn more at vernier.com/melt-stations

Wide-Range Temperature Probes

The wide-range temperature probes are designed to be used as you would use a thermometer for experiments such as the recrystallization of benzoic acid, simple and fractional distillations, determination of boiling points, the synthesis and analysis of aspirin and other organic compounds, and more.

Go Direct Wide-Range Temperature

GDX-WRT

*Wide-Range Temperature Probe**

WRT-BTA

Learn more at vernier.com/gdx-wrt

Organic Chemistry with Vernier

Organic Chemistry with Vernier contains experiments that represent a broad range of topics and techniques taught in most university organic chemistry lab courses. The experiments in this book build upon prior knowledge, laboratory techniques, and skills students have learned in general chemistry courses.

Updated instructions for Go Direct sensors will be available late 2020.

Topics include

- Distillation
- Chromatography
- Synthesis
- Polarimetry

Learn more at vernier.com/chem-o

Download only
CHEM-O-E

Printed book + download
CHEM-O

* requires an interface

For more information, and to see all our products, visit vernier.com

Featured Products

Go Direct Sensors

Sensor	Order Code
Go Direct® Colorimeter	GDX-COL
Go Direct Conductivity	GDX-CON
Go Direct Constant Current System	GDX-CCS
Go Direct Current	GDX-CUR
Go Direct Drop Counter	GDX-DC
Go Direct Electrode Amplifier	GDX-EA
Go Direct Gas Pressure	GDX-GP
Go Direct Melt Station	GDX-MLT
Go Direct ORP	GDX-ORP
pH Sensors	
Go Direct Glass-Body pH	GDX-GPH
Go Direct pH	GDX-PH
Go Direct Tris-Compatible Flat pH	GDX-FPH
Go Direct Radiation Monitor	GDX-RAD
Go Direct SpectroVis® Plus	GDX-SVISPL
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Wide-Range Temperature	GDX-WRT
Go Direct Voltage	GDX-VOLT

Go Direct Charge Station

Accessory	Order Code
Go Direct Charge Station	GDX-CRG

See all our products for chemistry at vernier.com/chemistry

Looking for Replacement Parts?

Visit vernier.com/replacements

LabQuest Sensors

Sensor	Order Code
Colorimeter	COL-BTA
Conductivity Probes	
Conductivity Probe	CON-BTA
Platinum-Cell Conductivity Probe	CONPT-BTA
Current Probes	
Constant Current System	CCS-BTA
Current Probe	DCP-BTA
Drop Counter	VDC-BTD
Electrode Amplifier	EA-BTA
Gas Pressure Sensors	
Gas Pressure Sensor	GPS-BTA
Pressure Sensor 400	PS400-BTA
Instrumentation Amplifier	INA-BTA
Melt Station	MLT-BTA
ORP Sensor	ORP-BTA
pH Sensors	
Glass-Body pH Electrode BNC (requires Electrode Amplifier)	GPH-BNC
pH Sensor	PH-BTA
Tris-Compatible Flat pH Sensor	FPH-BTA
Polarimeter (Chemical)	CHEM-POL
Radiation Monitor	VRM-BTD
Temperature Probes	
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA
Thermocouple	TCA-BTA
Wide-Range Temperature Probe	WRT-BTA
Voltage Probes	
Differential Voltage Probe	DVP-BTA
Voltage Probe	VP-BTA

Balances

Sensor	Order Code
OHAUS Scout® (120 g)	OHS-123
OHAUS Scout (220 g)	OHS-222
OHAUS Scout (420 g)	OHS-422

Spectrometers

Spectrometer	Order Code
Go Direct SpectroVis Plus	GDX-SVISPL
Vernier Emissions Spectrometer	VSP-EM
Vernier Fluorescence/UV-VIS Spectrophotometer	VSP-FUV
Vernier Spectrometer (Ocean Optics™)	V-SPEC
Vernier UV-VIS Spectrophotometer	VSP-UV

Gas Chromatograph

Gas Chromatograph	Order Code
Go Direct Mini GC™	GDX-GC

Lab Equipment and Accessories

Accessory	Order Code
Cuvette Rack	CUV-RACK
Electrode Support	ESUP
Melt Station Capillary Tubes	MLT-TUBE
Plastic Cuvettes (100)	CUV
Stir Station	STIR

Lab Books†

Book Title	Order Code
Chemistry with Vernier	CWV
Advanced Chemistry with Vernier	CHEM-A
Vernier Chemistry Investigations for Use with AP Chemistry*	APCHEM
Investigating Chemistry through Inquiry	CHEM-I
Organic Chemistry with Vernier	CHEM-O
Quimica con Vernier	CWV-ES

† Books listed here include printed book and download; also available as a download only

** AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.*

See all our products for chemistry at vernier.com/chemistry

Physical Science

vernier.com/physical-science

From matter and energy to motion and forces, Vernier offers the support you need and the technology your students can use to investigate physical science.

Physical Science Sets Learning in Motion

Our hands-on physical science investigations help students understand the scientific concepts of real-world phenomena such as energy transfer during phase changes, the cooling effect of evaporation, and principles of simple machines.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

Physical Science with Vernier

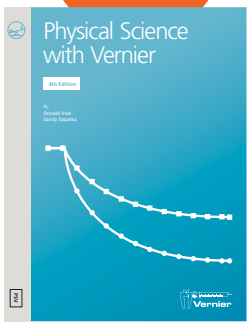
Physical Science with Vernier contains 40 ready-to-use experiments for physical science. Experiments are included for nine Vernier sensors and cover a variety of topics in chemistry and physics.

Topics include

- Structures and properties of matter
- Forces and interactions
- Waves and electromagnetic radiation
- Chemical reactions

Learn more at vernier.com/psv

INCLUDES 40 EXPERIMENTS



Download only
PSV-E

Printed book + download
PSV

Go Direct Sensor Carts

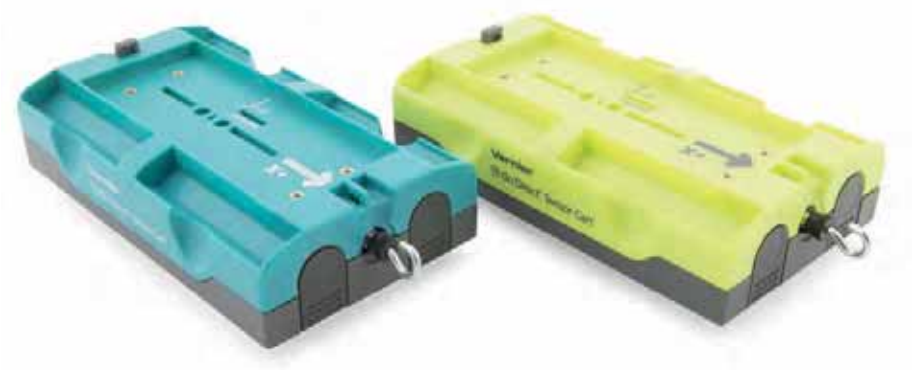
With our Go Direct® Sensor Carts, students can explore force, position, velocity, and acceleration directly on their devices via Bluetooth® wireless technology—no wires or additional equipment required. Each cart features built-in sensors to simplify experiment setup.

Go Direct Sensor Cart (Green)

GDX-CART-G

Go Direct Sensor Cart (Yellow)

GDX-CART-Y



vernier.com/gdx-cart

Physical Science

EXPERIMENT 23

Reflectivity of Light

After comparing the amount of light reflected from different colors of paper, students apply the results to help answer their questions about planetary albedo.

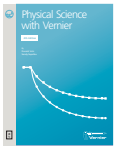
Sensor Used

Go Direct Light and Color

Students use this sensor to measure the brightness of a light bulb or the reflectance of light off of various objects. They can also measure UV light and relative amounts of red, blue, and green light.

GDX-LC

Experiment Source



Physical Science with Vernier

Download only: PSV-E
Printed book + download: PSV

Learn more at vernier.com/psv-23

Physical Science

40 Experiments Available

EXPERIMENT 3

Freezing and Melting of Water

Students measure the temperature of water as it changes from a liquid to a solid. The data are analyzed to make predictions about the freezing patterns of other substances.

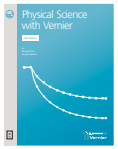
Sensor Used

Go Direct® Temperature

This is a rugged, general-purpose sensor that students can use to monitor temperature.

GDX-TMP

Experiment Source



Physical Science with Vernier

Download only: PSV-E
Printed book + download: PSV

Learn more at vernier.com/psv-3

EXPERIMENT 21

Pulleys

By comparing the effort force to the resistance force required to lift a mass, students determine the mechanical advantage of different pulley systems.

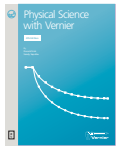
Sensor Used

Go Direct Force and Acceleration

Students can use this sensor to measure forces of up to 50 N. The included 3-axis accelerometer makes it a versatile sensor for many topics in physical science.

GDX-FOR

Experiment Source



Physical Science with Vernier

Download only: PSV-E
Printed book + download: PSV

Learn more at vernier.com/psv-21

Featured Products

Looking for Replacement Parts?

Visit vernier.com/replacements

Go Direct Sensors

Sensor	Order Code
Go Direct 3-Axis Magnetic Field	GDX-3MG
Go Direct Acceleration	GDX-ACC
Carts and Tracks	
Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX
Go Direct Sensor Cart (Green)	GDX-CART-G
Go Direct Sensor Cart (Yellow)	GDX-CART-Y
Go Direct Conductivity	GDX-CON
Go Direct Current	GDX-CUR
Go Direct Energy	GDX-NRG
Go Direct Force and Acceleration	GDX-FOR
Go Direct Gas Pressure	GDX-GP
Go Direct Light and Color	GDX-LC
Go Direct Motion	GDX-MD
Go Direct pH	GDX-PH
Go Direct Photogate	GDX-VPG
Go Direct Sound	GDX-SND
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Voltage	GDX-VOLT
Go Direct Structures & Materials Tester	GDX-VSMT

Go Direct Charge Station

Accessory	Order Code
Go Direct Charge Station	GDX-CRG

LabQuest Sensors

Sensor	Order Code
Accelerometers	
3-Axis Accelerometer	3D-BTA
25-g Accelerometer	ACC-BTA
Low-g Accelerometer	LGA-BTA
Conductivity Probe	CON-BTA
Current Probes	
Current Probe	DCP-BTA
High Current Sensor	HCS-BTA
Energy Sensor	VES-BTA
Force Sensors	
Dual-Range Force Sensor	DFS-BTA
Force Plate	FP-BTA
Gas Pressure Sensor	GPS-BTA
Light Sensor	LS-BTA
Magnetic Field Sensor	MG-BTA
Microphone	MCA-BTA
Motion Detector	MD-BTD
pH Sensor	PH-BTA
Photogate	VPG-BTD
Sound Level Sensor	SLS-BTA
Structures & Materials Tester	VSMT
Temperature Probes	
Go! Temp (USB Sensor)	GO-TEMP
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA
Thermocouple	TCA-BTA
Voltage Probes	
30-Volt Voltage Probe	30V-BTA
Differential Voltage Probe	DVP-BTA
Voltage Probe	VP-BTA

Accessories & Lab Equipment

Product	Order Code
Balances	
OHAUS Scout® (120 g)	OHS-123
OHAUS Scout (220 g)	OHS-222
OHAUS Scout (420 g)	OHS-422
Electrode Support	ESUP
pH Storage Solution	PH-SS
pH Buffer Capsules Kit	PH-BUFCAP
Stir Station	STIR
Vernier Circuit Board 2	VCB2

Lab Books

Title	Order Code
Physical Science with Vernier	Printed book + download: PSV Download only: PSV-E
Chemistry with Vernier	Printed book + download: CWV Download only: CWV-E
Physics with Vernier	Printed book + download: PWV Download only: PWV-E

See all our products for physical science at vernier.com/physical-science

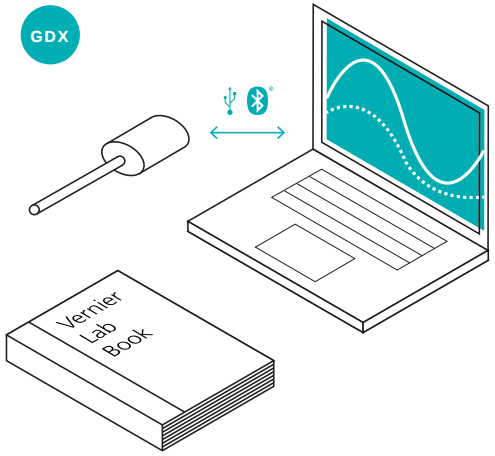
Physics

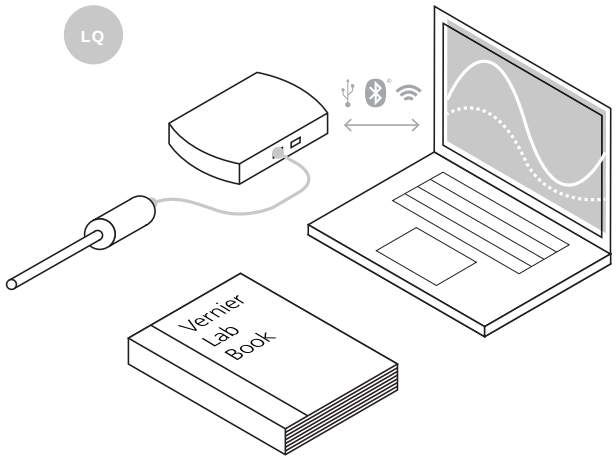
vernier.com/physics

From kinematics to optics, Vernier technology helps your students connect the dots between the classroom and the real world. Our physics products enable student and educator success so that you can spend less time troubleshooting and more time teaching your students about the scientific principles of the world around them.

Topics

Explore a sampling of our featured experiments by topic to learn how Vernier technology helps your students engage with data-collection technology and deepen their understanding of key physics concepts.





A Guide to Vernier Data Collection

GDX

Our Go Direct® technology connects directly to compatible student devices—computers, Chromebooks, LabQuest® 2, and iOS, iPadOS,™ and Android™ devices. Its ease of use maximizes valuable lab time so you can focus on teaching.

LQ

With over 80 sensors to choose from, our LabQuest family of sensors offers a wide variety of experiments to integrate into your existing curriculum. Connect LabQuest sensors with an interface to your device or use LabQuest 2 as a standalone device in the field or lab.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

1-D Motion and Force

EXPERIMENT 1

Graph Matching

Kinesthetic experience coupled with real-time graphing helps cement student understanding of the relationships between motion, position *vs.* time graphs, and velocity *vs.* time graphs.

Sensor Used

GDX

Go Direct® Motion

Go Direct Motion uses ultrasound to measure the position, velocity, and acceleration of moving objects.

GDX-MD

Can also be done with

LQ

Motion Detector

MD-BTD

Go!Motion (USB motion detector)

GO-MOT

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-1

EXPERIMENT 12

Static and Kinetic Friction

Make investigating friction easy with a digital force sensor. Students re-create the friction graph from their textbook while determining coefficients of static and kinetic friction.

Sensor Used

GDX

Go Direct Force and Acceleration

Measure forces as small as ±0.1 N and up to ±50 N with this sensor that couples a 3-axis accelerometer with a stable and accurate force sensor. Use it to measure pushes and pulls in the classroom or outdoors.

GDX-FOR

Can also be done with

LQ

Dual-Range Force Sensor

DFS-BTA

GDX

Go Direct Sensor Cart (green or yellow)

GDX-CART-G (green)
GDX-CART-Y (yellow)

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-12

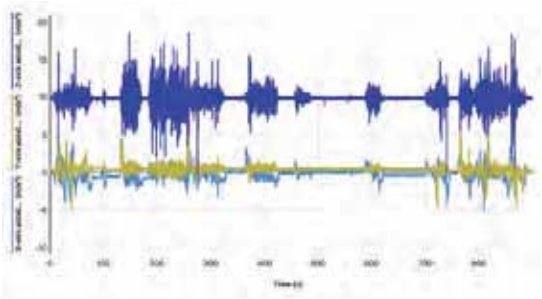
GDX connects directly to devices

LQ requires an interface

EXPERIMENT 21

Accelerations in the Real World

In this inquiry activity, students take an acceleration sensor out of the classroom and into different situations, whether it be cars, elevators, amusement parks, or elsewhere.



Sensor Used

GDX

Go Direct Acceleration

Collect acceleration, rotation, and altitude data in the classroom or in the field.

GDX-ACC

Can also be done with

3-Axis Accelerometer

LQ 3D-BTA

GDX **Go Direct Force and Acceleration**

GDX-FOR

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-21

EXPERIMENT 14

Pendulum Periods

Take a classic experiment to the next level with precision measurement of pendulum period. Students test three variables to discover which factors influence the period.

Sensor Used

GDX

Go Direct Photogate

This double-gate sensor includes two photogates built into the arms of the sensor. It accurately measures velocity and acceleration.

GDX-VPG

Can also be done with

LQ **Vernier Photogate**

VPG-BTD

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-14

Dynamics Cart and Track Systems

One Dynamics System—Three Ways to Collect Data

Depending on your budget and your needs, we offer three ways to collect motion data.

1 Go Direct Sensor Cart GDX

The wireless Go Direct® Sensor Cart includes an optical encoder on a wheel to sense the displacement of the cart, on or off track. No interface is needed to use this system with our free Graphical Analysis™ 4 app. Students can perform impulse and momentum experiments with the built-in force sensor, and the 3-axis accelerometer means you can take your Sensor Cart off campus to investigate accelerations on a swing or merry-go-round.

2 The Motion Encoder* LQ

VERNIER EXCLUSIVE

For classrooms already equipped with data-collection interfaces, the Motion Encoder dramatically improves data quality and simplifies experiment setup over the traditional ultrasonic Motion Detector. An optical sensor under the dynamics cart senses the passage of the cart over a striped decal on the track. The displacement information is sent as an encoded IR signal to a receiver at the track's end. This optical-only system provides excellent, repeatable, and noise-resistant data.

** U.S. Patent No. 9,488,503*

3 A Traditional Motion Detector GDX LQ

The Motion Detector is the classic method for collecting position data. Use a Motion Detector bracket to measure cart motion for the entire length of the track. You can even use two Motion Detectors at once to study cart collisions.

Unlike the Motion Encoder or Go Direct Sensor Cart, the Motion Detector can be used for dynamics experiments other than cart-on-track experiments. Students can graph their own walking motion, study a simple pendulum, or graph a ball toss with a Motion Detector. If you want to use a Motion Detector for all motion experiments, get the Dynamics Cart and Track System without the Motion Encoder or Go Direct Sensor Cart.

Dynamics Cart and Track System with Go Direct Sensor Cart

BUILT-IN SENSORS = LOWER TOTAL COST

The Dynamics Cart and Track System with Go Direct Sensor Cart includes essential laboratory equipment for teaching dynamics and kinematics. With our Go Direct Sensor Cart, students can explore force, position, velocity, and acceleration directly on their device using Bluetooth® wireless technology. There are no wires to create drag, and no additional equipment is required! Each cart features built-in sensors that simplify experiment setup and make this system the best choice for studying dynamics and kinematics.

with 1.2 m Track DTS-GDX vernier.com/dts-gdx

with 2.2 m Track DTS-GDX-LONG vernier.com/dts-gdx-long

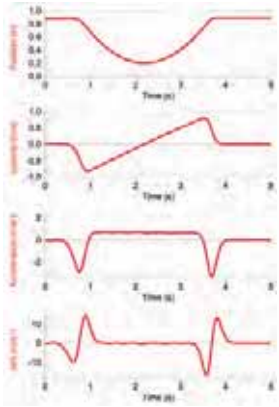
Dynamics Cart and Track System with Motion Encoder

RECOMMENDED OPTION FOR USE WITH LOGGER *PRO*® 3

The Dynamics Cart and Track System with Motion Encoder includes an optical position sensing system to record cart motion.

with 1.2 m Track DTS-EC vernier.com/dts-ec

with 2.2 m Track DTS-EC-LONG vernier.com/dts-ec-long



Motion encoder data are so pristine that you can usefully graph jerk vs. time.

Dynamics Cart and Track System

USE WITH SENSORS YOU ALREADY OWN—SENSORS ARE NOT INCLUDED.

The Dynamics Cart and Track System features the Combination Track/Optics Bench, two low-friction plastic carts (one standard and one with an adjustable plunger), and attachment accessories.

with 1.2 m Track DTS vernier.com/dts

with 2.2 m Track DTS-LONG vernier.com/dts-long

Dynamics Cart and Track Systems

EXPERIMENT 4

Determining *g* on an Incline

Watch a video

Students mimic Galileo's seminal experiment with modern tools using a low-friction setup to determine the acceleration of gravity on Earth.

Sensor Used

GDX

Dynamics Cart and Track System with Go Direct® Sensor Cart

This completely wireless system simplifies experiment setup and allows basic experiments to be conducted with or without the track.

DTS-GDX

Can also be done with

LQ **Dynamics Cart and Track System with Motion Encoder**

DTS-EC

LQ **Motion Detector and Dynamics Cart and Track System**

MD-BTD
DTS

GDX **Go Direct Motion and Dynamics Cart and Track System**

GDX-MD
DTS

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-4a

Go Direct Sensor Carts

We've added wireless sensors to our popular dynamics cart. Each cart includes an encoder wheel to report position, velocity, and acceleration; a 3-axis accelerometer to measure independent accelerations; and a ±50 N force sensor to measure pushes and pulls. Conduct basic physics investigations with or without a track.

Go Direct Sensor Cart (Green)
GDX-CART-G

Go Direct Sensor Cart (Yellow)
GDX-CART-Y

GDX

vernier.com/gdx-cart

Dynamics Cart and Track Systems—Featured Kits and Accessories

Fan Cart

The Fan Cart works with a Motion Detector and the Vernier Dynamics Cart and Track System. Study Newton's second law using variable fan thrust and included mass bars.

CART-F

vernier.com/cart-f

Encoder Fan Cart

Use the Encoder Fan Cart with the Motion Encoder System. Study Newton's second law using variable fan thrust and included mass bars.

CART-FEC

vernier.com/cart-fec

LQ

Friction Pad DTS

Add a Friction Pad to any of our plastic dynamics carts to study the effect of consistent friction on the motion of the cart.

DTS-PAD

vernier.com/dts-pad

Motion Encoder Cart and Receiver

This kit includes a fully assembled Motion Encoder Cart, as well as the Motion Encoder Receiver and Motion Encoder Long Track Strip.

DTS-MEC

vernier.com/dts-mec

LQ

Eddy Current Brake

Eddy current brakes are used as a braking system for high-speed trains and roller coasters. Recreate this unusual braking system in your classroom or laboratory by installing our Eddy Current Brake into the end cap of a plastic Vernier dynamics cart. As the cart moves over the track, the magnets in the Eddy Current Brake create an electromagnetic drag on the cart that is proportional to the cart's speed.

DTS-ECB

vernier.com/dts-ecb

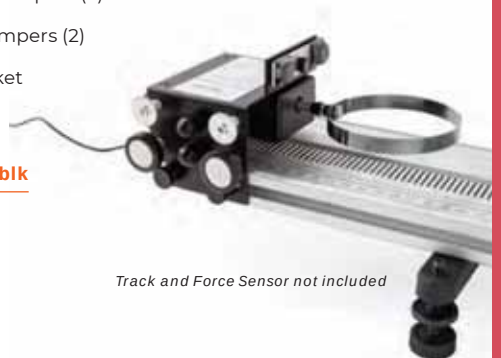
Bumper and Launcher Kit

With the Bumper and Launcher Kit, students can use the Dynamics Cart and Track System to perform Hooke's law experiments or to study momentum and impulse.
The kit includes

- Clay (~20 grams)
- Clay holders (2)
- Dual-magnet bumper
- Force sensor mounting screw
- Hoop bumpers (2)
- Magnetic bumpers (2)
- Rubber bumpers (2)
- Track bracket

BLK

vernier.com/blk



Track and Force Sensor not included

Featured Products

Motion Detectors

Go Direct Motion GDX

Go Direct® Motion uses ultrasound to measure the position, velocity, and acceleration of moving objects. It connects via Bluetooth® wireless technology or via USB to your device.

GDX-MD

Motion Detector LQ

The Motion Detector uses ultrasound to measure the position of carts, balls, people, and other objects. It can be used with interfaces from the LabQuest® family, LabPro,® and CBL 2.™ It is not supported with Go! Link® or EasyLink.®

MD-BTD

Go! Motion

Go! Motion is our motion detector that connects directly to a computer or Chromebook™ USB port—eliminating the need for an additional data-collection interface. This USB motion detector works with Logger *Pro*® 3, Logger Lite,® and the Graphical Analysis™ 4 app.

GO-MOT

vernier.com/motion-detectors

Photogates

Go Direct Photogate GDX

Go Direct Photogate is a double-gate sensor that includes two photogates built into the arms of the sensor, which accurately measures velocity and acceleration without needing to know anything about the geometry of the object. Go Direct Photogate also includes a single laser gate for use with objects passing outside of the arms of the sensor (required visible light laser not included). The sensor can be used to study free fall, rolling objects, collisions, and pendulums.

GDX-VPG

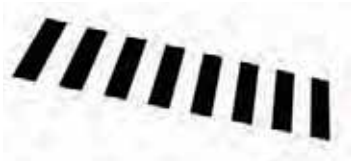
Photogate LQ

Study free fall, rolling objects, collisions, and pendulums with the Vernier Photogate. Use the built-in laser detector to create a photogate through which you could drive a truck. It includes an accessory rod for attaching to a ring stand or for adding the Ultra Pulley Attachment (sold separately).

VPG-BTD

Picket Fence GDX LQ

PF



Ultra Pulley Attachment GDX LQ

SPA

vernier.com/photogates

Featured Products

Accelerometers

Go Direct Acceleration

GDX

Collect acceleration, rotation, and altitude data in the classroom or in the field. This 3-axis acceleration sensor has two acceleration ranges plus an altimeter and a 3-axis gyroscope.

Acceleration Ranges: ±157 m/s², ±1960 m/s²
Gyroscope: 3 axis, ±2,000 °/s
Altimeter: –1,800 m to 10,000 m

GDX-ACC

Low-g Accelerometer

LQ

Use the Low-g Accelerometer to study the one-dimensional motion of a car (real or toy), pendulum bob, an elevator, or an amusement park ride.

Range: ±50 m/s²

LGA-BTA

3-Axis Accelerometer

LQ

Range: ±50 m/s²

3D-BTA

25-g Accelerometer

LQ

Range: ±250 m/s²

ACC-BTA

vernier.com/accelerometers

Force Sensors

Go Direct Force and Acceleration

GDX

Go Direct Force and Acceleration includes a ±50 N force sensor, a 3-axis accelerometer, and a 3-axis gyroscope. Take it on an amusement park ride, mount it on a dynamics cart, or attach a string and whirl it in a horizontal or vertical circle—in wireless mode, your imagination is the only limiting factor!

Force: ±50 N
Acceleration: 3 axis, ±16 *g*
Gyroscope: 3 axis, ±2000 °/s

GDX-FOR

Dual-Range Force Sensor

LQ

Using our Dual-Range Force Sensor, students can test Newton's third law of motion, explore Hooke's law, or graph the transition from static friction to kinetic friction.

Ranges: ±10 N, ±50 N

DFS-BTA

Force Plate

LQ

The Force Plate—a force sensor about the size of a bathroom scale—is tough enough to jump on. Two handles are included for pushing or pulling.

Ranges: –850 to +3500 N
–200 to +850 N

FP-BTA

vernier.com/force-sensors

2-D Motion and Force

Featured Experiments

EXPERIMENT 8B

Projectile Motion

Predict the landing point of a projectile based on the launch velocity and initial height. With precision photogate timing, success depends on student understanding.

Sensor Used

GDX

Go Direct Projectile Launcher

Use the Go Direct® Projectile Launcher to investigate important concepts in two-dimensional kinematics. Launch steel balls at angles between 0 and 90 degrees and over distances up to 2.5 m.

GDX-PL

Can also be done with

Vernier Projectile Launcher

LQ VPL

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-8b

EXPERIMENT 12A

Centripetal Acceleration

Students explore the relationships among force, speed, and radius through reliable data collection using sensors.

Sensors Used

GDX

Go Direct Centripetal Force Apparatus

This is an ideal combination to explore rotational dynamics when combined with Go Direct Force and Acceleration (not included).

GDX-CFA

GDX

Go Direct Force and Acceleration

This couples a 3-axis accelerometer with a stable and accurate force sensor that measures forces as small as ±0.1 N and up to ±50 N. Measure angular rotation using the 3-axis gyroscope.

GDX-FOR

Can also be done with

LQ **Centripetal Force Apparatus**
CFA

LQ **Dual-Range Force Sensor**
DFS-BTA

LQ **Photogate**
VPG-BTD

Experiment Source

Advanced Physics with Vernier—Mechanics

Download only: PHYS-AM-E
Printed book + download: PHYS-AM

Learn more at vernier.com/phys-am-12a

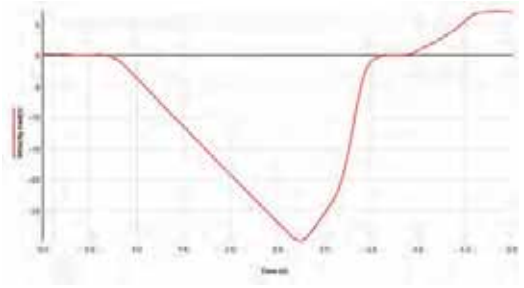
GDX connects directly to devices

LQ requires an interface

EXPERIMENT 13

Rotational Dynamics

Apply a torque and measure an angular acceleration. Students explore the version of Newton's second law that applies to rotation.



Sensor Used

GDX

Go Direct Rotary Motion

Measure angular displacement, angular velocity, and angular acceleration easily and precisely.

GDX-RMS

Can also be done with

LQ **Rotary Motion Sensor**

RMV-BTD

Accessories Used

Rotational Motion Accessory Kit

Used with a rotary motion sensor to study the motion of a physical pendulum; the rotational inertia of disks, rings, and point masses; and the conservation of angular momentum

AK-RMV

Experiment Source

Advanced Physics with Vernier—Mechanics

Download only: PHYS-AM-E

Printed book + download: PHYS-AM

Learn more at vernier.com/phys-am-13

Featured Products

Go Direct Acceleration GDX

Collect acceleration, rotation, and altitude data in the classroom or in the field. This 3-axis acceleration sensor has two acceleration ranges plus an altimeter and a 3-axis gyroscope.

GDX-ACC

vernier.com/gdx-acc

Projectile Launcher Accessories GDX LQ

Independence of Motion Accessory

The Independence of Motion Accessory enables students to use the Vernier Projectile Launcher to perform the classic experiment where one ball is dropped as another is projected horizontally. The balls strike the floor simultaneously.

IOM-VPL

vernier.com/iom-vpl

Time of Flight Pad

The Time of Flight Pad is used with a projectile launcher or photogate (not included) to precisely measure how long a projectile has been in motion.

TOF-VPL

vernier.com/tof-vpl

Centripetal Force Apparatus Accessories

Moment of Inertia Kit

CFA-MIK

vernier.com/cfa-mik

GDX LQ

Motor Accessory Kit

GDX-CFA-MAK

vernier.com/gdx-cfa-mak

GDX

Sensor Bracket

CFA-SBK

vernier.com/cfa-sbk

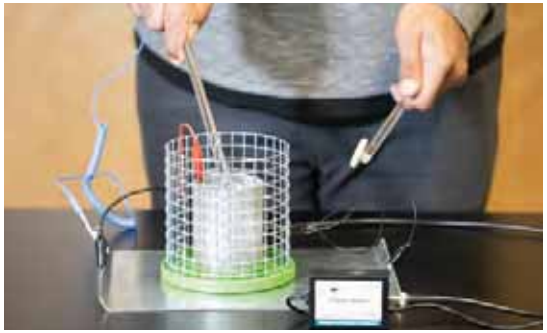
GDX LQ

Electricity and Magnetism

EXPERIMENT 6

Electrostatics

Using our Charge Sensor (essentially a digital electroscope), students explore charging by friction, conduction, and induction.



Sensor Used

LQ

Charge Sensor

Use the Charge Sensor as an electronic electroscope to obtain quantitative measurements when studying charging by induction, friction, or contact.

CRG-BTA

Accessory Used

Electrostatics Kit

Students use the Electrostatics Kit to perform a range of experiments in electrostatics with the Charge Sensor.

ESK-CRG

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

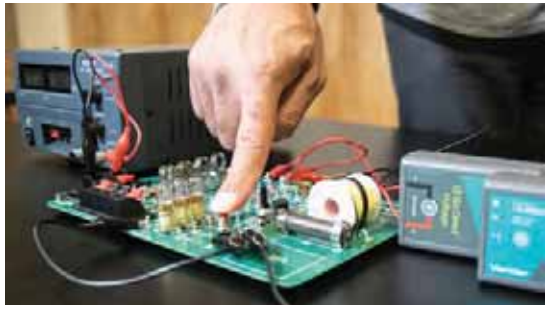
Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-6

EXPERIMENT 22

Ohm's Law

Students compare the potential *vs.* current graphs for resistors and for a light bulb in this exploration of Ohm's law.



Sensors Used

GDX

Go Direct® Voltage

This sensor combines a wide input voltage range and high precision, making it an excellent choice for investigations of both AC/DC circuits and electromagnetism.

GDX-VOLT

GDX

Go Direct Current

Measure electric currents in circuits with this versatile sensor.

GDX-CUR

Can also be done with

LQ **Differential Voltage Probe**

DVP-BTA

LQ **Current Probe**

DCP-BTA

Accessory Used

Vernier Circuit Board 2

VCB2

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-22

GDX connects directly to devices

LQ requires an interface

EXPERIMENT 25

Magnetic Field of a Coil

How do different factors affect the magnetic field in the center of a coil of wire? Students investigate the number of turns and the amount of current in a wire coil.

Sensor Used

GDX

Go Direct 3-Axis Magnetic Field

Determine the magnitude and direction of a magnetic field at any point in space with this 3-axis sensor.

GDX-3MG

Can also be done with

LQ **Magnetic Field Sensor**

MG-BTA

Accessory Used

Extech® Digital Power Supply

This power supply provides constant current or constant voltage for physics activities that require DC power.

EXPS

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-25

Featured Products

Additional LabQuest Voltage and Current Probes

LQ

Sensor	Range	URL
Current Probe	±0.6 A	vernier.com/dcp-bta
High Current Sensor	±10 A	vernier.com/hcs-bta
Instrumentation Amplifier	±1 V	vernier.com/ina-bta
Differential Voltage Probe	±6 V	vernier.com/dvp-bta
Voltage Probe	±10 V	vernier.com/vp-bta
30-Volt Voltage Probe	±30 V	vernier.com/30v-bta

Power Amplifier

LQ

Use this as a power supply for DC and AC circuit investigations or to drive devices such as speakers, lamps, and small DC motors.

PAMP

High-Voltage Electrostatics Kit

LQ

Investigate the distribution of charge on a sphere, transfer of charge on contact between two spheres, and charging by induction with this kit.

HVEK-CRG

Electrostatic High-Voltage Genecon

LQ

A great addition to the High Voltage Electrostatics Kit, the Electrostatic High-Voltage Genecon generates both positive and negative charges and reliably creates charge differences in high humidity.

HVEK-GEN

Vernier Circuit Board 2

Use this convenient platform to study basic series and parallel circuits as well as RLC circuits. Many components for experimentation are provided.

VCB2

Optional Breadboard Kit

for the Vernier Circuit Board 2

Install this small breadboard to easily conduct experiments using additional electronic components not permanently mounted on the Vernier Circuit Board 2.

VCB2-OBBK

Thermodynamics

Featured Experiments

GDX connects directly to devices

LQ requires an interface

EXPERIMENT 1

Behavior of a Gas

Students collect pressure and temperature data to discover kinetic molecular theory and the iconic expression PV = nRT.

Sensors Used

GDX

Go Direct® Gas Pressure

Measure the absolute pressure of a gas.

GDX-GP

GDX

Go Direct Temperature

This is a rugged, general-purpose sensor that students can use to monitor temperature.

GDX-TMP

Can also be done with

LQ **Gas Pressure Sensor**

GPS-BTA

LQ **Stainless Steel Temperature Probe**

TMP-BTA

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

Download only: PHYS-ABM-E

Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-1

INNOVATIVE USE

Radiant Energy with FLIR ONE®

Visible light interacts with matter in different ways, depending on the color of the matter. Students use a thermal camera to measure the invisible infrared light that results.

Sensor Used

FLIR ONE Pro Thermal Camera for iOS

Reveal the hidden world of infrared vision. When used with our Vernier Thermal Analysis Plus app, students can also collect temperature *vs.* time data for up to four spots or regions, along with a thermal image video.

FLIRPRO-IOS

Can also be done with

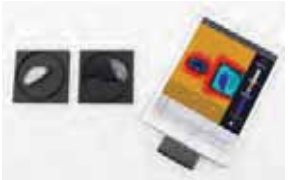
FLIR ONE Pro LT

FLIRLT-IOS

FLIR ONE

FLIRONE3-IOS

Software Used



Vernier Thermal Analysis® Plus for FLIR ONE

Students can easily observe temperature changes on the skin, illustrate convection, detect heating due to friction, compare heat conduction in different materials, and analyze the transparency of materials in infrared light.

Download on the App Store

Experiment Source

FREE DOWNLOAD

vernier.com/radiant-energy

Featured Products

FLIR ONE Thermal Cameras

Using a FLIR ONE Thermal Camera, students can observe temperature changes on the skin, illustrate convection, track heating due to friction, compare heat conduction in different materials, analyze the transparency of materials in infrared compared to visible light, and so much more.

FLIR ONE Pro

FLIRPRO-IOS

FLIR ONE Pro LT

FLIRLT-IOS

FLIR ONE Gen 3

FLIRONE3-IOS

vernier.com/flir

Vernier Thermal Analysis Plus App

The Vernier Thermal Analysis® Plus app makes it possible to analyze temperatures of up to four spots or regions and collect temperature data as a function of time. Examine the in-app graph, select different points or regions to examine, collect time-lapse videos for longer experiments, or export data to the Logger *Pro*® 3 or Graphical Analysis™ GW app for further analysis.

vernier.com/thermal-analysis

Download on the App Store

Gas Pressure Sensors

Go Direct Gas Pressure

Range: 0 to 400 kPa

GDX-GP

Gas Pressure Sensor

Range: 0 to 210 kPa

GPS-BTA

vernier.com/gas-pressure-sensors

Temperature Probes

Go Direct Surface Temperature

Range: –25 to 125°C

GDX-ST

Go Direct Temperature

Range: –40 to 125°C

GDX-TMP

Surface Temperature Sensor

Range: –25 to 125°C

STS-BTA

Stainless Steel Temperature Probe

Range: –40 to 135°C

TMP-BTA

vernier.com/temperature-sensors

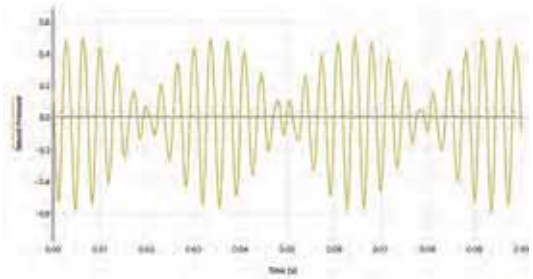
For more information, and to see all our products, visit vernier.com

Waves and Sound

Featured Experiments

EXPERIMENT 32

Sound Waves and Beats



Compare data from sound waves with sinusoidal functions. What information is contained in each parameter? Students also observe sound wave interference.

Sensor Used

GDX

Go Direct® Sound

Use this sensor to easily capture and evaluate waveforms.

GDX-SND

Can also be done with

LQ

Microphone

MCA-BTA

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-32

EXPERIMENT 3

Standing Waves on a String

Students explore waves on a string that is fixed at both ends, create harmonics, and relate string tension and wave speed.

Products Used

Power Amplifier

Drive devices such as speakers, lamps, and small DC motors.

PAMP

Power Amplifier Accessory Speaker

Study mechanical waves on strings and springs.

PAAS-PAMP

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-3

Featured Products

Microphone

LQ

Display and study the waveforms of sounds from voices and musical instruments. This sensor is also appropriate for speed of sound experiments.

MCA-BTA vernier.com/mca-bta

Sound Level Sensor

LQ

Use the Sound Level Sensor to easily measure sound level in decibels (dB) in a variety of experiments.

Range: 55 to 110 dB

SLS-BTA vernier.com/sls-bta

Light and Optics

Featured Experiments

GDX connects directly to devices

LQ requires an interface

EXPERIMENT 29

Light, Brightness, and Distance

Illuminate the inverse square law for light intensity in this experiment, which requires a dark room and a point source of light in addition to a light sensor.

Sensor Used

GDX

Go Direct Light and Color

Measure light intensity in the visible to ultraviolet electromagnetic spectrum. An RGB color sensor detects relative contributions of primary colors in light.

GDX-LC

Can also be done with

LQ **Light Sensor**

LS-BTA

Accessories Used

Optics Expansion Kit

OEK

Combination 1.2 m Track/ Optics Bench

TRACK

Experiment Source

Physics with Vernier

Download only: PWV-E
Printed book + download: PWV

Learn more at vernier.com/pwv-29

EXPERIMENT 16

Thin Lenses and Real Images

The number 4 has no symmetry, making it an ideal shape for examining real, inverted images. Students measure object and image distances and sizes to determine focal length and magnification.

Accessories Used

Optics Expansion Kit

Add this kit to your Dynamics Cart and Track System to conduct optics experiments, such as image formation with lenses and light intensity *vs.* distance. You can even use the kit to build a basic telescope.

OEK

Combination 1.2 m Track/Optics Bench

TRACK

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-16

Light and Optics

EXPERIMENT 15

Curved Mirrors and Images

Students focus real images on a half screen and use parallax to locate a virtual image in this standard optics experiment.

Accessories Used

Optics Expansion Kit

Add this kit to your Dynamics Cart and Track System to conduct optics experiments, such as image formation with lenses and light intensity *vs.* distance. You can even use the kit to build a basic telescope.

OEK

Mirror Set for Optics Expansion Kit

This set extends the kit so students can easily study image formation by concave and convex mirrors.

M-OEK

Combination 1.2 m Track/Optics Bench

TRACK

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

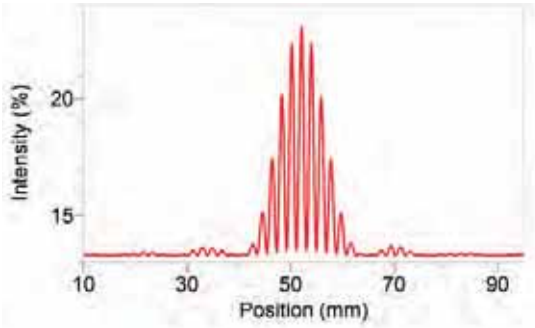
Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-15

EXPERIMENT 19

Interference

Explore the wave nature of light with the classic double-slit experiment for light. Students can vary slit width and separation. In addition, they can study single-slit diffraction.



Accessories Used

Diffraction Apparatus

This set extends the kit so students can easily study image formation by concave and convex mirrors.

DAK

Combination 1.2 m Track/Optics Bench

TRACK

Green Diffraction Laser *(optional)*

Add this to your Diffraction Apparatus to study the effect of wavelength on a diffraction pattern.

GDL-DAK

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-19

Featured Products

Light Sensors

Go Direct® Light and Color GDX

This sensor combines the power of visible light, UV, and RGB sensors to measure source emission, transmittance, and reflection of light in the visible light to ultraviolet electromagnetic spectrum.

GDX-LC

Light Sensor LQ

Investigate polarizers, reflectivity, and solar energy with this sensor that approximates the human eye in spectral response. It's great for inverse square law experiments.

LS-BTA

vernier.com/light-sensors

Optics Expansion Kit

Use the Optics Expansion Kit with your dynamics track (not included) to conduct optics experiments, such as image formation with lenses and light intensity *vs.* distance. You can even use the kit to build a basic telescope.

Kit includes

- 3 lenses (100 mm converging lens, 200 mm converging lens, −150 mm diverging lens)
- Screen
- Combination luminous and point light source
- Light Sensor Holder*
- Aperture screen
- Power supply

The Optics Expansion Kit is used in *Physics with Vernier* and *Advanced Physics with Vernier—Beyond Mechanics* experiments.

OEK

Download free sample experiments at vernier.com/oek

Combination Dynamics Track and Optical Bench

The Combination Dynamics Track and Optical Bench is aluminum and includes a metric scale. Extremely rigid, this 1.2 (or 2.2) meter track will not sag under use. The track includes 2 Adjustable Two Foot Levelers.

with 1.2 m Track TRACK vernier.com/track

with 2.2 m Track TRACK-LONG vernier.com/track-long

See website for replacement parts. ** Light Sensor Holder can be used with any style Vernier light sensor.*

Polarizer/Analyzer Set

Using the Polarizer/Analyzer Set, students can study light polarization and do experiments such as Malus's law. The set consists of three adjustable linear polarizers, one of which includes attachment points for either of our Rotary Motion Sensors. Requires components from the Optics Expansion Kit and either a LabQuest® Light Sensor or Go Direct® Light and Color for use.

PAK-OEK

vernier.com/pak-oek

Mirror Set

The Mirror Set extends the Optics Expansion Kit so students can easily study image formation by concave and convex mirrors. The set includes a concave mirror, a convex mirror, and a half screen. It requires components from the Optics Expansion Kit for use.

M-OEK

vernier.com/m-oek

Light source not included

Color Mixer

The Color Mixer accessory can be used to study the mixing of red, blue, and green light by additive and subtractive mixing. It requires a Combination Track/Optics Bench (not included).

CM-OEK

Download a free sample experiment at vernier.com/cm-oek

See website for replacement parts.

Modern Physics

Featured Experiments

GDX connects directly to devices

LQ requires an interface

EXPERIMENT 21

The Spectrum of Atomic Hydrogen

Compare the spectrum of an incandescent lamp with the few lines of the hydrogen spectrum.

Sensor Used

Vernier Emissions Spectrometer

This emissions spectrometer gives precise measurements over a range of 350–900 nm. Use it to examine spectra of light bulbs, spectrum tubes, or the sun.

VSP-EM

Accessories Used

Spectrum Tube Single Power Supply

These power supplies feature an ultra-safe design for electrifying spectrum tubes.

ST-SPS

Spectrum Tube (Hydrogen)

ST-H

Vernier Emissions Fiber

VSP-EM-FIBER

Experiment Source

Advanced Physics with Vernier—Beyond Mechanics

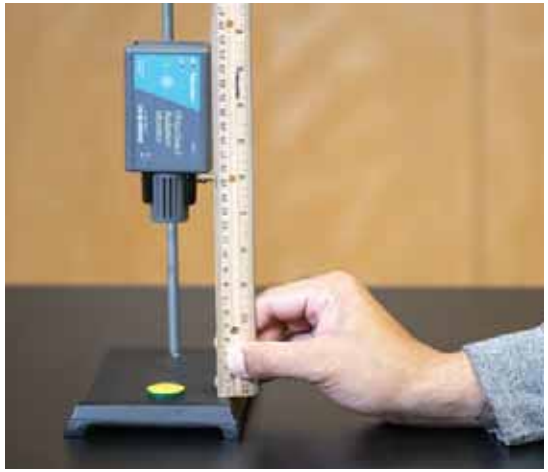
Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Learn more at vernier.com/phys-abm-21

EXPERIMENT 2

Distance and Radiation

Students use a gamma emitter and radiation monitor to determine the relationship between radiation counts and distance. This is a great follow-up to our Light, Brightness, and Distance experiment (see page 113)!



Sensor Used

GDX

Go Direct® Radiation Monitor

Use this sensor to detect alpha, beta, gamma, and X-ray radiation.

GDX-RAD

Can also be done with

LQ **Vernier Radiation Monitor**

VRM-BTD

Experiment Source

Nuclear Radiation with Vernier

FREE DOWNLOAD vernier.com/nrv

Featured Products

Vernier Emissions Spectrometer

The Vernier Emissions Spectrometer gives precise measurements over a range of 350–900 nm. Use it with or without an optical fiber (not included) to examine spectra of light bulbs, spectrum tubes, or the sun.

VSP-EM

vernier.com/vsp-em

Vernier Emissions Fiber

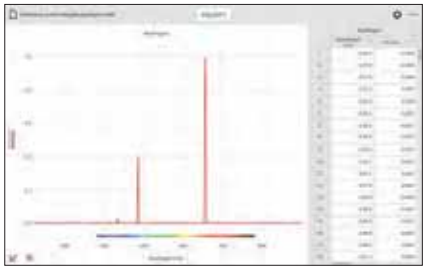
VSP-EM-FIBER

vernier.com/vsp-em-fiber

Vernier Spectral Analysis® App

Our free Vernier Spectral Analysis app makes it easy to incorporate spectroscopy into your physics lab. Using the app, students can analyze spectra from diverse sources such as spectrum tubes, light bulbs, and the sun.

vernier.com/spectral-analysis



Spectrum Tube Power Supplies

Spectrum Tube Single Power Supply

These power supplies feature an ultra-safe design for electrifying spectrum tubes.

ST-SPS

vernier.com/st-sps

Spectrum Tube Carousel Power Supply

These power supplies hold eight gas spectrum tubes.

ST-CAR

vernier.com/st-car

Spectrum Tubes

Spectrum Tubes

Spectrum Tubes are permanently enclosed in protective plastic carriers, with no exposed high voltage.
All Spectrum Tubes are sold separately:

Hydrogen	ST-H
Nitrogen	ST-N
Helium	ST-HE
Neon	ST-NE
Carbon Dioxide	ST-CO2
Air	ST-AIR
Argon	ST-AR

vernier.com/spectrum-tubes

Spectrum Tubes carry a two-year warranty (hydrogen tube: two years or 40 hours, whichever comes first; all other tubes: two years or 100 hours, whichever comes first).

Radiation Monitors

Vernier Radiation Monitor LQ

The Vernier Radiation Monitor detects alpha, beta, gamma, and X-ray radiation and can be used for experiments in nuclear counting statistics, shielding, and decay rate measurements.

VRM-BTD

Go Direct Radiation Monitor GDX

Explore radiation statistics, measure the rate of nuclear decay, and monitor radon progeny. Go Direct Radiation Monitor detects alpha, beta, gamma, and X-ray radiation, and it includes LED and audible indicators.

GDX-RAD

vernier.com/radiation-monitors

Nuclear Radiation with Vernier

This free e-book contains six experiments for data collection with a radiation monitor, including Distance and Radiation, Counting Statistics, Lifetime Measurement, Background Radiation Sources, Radiation Shielding, and Alpha, Beta, and Gamma.

FREE DOWNLOAD
vernier.com/nrv

Lab Books

Physics with Vernier

GDX LQ

Physics with Vernier has 35 experiments in mechanics, sound, light, electricity, and magnetism. This book has a wide variety of experiments for Motion Detectors, Force Sensors, Light Sensors, and more.

Download only: PWV-E
Printed book + download: PWV

Advanced Physics with Vernier—Mechanics

LQ

Advanced Physics with Vernier—Mechanics is the first of a two-volume set of experiments for the more in-depth introductory physics courses, such as university physics, AP* Physics, and IB‡ Physics.

Download only: PHYS-AM-E
Printed book + download: PHYS-AM

Advanced Physics with Vernier—Beyond Mechanics

LQ

Advanced Physics with Vernier—Beyond Mechanics is the second volume for more in-depth introductory physics courses. These experiments are designed for an interactive teaching style, with planned moments for instructor- or student-led discussion.

Download only: PHYS-ABM-E
Printed book + download: PHYS-ABM

Physics Explorations and Projects

GDX LQ

Physics Explorations and Projects is a collection of investigations aligned to the NGSS. These investigations invite students to explore phenomena without extensive instructions. The guided-inquiry format involves students having some choice in what they measure and analyze.

Download only: PEP-E
Printed book + download: PEP

** AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.*

‡ The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

Learn more at vernier.com/lab-books

Digital Curriculum

Pivot Interactives

Students overlay measurement tools onto high-quality videos to make measurements, such as in this activity where students calculate torque.

pivot interactives

Deepen Student Understanding with Pivot Interactives

Pivot Interactives provides students with instant access to a robust collection of web-based interactive video exercises.

Each activity consists of student-controlled videos that allow variation of experimental parameters one at a time. Each video exercise challenges students to answer open-ended questions, collect their own data, and develop a mathematical model that describes the relationship between the variables.

See Pivot in Action

Watch a video

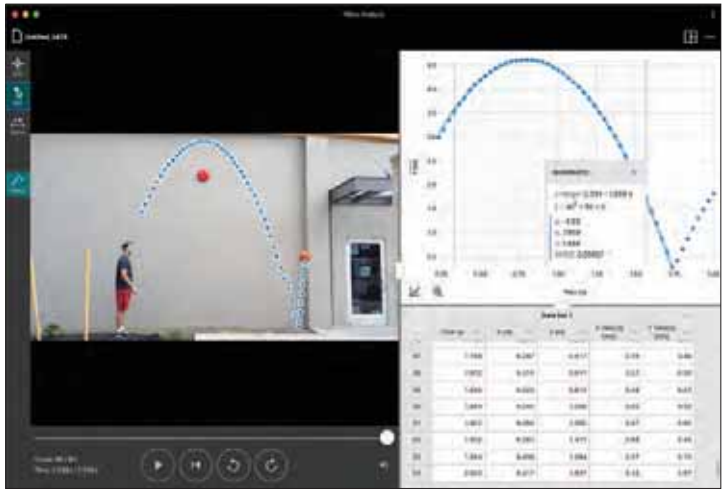
Start a free 30-day trial* today at pivotinteractives.com

** Not available in countries subject to GDPR*

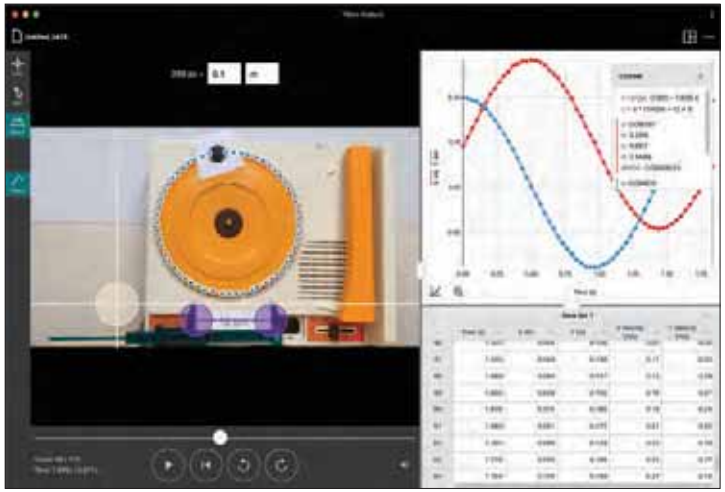
Features

- Classroom-ready experiments with teacher guides and grading/feedback tools
- Libraries (or matrices) of videos for each topic in introductory physics
- Web-based access on computers, Chromebooks, and mobile devices

NEW Vernier Video Analysis



Follow the trajectory of a basketball and demonstrate projectile motion.



Show the link between circular motion and simple harmonic motion.

The Vernier Video Analysis™ app brings video analysis to your students in a dedicated and streamlined application.

Benefits

Students can use their supported devices in the laboratory or out in the field to insert a video with recorded motion, mark points to track the object in motion, and set the scale of the video. Video Analysis generates accurate and visually rich graphs and a data table reflecting the recorded motion.

WORKS ON YOUR CHROMEBOOKS!

Features

- Video Analysis app is compatible with multiple devices and platforms: macOS,® iPadOS,™ iOS, Windows® 10, Chrome OS,™ and Android.™
- Students can use prepared videos, found videos, or collect their own videos for analysis.
- Video analysis makes it possible to do experiments that cannot be done with sensors, such as following a basketball in flight.
- Analysis is rapid and easily repeated, so students are able to immediately analyze and think critically about the collected data.
- You do not need to purchase other multi-featured apps just to do video analysis—our dedicated app streamlines the work to save time with better results.
- Easy annual site-licensing makes purchasing and renewing quick and easy.

Vernier Video Analysis runs in the Chrome,™ Safari,® and Firefox™ browsers.

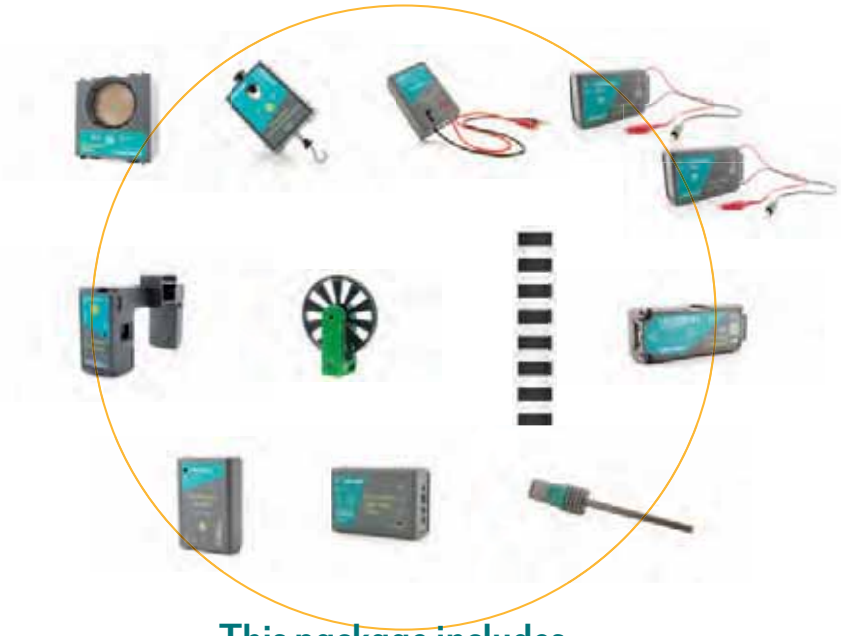
Browsers can run on Chrome OS, Windows, macOS, Android, iOS, and iPadOS.

Get a free trial and learn about site license options at vernier.com/video-analysis

Learn more at vernier.com/video-analysis

Physics Go Direct Package GDX

12 Products • GDP-PHY-DX



This package includes

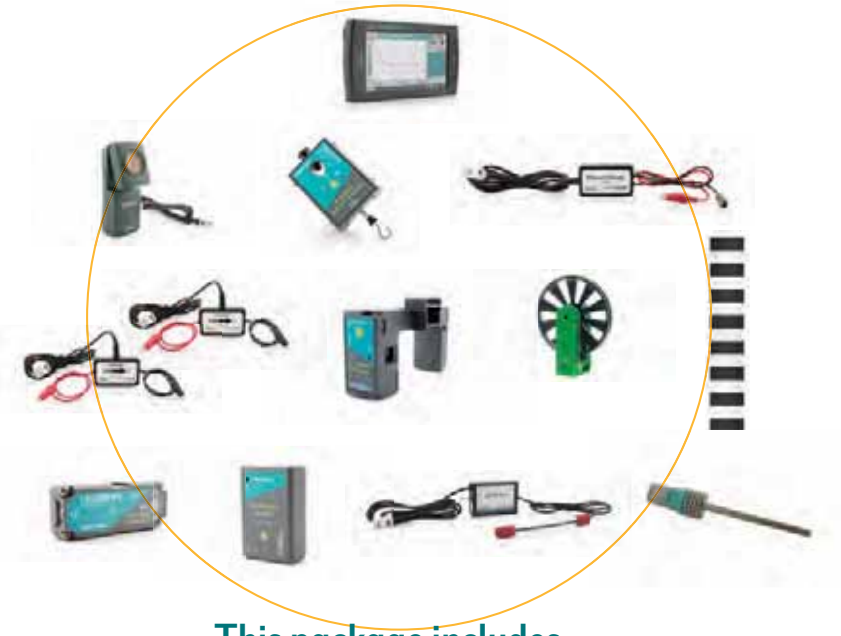
- Go Direct Motion
- Go Direct Force and Acceleration
- Go Direct Voltage
- Go Direct Current (2)
- Go Direct Photogate
- Ultra Pulley Attachment
- Picket Fence
- Go Direct Acceleration
- Go Direct Sound
- Go Direct Light and Color
- Go Direct 3-Axis Magnetic Field

All sensors work with our free Graphical Analysis™ 4 app, as well as LabQuest 2.

Learn more at vernier.com/gdp-phy-dx

Physics LabQuest Package LQ

13 Products • LQ2-PHY-DX



This package includes

- Vernier LabQuest 2 Interface
- Motion Detector
- Go Direct Force and Acceleration
- Differential Voltage Probe
- Current Probe (×2)
- Go Direct Photogate
- Ultra Pulley Attachment
- Picket Fence
- Go Direct Acceleration
- Go Direct Sound
- Light Sensor
- Go Direct 3-Axis Magnetic Field

All sensors work with our free Graphical Analysis 4 app, as well as LabQuest 2.

Learn more at vernier.com/lq2-phy-dx

More packages available online at vernier.com/physics-packages

Featured Products

Go Direct Sensors

Sensor	Order Code
Go Direct® 3-Axis Magnetic Field	GDX-3MG
Go Direct Acceleration	GDX-ACC
Carts and Tracks	
Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX
Go Direct Sensor Cart (Green)	GDX-CART-G
Go Direct Sensor Cart (Yellow)	GDX-CART-Y
Go Direct Centripetal Force Apparatus	GDX-CFA
Go Direct Current	GDX-CUR
Go Direct Force and Acceleration	GDX-FOR
Go Direct Gas Pressure	GDX-GP
Go Direct Light and Color	GDX-LC
Go Direct Motion	GDX-MD
Go Direct Photogate	GDX-VPG
Go Direct Projectile Launcher	GDX-PL
Go Direct Radiation Monitor	GDX-RAD
Go Direct Rotary Motion	GDX-RMS
Go Direct Sound	GDX-SND
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Voltage	GDX-VOLT

Go Direct Charge Station

Sensor	Order Code
Go Direct Charge Station	GDX-CRG

LabQuest Sensors

Sensor	Order Code
Accelerometers	
3-Axis Accelerometer	3D-BTA
25-g Accelerometer	ACC-BTA
Low-g Accelerometer	LGA-BTA
Carts and Tracks	
Dynamics Cart and Track System with Motion Encoder	DTS-EC
Encoder Fan Cart	CART-FEC
Current Sensors	
Current Probe	DCP-BTA
High Current Sensor	HCS-BTA
Electricity and Magnetism Sensors	
Charge Sensor	CRG-BTA
Magnetic Field Sensor	MG-BTA
Force Sensors	
Dual-Range Force Sensor	DFS-BTA
Force Plate	FP-BTA
Gas Pressure Sensor	GPS-BTA
Light Sensors	
Diffraction Apparatus	DAK
Light Sensor	LS-BTA
Motion Detectors	
Go!Motion® (USB sensor)	GO-MOT
Motion Detector	MD-BTD
Photogate	VPG-BTD
Power Amplifier	PAMP
Projectiles	
Projectile Launcher	VPL
Time of Flight Pad	TOF-VPL
Radiation Monitor	VRM-BTD
Rotary Motion Sensor	RMV-BTD
Sound Sensors	
Microphone	MCA-BTA
Sound Level Sensor	SLS-BTA
Temperature Probes	
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA
Voltage Probes	
30-Volt Voltage Probe	30V-BTA
Differential Voltage Probe	DVP-BTA
Instrumentation Amplifier	INA-BTA
Voltage Probe	VP-BTA

See all our products for physics at vernier.com/physics

For more information, and to see all our products, visit vernier.com

Looking for Replacement Parts?

Visit vernier.com/replacements

Emissions Spectrometer

Spectrometer	Order Code
Vernier Emissions Spectrometer	VSP-EM

Infrared Cameras

Camera	URL
FLIR ONE® Thermal Cameras	vernier.com/flir-one-thermal-cameras

Engineering, Coding, and Robotics

vernier.com/engineering

Encourage curiosity, build confidence, and spark an interest in STEM careers in your students. Vernier solutions give your students practical ways to learn engineering design principles, integrate sensor data into computer science concepts, and learn coding with robotics.

Topics

Explore a sampling of our featured experiments and investigations by topic to learn how Vernier technology helps your students engage with data-collection technology and deepen understanding of key engineering, computer science, and STEM concepts.

Engineering

PAGE 124

Bridge and Structure Testing

Renewable Energy

Arduino®

Our solutions help your students understand the engineering design process, critical thinking, and teamwork. Your students learn to build and design bridges, wind turbines, and more. Plus, our world-class technical support ensures success in the classroom.

Coding with Sensors

PAGE 128

Block-Based

python™

JavaScript™

Coding introduces problem solving, nurtures creativity, increases critical thinking, and builds confidence. We have added coding support to our Go Direct® sensors so that your students can develop computational thinking as they learn to code.

Robotics

PAGE 129

LEGO education

makeblock®

When your students design robots and develop code, they express ideas in new ways. With robotics, your students learn skills extending beyond the screen as they program robots to interact with the physical world.

Professional Development

Whether you're currently using data-collection technology in your classroom or just exploring new possibilities, you'll feel confident and prepared throughout the school year with our hands-on workshops, online training opportunities, and options for personalized professional development.

vernier.com/training

Engineering

Bridge and Structure Testing

FEATURED ACTIVITY

Bridge Competition

In this team competition, students use the engineering design process to design a bridge with the highest efficiency, following a set of constraints and design requirements.

Equipment Used

NEW Go Direct® Structures & Materials Tester

Use our new Go Direct Structures & Materials Tester to evaluate the strength of model bridges and engineered structures by measuring the applied load. Utilizing both load and displacement sensors, your students can evaluate the properties of materials.

Benefits

- The force and displacement sensors connect via Bluetooth® wireless technology or via USB.
- Uses our free Graphical Analysis™ 4 app to collect and analyze data
- Exact force and displacement for bends and breaks
- Accurate positioning for center and off-center loading
- Easy loading for different sizes and shapes
- Includes free *Materials Testing: Beams to Bridges* e-book

GDX-VSMT

Activity Source

Materials Testing: Beams to Bridges with the Go Direct Structures & Materials Tester

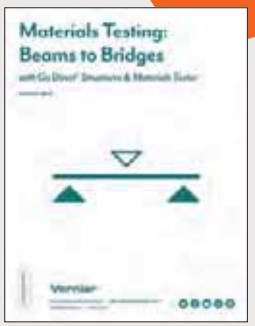
FREE DOWNLOAD*

**Free with purchase of Go Direct Structures & Materials Tester*

Learn more at vernier.com/gdxvsmt-bb-e

INCLUDES 5 ACTIVITIES

NEW *Materials Testing: Beams to Bridges with the Go Direct Structures & Materials Tester*



With the activities in this e-book, students use the Go Direct Structures & Materials Tester to investigate materials and structures.

Topics include

- Beams: Investigate the relationship between dimensions and flexibility.
- Trusses: Explore why trusses fail and how to compensate for weaknesses.
- Bridges: Use the engineering design process to build and test bridges.

vernier.com/gdxvsmt-bb-e

FREE DOWNLOAD*

**Free with purchase of Go Direct Structures & Materials Tester*

Truss Tester Accessory

The Truss Tester Accessory attaches to the Go Direct Structures & Materials Tester, holds a single truss upright, and allows the load to be applied in a variety of locations.

VSMT-TRUSS

vernier.com/vsmt-truss

PLTW Engineering

PLTW Engineering (9–12) empowers students to step into the role of an engineer and adopt a problem-solving mindset, inspiring students to believe in their own potential and see themselves in a career that improves communities.

Learn more at vernier.com/pltw

Renewable Energy

FEATURED EXPERIMENT

Project: Maximum Energy Output

Challenge your students to design their own wind turbines following the provided design requirements, constraints, and deliverables.

Sensor Used

Go Direct Energy

Use Go Direct Energy with our free Graphical Analysis 4 app to determine the power output of a renewable energy system. Connect a source, such as KidWind solar panels or wind turbines, and students can quantitatively evaluate the effects of their design changes.

GDX-NRG

Accessory Used

Vernier Variable Load

The Vernier Variable Load provides a range of resistive loads for projects with wind turbines or solar panels. This load is used in our *Renewable Energy with Vernier* lab book.

VES-VL

Experiment Source

Renewable Energy with Vernier

Download only: REV-E
Printed book + download: REV

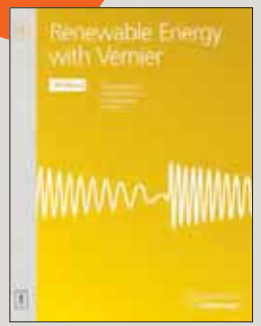
Learn more at vernier.com/rev-15

Renewable Energy with Vernier

INCLUDES **26** EXPERIMENTS

The *Renewable Energy with Vernier* lab book features 26 experiments in wind and solar energy. The book contains a combination of explorations, classic experiments, inquiry investigations, engineering projects, and more.

Learn more at vernier.com/rev



Download only
REV-E

Download + printed book
REV

Additional Products

KidWind Advanced Wind Experiment Kit

Discover advanced aspects of wind turbine technology. Test different blade designs, gear ratios, generators, and devices to measure electrical and weightlifting power.

KW-AWX

More KidWind renewable energy products can be found at vernier.com/kidwind

Engineering

Arduino

FEATURED PROJECT

Laser Pointer Controlled by a Motion Detector

This coding challenge integrates measurement, math, and motor control as students program the Arduino® microcontroller to monitor the location of an object and to point a servo motor at the located object, even if it is moving.

Products Used

Motion Detector

Use the Motion Detector to measure position, velocity, and acceleration of moving objects.

MD-BTD

Digital Control Unit

Use the Digital Control Unit to activate output lines for controlling DC electrical devices such as DC motors, servo motors, buzzers, pumps, and LEDs.

DCU-BTD

SparkFun® RedBoard with Cable

The RedBoard is an Arduino-compatible board, which is perfect for use with the Vernier Arduino Interface Shield.

ARD-RED

Vernier Ardunio Interface Shield

This shield provides a convenient way to make connections from Arduino microcontrollers, like the RedBoard, to Vernier sensors.

BT-ARD

Project Source

Online Arduino Sensor Guide
vernier.com/arduino

Learn more at vernier.com/arduino

Online Arduino Sensor Guide

The availability of inexpensive, easy-to-program Arduino microcontrollers, like the SparkFun RedBoard, makes integrating engineering concepts into your curriculum easy and affordable. Vernier offers a free online guide that helps you with using Vernier LabQuest sensors with Arduino.

vernier.com/arduino

INCLUDES 12 EXAMPLE PROJECTS

Popular LabQuest Sensors Compatible with Arduino

Dual-Range Force Sensor

DFS-BTA

Photogate

VPG-BTD

Stainless Steel Temperature Probe

TMP-BTA

pH Sensor

PH-BTA

Most of our LabQuest® sensors are compatible with Arduino. In addition to these popular sensors, a complete list can be found at vernier.com/arduino

Featured Products

Bridge and Structure Testing

Product		Order Code
NEW Go Direct® Structures & Materials Tester		GDX-VSMT
Vernier Structures & Materials Tester		VSMT
Truss Tester		VSMT-TRUSS

Arduino

Product		Order Code
SparkFun RedBoard with Cable		ARD-RED
Vernier Arduino Interface Shield		BT-ARD
Anemometer		ANM-BTA
Dual-Range Force Sensor		DFS-BTA

Gas Pressure Sensor		GPS-BTA
Light Sensor		LS-BTA»
Motion Detector		MD-BTD
pH Sensor		PH-BTA
Photogate		VPG-BTD
Soil Moisture Sensor		SMS-BTA
Stainless Steel Temperature Probe		TMP-BTA
Surface Temperature Sensor		STS-BTA

Renewable Energy

Product		Order Code
Go Direct Energy		GDX-NRG
Vernier Variable Load		VES-VL
KidWind Advanced Wind Experiment Kit		KW-AWX
KidWind Balsa Blade Sheets		KW-BBS10
KidWind Wind Turbine Generator with Wires		KW-GEN
KidWind Tower and Base Set		KW-TBS
KidWind Basic Turbine Building Parts		KW-BTPART
Renewable Energy with Vernier		REV-E REV

See all of our products for engineering at vernier.com/engineering

Coding with Go Direct Sensors

Coding with Go Direct® Sensors

Vernier offers a range of coding solutions—from entry-level to advanced instrument-control programming. With Vernier technology and an appropriate coding application, your students can create code to visualize scientific data, incorporate sensor input, and create sensor-controlled projects.

Block-Based Coding

Scratch

Block-based programming is ideal for students new to coding. With Scratch, students can develop their coding skills with fun, hands-on projects. Block-based coding in Scratch helps students get started making natural connections between their digital and physical worlds.

Workbench

Google Workbench's unique platform lets students add devices for data collection such as Vernier sensors or SAM Labs blocks while they code. Students simply connect these devices to Workbench and build block-based programs that bring the data to life.

Connecting to Python®

With our Python module, you can connect Vernier Go Direct sensors to your Python project. Your students can write Python programs to visualize Go Direct sensor data or integrate that data into a larger Python project.

Using JavaScript™

Use JavaScript to integrate Go Direct sensor data into your custom web applications. Integrate coding, sensor data collection, and web design by combining the Vernier Go Direct library with other libraries including Chart.js, Desmos.js, and p5.js.

Learn more at vernier.com/coding-robotics

PROJECT LEAD THE WAY PLTW

Computer Science

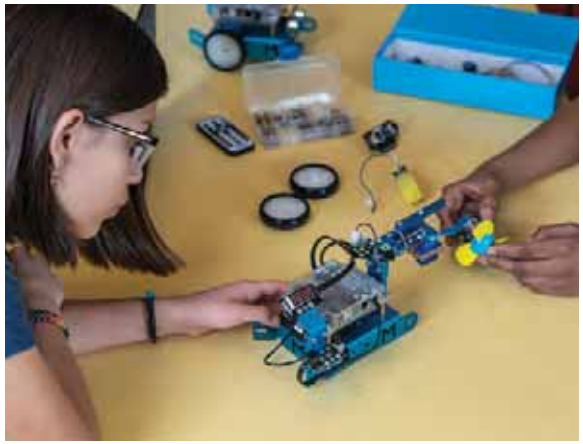
PLTW Computer Science (9–12) engages students in real-world activities, projects, and problems that challenge them to apply computational thinking and logic to solve big problems.

Learn more at vernier.com/pltw

Learn more about other partners including SAM Labs, Microsoft,® and Google.

See page 2.

Robotics



Vernier Robotics

When your students learn to program robots, they learn to organize, express, and share their ideas in a whole new way. With robotics in the classroom, your students learn coding skills that extend beyond the screen as they program robots to interact with the physical world.

We recognize that educators partner with dependable providers that they know and love. We strive to do the same, which is why we work with LEGO® Education and Makeblock. Boost your students' understanding of robotics concepts with downloadable e-books that incorporate problem-solving, engineering design, and critical thinking skills.

LEGO® Education

LEGO® MINDSTORMS® Education EV3 is a hands-on, cross-curricular robotics STEM solution that engages students by providing the resources to design, build, and program their creations while helping them develop essential 21st-century skills such as creativity, critical thinking, collaboration, and communication.

Makeblock®

Help your students learn how to organize, express, and share their ideas in a whole new way through coding. With Makeblock robots coupled with exclusive STEM activities from Vernier, your students will learn coding skills as they program robots to interact with the physical world.

Learn more at vernier.com/coding-robotics

STEM with Vernier

Science

Vernier technology is used in 150 countries in biology, biotechnology, chemistry, Earth science, environmental science, physical science, physics, and water quality courses. From primary schools to graduate studies, you can rely on Vernier technology for hands-on learning when science is the key focus of your STEM program.

Using Vernier technology, students

- Ask questions and define problems to investigate
- Plan and carry out investigations
- Decide what data to gather and how much data are needed to produce reliable results
- Analyze and interpret data

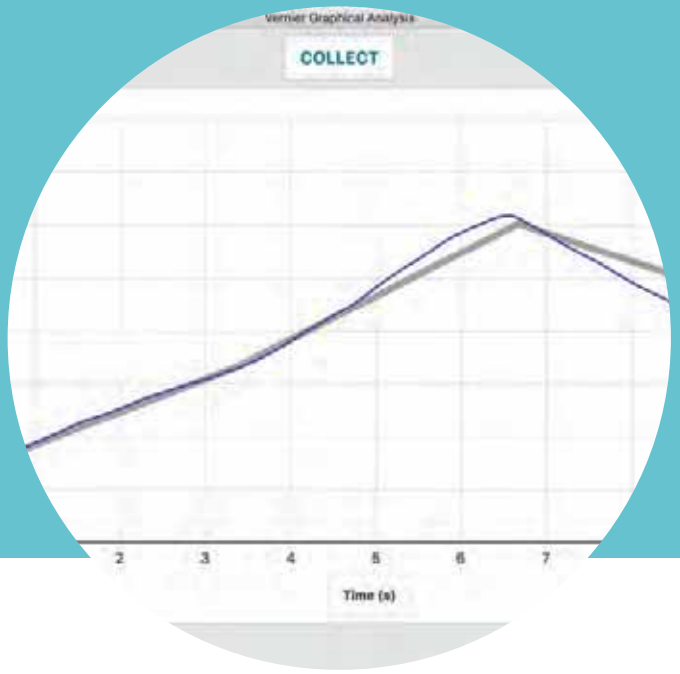
Technology

All Vernier technology—from sensors used in hands-on experiments to technology to test design solutions—supports a robust, engaging STEM education.

What other educators are saying

"The range of compatible sensors is extensive....We have found the equipment extremely useful in demonstrating to pupils how our simplistic experiments relate to, and might be conducted, in industry. In some of our experiments, the equipment provides more teaching time without taking the practical element of the sciences away. The LabQuest 2 allows us to carry out meaningful experiments that we have not been able to do before."

—Chris Jessop, AKS School, Lytham, United Kingdom



Engineering

The practices of engineering, when combined with Vernier sensors, allow students to identify problems, design solutions, and test those solutions using sensor data.

Vernier supports hands-on engineering activities

- Engineering design projects
- Feedback and control projects
- Bridge testing and contests
- Structures and materials testing
- Wind and solar energy investigations and design challenges

Math

Computational thinking, visualizing data, and recognizing patterns are all part of scientific investigations and engineering activities using Vernier sensors and software.

Vernier technology engages student and helps them

- Understand grade-level appropriate mathematics and statistics when analyzing data
- Visualize data using a variety of analytical tools to show relationships

International Dealers

Vernier and the Environment

A strong commitment to the environment is central to our mission.

Here are just a few examples of our practices

- **Solar panels**—We have installed over 37,000 watts of solar panels.
- **Alternative transportation**—All employees are provided with free transit passes and are encouraged to walk, bike, carpool, or take public transport to work.
- **Recycling**—We recycle everything we can: paper, plastic, aluminum, cardboard, electronics, batteries, and more.
- **Worm bin composting**—Vernier employees compost food scraps and yard clippings using a colony of red wiggler worms.
- **Electric car charging stations**—Over 10% of Vernier employees own hybrid, plug-in hybrid, or pure electric vehicles.
- **Packing materials**—Employees reuse boxes and packing materials.
- **Lighting**—We've installed energy-saving LED bulbs in our fixtures.
- **LEED-EB Gold rating**—In 2006, and again in 2016, our building qualified for the second highest rating possible from the U.S. Green Building Council.
- **Green Company Award**—We have been named one of the 100 Best Green Companies to Work For in Oregon for eleven years.
- **Printing**—This catalog was produced using 100% wind energy and printed with vegetable-based inks on FSC, SFI and PEFC certified paper stock containing recycled content.

For more information, and to see all our products, visit vernier.com

Sensors & Accessories

The Vernier Sensor Advantage

Outstanding Performance

With 39 years of experience developing technology for education, we design our sensors for active, hands-on experiments. Vernier sensors are rugged, classroom-proven technology that are well supported and easy to use. The sensors provide consistent, high-quality results for the demands of the classroom.

Connect & Collect

Simply connect, and you're ready to collect. All Vernier sensors on the following pages are automatically detected and set up for data collection when used with Vernier software.

Go Direct Sensors

Our Go Direct® sensors connect directly to a computer, Chromebook,™ or a mobile device via Bluetooth® wireless technology or USB connection. Most sensors include a rechargeable battery to power the sensor when used wirelessly.

LabQuest Sensors

Our LabQuest® sensors require an interface from the LabQuest family, such as LabQuest 2, LabQuest Stream,® or LabQuest Mini. The interface sends information from the sensor to the data-collection and analysis software on a device such as a computer, Chromebook, or mobile device.

For more information on sensor compatibility, visit vernier.com/sensors

Generous Warranty

Buy with confidence. Most Vernier sensors are covered by a 5-year limited warranty. During the warranty period, Vernier will repair or replace the item if there is a defect in materials or workmanship. Outside the warranty, Vernier will attempt to repair most products, often at no charge.

Go Direct Sensors

Sensor	Order Code
Go Direct 3-Axis Magnetic Field	GDX-3MG
Go Direct Acceleration	GDX-ACC
Go Direct Blood Pressure	GDX-BP
Carts and Tracks	
Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX
Go Direct Sensor Cart (Green)	GDX-CART-G
Go Direct Sensor Cart (Yellow)	GDX-CART-Y
Go Direct Centripetal Force Apparatus (requires Go Direct Force and Acceleration)	GDX-CFA
Go Direct CO_2 Gas	GDX-CO2
Go Direct Colorimeter	GDX-COL
Go Direct Conductivity	GDX-CON
Go Direct Constant Current System	GDX-CCS
Go Direct Current	GDX-CUR
Go Direct Drop Counter	GDX-DC
Go Direct EKG	GDX-EKG
Go Direct Electrode Amplifier	GDX-EA
Go Direct Energy	GDX-NRG
Go Direct Ethanol Vapor	GDX-ETOH
Go Direct Force and Acceleration	GDX-FOR
Go Direct Gas Pressure	GDX-GP
Go Direct Hand Dynamometer	GDX-HD
Heart Rate Monitors	
Go Wireless Exercise Heart Rate	GW-EHR
Go Wireless Heart Rate	GW-HR
Go Direct Ion-Selective Electrode Amplifier	GDX-ISEA
Ion-Selective Electrodes (ISE)*	
Go Direct Ammonium ISE	GDX-NH4
Go Direct Calcium ISE	GDX-CA
Go Direct Chloride ISE	GDX-CL
Go Direct Nitrate ISE	GDX-NO3
Go Direct Potassium ISE	GDX-K
Go Direct Light and Color	GDX-LC
Go Direct Melt Station	GDX-MLT
Go Direct Motion	GDX-MD
Go Direct Mini GC	GDX-GC
Go Direct O_2 Gas	GDX-O2
Go Direct Optical Dissolved Oxygen	GDX-ODO
Go Direct ORP	GDX-ORP
pH Sensors	
Go Direct Glass-Body pH	GDX-GPH
Go Direct pH	GDX-PH
Go Direct Tris-Compatible Flat pH	GDX-FPH
Go Direct Photogate	GDX-VPG
Go Direct Polarimeter	GDX-POL
Go Direct Projectile Launcher	GDX-PL
Go Direct Radiation Monitor	GDX-RAD
Go Direct Respiration Belt	GDX-RB
Go Direct Rotary Motion	GDX-RMS
Go Direct Sound	GDX-SND
Go Direct SpectroVis Plus	GDX-SVISPL
Go Direct Spirometer	GDX-SPR
Go Direct Structures & Materials Tester	GDX-VSMT
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Wide-Range Temperature	GDX-WRT
Go Direct Voltage	GDX-VOLT

** Ion-Selective Electrodes require excellent chemical technique and careful calibration to obtain accurate results; they are not recommended for primary or middle school students.*

LabQuest Sensors

Sensor	Order Code
Accelerometers	
3-Axis Accelerometer	3D-BTA
25-g Accelerometer	ACC-BTA
Low-g Accelerometer	LGA-BTA
Anemometer	ANM-BTA
Barometer	BAR-BTA
Blood Pressure Sensor	BPS-BTA
Charge Sensor	CRG-BTA
CO_2 Gas Sensor	CO2-BTA
Colorimeter	COL-BTA
Conductivity Probes	
Conductivity Probe	CON-BTA
Platinum-Cell Conductivity Probe	CONPT-BTA
Constant Current System	CCS-BTA
Current Probes	
Current Probe	DCP-BTA
High Current Sensor	HCS-BTA
Diffraction Apparatus	DAK
Digital Control Unit	DCU-BTD
Drop Counter	VDC-BTD
EKG Sensor	EKG-BTA
Electrode Amplifier	EA-BTA
Energy Sensor	VES-BTA
Ethanol Sensor	ETH-BTA
Flow Rate Sensor	FLO-BTA
Force Sensors	
Dual-Range Force Sensor	DFS-BTA
Force Plate	FP-BTA
Gas Pressure Sensors	
Gas Pressure Sensor	GPS-BTA
Pressure Sensor 400	PS400-BTA
Goniometer	GNM-BTA
Hand Dynamometer	HD-BTA
Heart Rate Monitors	
Exercise Heart Rate Monitor	EHR-BTA
Hand-Grip Heart Rate Monitor	HGH-BTA
Instrumentation Amplifier	INA-BTA
Ion-Selective Electrodes (ISE)*	
Ammonium ISE	NH4-BTA
Calcium ISE	CA-BTA
Chloride ISE	CL-BTA
Nitrate ISE	NO3-BTA
Potassium ISE	K-BTA
Light Sensor	LS-BTA
Magnetic Field Sensor	MG-BTA
Melt Station	MLT-BTA
Microphone	MCA-BTA
Motion Detectors	
Dynamics Cart and Track System with Motion Encoder	DTS-EC
Motion Detector	MD-BTD
O_2 Gas Sensor	O2-BTA
Optical DO Probe	ODO-BTA
ORP Sensor	ORP-BTA
PAR Sensor	PAR-BTA
pH Sensors	
Glass-Body pH Electrode BNC (requires Electrode Amplifier)	GPH-BNC
pH Sensor	PH-BTA
Tris-Compatible Flat pH Sensor	FPH-BTA
Photogate	VPG-BTD
Polarimeter (Chemical)	CHEM-POL
Power Amplifier	PAMP
Projectile Launcher	VPL
Pyranometer	PYR-BTA
Qubit Sensors	vernier.com/qubit
Radiation Monitor	VRM-BTD
Relative Humidity Sensor	RH-BTA
Respiration Monitor Belt (requires Gas Pressure Sensor)	RMB
Rotary Motion Sensor	RMV-BTD
Salinity Sensor	SAL-BTA
Soil Moisture Sensor	SMS-BTA
Sound Level Sensor	SLS-BTA
Spirometer	SPR-BTA
Temperature Probes	
Extra-Long Temperature Probe	TPL-BTA
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA
Thermocouple	TCA-BTA
Wide-Range Temperature Probe	WRT-BTA
Turbidity Sensor	TRB-BTA
UV Sensors	
UVA Sensor	UVA-BTA
UVB Sensor	UVB-BTA
Voltage Probes	
30-Volt Voltage Probe	30V-BTA
Differential Voltage Probe	DVP-BTA
Voltage Probe	VP-BTA

USB-Only Sensors

Sensor	Order Code
Go! Motion	GO-MOT
Go!Temp	GO-TEMP
OHAUS® Balances	vernier.com/ohaus
Spectrometers	
Go Direct SpectroVis® Plus (USB and Wireless)	GDX-SVISPL
Vernier Emissions Spectrometer	VSP-EM
Vernier Flash Photolysis Spectrometer	VSP-FP
Vernier Fluorescence/UV-VIS Spectrophotometer	VSP-FUV
Vernier Spectrometer (Ocean Optics™)	V-SPEC
Vernier UV-VIS Spectrophotometer	VSP-UV

Accessories & Replacement Parts

Sensors

Part Name	Order Code
Blood Pressure Sensors	
Small Blood Pressure Cuff	CUFF-SM
Standard Blood Pressure Cuff	CUFF-STD
Large Blood Pressure Cuff	CUFF-LG
CO_2 and/or O_2 Gas Sensors	
250 mL Nalgene® Bottle (1 opening)	CO2-BTL
BioChamber 250 (250 mL) (2 openings)	BC-250
BioChamber 2000 (2000 mL) (2 openings)	BC-2000
Colorimeters	
Cuvette Lids (pkg. of 100)	CUV-LID
Cuvette Rack	CUV-RACK
Plastic Cuvettes (Visible Range) (pkg. of 100)	CUV
Conductivity Probes	
Conductivity Low Standard (500 mL)	CON-LST
Conductivity Middle Standard (500 mL)	CON-MST
Conductivity High Standard (500 mL)	CON-HST
Dissolved Oxygen Probe (Go Direct,® order code GDX-ODO)	
Go Direct Optical Dissolved Oxygen Replacement Cap	GDX-ODO-CAP
Dissolved Oxygen Probe (Optical, order code ODO-BTA)	
Optical DO Probe Metal Guard	ODO-GRD
Optical DO Probe Replacement Cap	ODO-CAP
Dissolved Oxygen Probe (Non-optical)	
DO Calibration Solution (60 mL)	DO-CAL
DO Filling Solution (130 mL)	FS
DO Polishing Strips	PS
DO Probe Membrane Cap	MEM
Drop Counters	
Microstirrer	MSTIR
Reagent Reservoir, 2 Valves, and Tip	VDC-RR
Stopper Stem	PS-STEM
Plastic 2-Way Valve	PS-2WAY
EKG Sensors	
EKG Electrodes (100)	ELEC
Electrode Amplifier (Go Direct, order code GDX-EA)	
Go Direct pH Electrode BNC	GDX-PH-BNC
Go Direct Glass-Body pH Electrode BNC	GDX-GPH-BNC
Go Direct Flat pH Electrode BNC	GDX-FPH-BNC
Go Direct ORP Electrode BNC	GDX-ORP-BNC
Electrode Amplifier (LabQuest, order code EA-BTA)	
pH Electrode BNC	PH-BNC
Glass-Body pH Electrode BNC	GPH-BNC
Flat pH Electrode BNC	FPH-BNC
ORP Electrode BNC	ORP-BNC
Energy Sensors	
Vernier Resistor Board	VES-RB
Vernier Variable Load	VES-VL
Ethanol Sensors	
Ethanol Cap Assemblies (pkg. of 3)	ETH-CAPS
Ethanol Stopper	ETH-STOP
Ethanol Tape	ETH-TAPE
Force Sensors	
Reflex Hammer Accessory Kit	RFX-ACC
Replacement Accessory Rod	ACC-ROD
Springs Set	SPRINGS
Dual-Range Force Sensor Replacement Parts Kit	DFS-RPK
Bumper Launcher Kit	BLK
Hoop Bumpers for Bumper and Launcher Kit	HOOPS-BLK
Gas Chromatographs	
GC Septa (pkg. of 4)	GC-SEP
GC Syringe, 1 µL Hamilton	GC-SYR-MIC
Gas Pressure Sensors	
Gas Pressure Sensor Bulb (1)	GPS-BULB1
Gas Pressure Sensor Bulb (set of 4)	GPS-BULB4
Pressure Sensor Accessories Kit	PS-ACC
#1 1-Hole Rubber Stopper	PS-STOP1
#5 2-Hole Rubber Stopper	PS-STOP5
Luer-Lock Connector	PS-LUER
Plastic 2-Way Valve	PS-2WAY
Plastic Tubing	PS-TUBING
Plastic Tubing Clamps (pkg. of 100)	PTC
Stopper Stem	PS-STEM
Syringe (20 mL, plastic)	PS-SYR
Syringe (20 mL, plastic) (pkg. of 10)	PS-SYR10
Heart Rate Sensors	
Heart Rate Hand Grips	HR-GRIP
Exercise Heart Rate Strap	HR-STRAP
Polar Transmitter Module	HR-TRANS
Ion-Selective Electrodes	
ISE Ammonium Replacement Module†	NH4-MOD
ISE Calcium Replacement Module†	CA-MOD
ISE Nitrate Replacement Module†	NO3-MOD
ISE Potassium Replacement Module†	K-MOD
ISE Ammonium Low Standard (500 mL)	NH4-LST
ISE Ammonium High Standard (500 mL)	NH4-HST
ISE Calcium Low Standard (500 mL)	CA-LST
ISE Calcium High Standard (500 mL)	CA-HST
ISE Chloride Low Standard (500 mL)	CL-LST
ISE Chloride High Standard (500 mL)	CL-HST
ISE Nitrate Low Standard (500 mL)	NO3-LST
ISE Nitrate High Standard (500 mL)	NO3-HST
ISE Potassium Low Standard (500 mL)	K-LST
ISE Potassium High Standard (500 mL)	K-HST
Melt Stations	
Melt Station Capillary Tubes (pkg. of 100)	MLT-TUBE
Motion Detectors	
Go!Motion to Computer Cable	GMC-USB
Motion Detector Cable	MDC-BTD
Motion Detector Clamp	MD-CLAMP
pH and ORP Sensors	
Microstirrer	MSTIR
pH Buffer Capsules (10 each of pH 4, 7, 10)	PH-BUFCAP
pH Storage Bottles (pkg. of 5)	BTL
pH Storage Solution (500 mL)	PH-SS
Photogates	
Cart Picket Fence	PF-CART
Go Direct Photogate Timing Cable	VPG-CB-GDX
Go Direct Time of Flight Pad Cable	TOF-CB-GDX
Laser Pointer	LASER
Laser Pointer Stand	STAND
Photogate Bar Tape Kit	TAPE-VPG
Picket Fence	PF

† ISE modules have a life expectancy of 1 to 2 years. We recommend that you do not purchase ISE replacement modules too far in advance of their expected time of use; degradation occurs while replacement modules are stored on the shelf.

Pulley Bracket	B-SPA
Ultra Pulley Attachment	SPA
Polarimeters (Chemical)	
Polarimeter Sample Cells (pkg. of 4)	CELLS-POL
Power Amplifier	
Accessory Speaker	PAAS-PAMP
Projectile Launchers	
Goggles (set of 2)	GGL-VPL
Time of Flight Pad	TOF-VPL
Steel Balls (set of 6)	STB-VPL
Projectile Stop	PS-VPL
Independence of Motion Accessory	IOM-VPL
Wax Tape (300 ft.)	WXT-VPL
Rotary Motion Sensors	
Rotational Motion Accessory Kit	AK-RMV
Rotary Motion Motor Kit	MK-RMV
Rotary Motion Sensor Replacement Pulley	RMV-PULLEY
Rotary Motion Sensor Replacement Parts Kit	RMV-RPK
Salinity Sensors	
Salinity Standard (500 mL)	SAL-ST
Spectrophotometers/Spectrometers	
Cuvette Lids (pkg. of 100)	CUV-LID
Cuvette Rack	CUV-RACK
Plastic Cuvettes (visible) (pkg. of 100)	CUV
Plastic Cuvettes (UV-VIS) (pkg. of 100)	CUV-UV
Quartz Cuvettes (pkg. of 2)	CUV-QUARTZ
Fluorescence/UV Quartz Cuvette (1)	CUV-QUARTZ-FUV
Spectrophotometer Optical Fiber (for GDX-SVISPL, VSP-UV, VSP-FUV)	VSP-FIBER
Vernier Emissions Fiber (for VSP-EM)	VSP-EM-FIBER
Spirometers	
Disposable Bacterial Filter (pkg. of 10)	SPR-FIL10
Disposable Bacterial Filter (pkg. of 30)	SPR-FIL30
Disposable Mouthpiece (pkg. of 30)	SPR-MP30
Disposable Mouthpiece (pkg. of 100)	SPR-MP100
Noseclip (pkg. of 10)	SPR-NOSE10
Noseclip (pkg. of 30)	SPR-NOSE30
O_2 Gas Sensor to Spirometer Adapter	O2-SPR
Structures & Materials Testers	
Truss Tester Accessory	VSMT-TRUSS
Turbidity Sensor (order code TRB-BTA)	
Turbidity Accessories Replacement Kit	TRB-ACC
Turbidity Bottles (pkg. of 6)	TRB-BOT
Voltage and Current Probes	
Inductor	IND
Miniature Alligator Clips for Vernier Circuit Board	VCB-GATOR
Optional Breadboard Kit for the Vernier Circuit Board 2	VCB2-OBBK
Replacement Lamps for Vernier Circuit Board	VCB-BULB
Resistivity Rods	RRS
Vernier Circuit Board 2	VCB2

Dynamics Cart and Track System

Part Name	Order Code
For any Cart and Track System	
Adjustable Two Foot Leveler	AL-VDS
Adjustable End Stop	AS-VDS
Anti-Roll Pegs	VDS-ARP10
Axles and Wheels for Cart	WHEELS-VDS
Cart Picket Fence	PF-CART
Cart—Plunger Cart (plastic)	DTS-CART-P
Cart—Standard Cart (plastic)	DTS-CART-S
Motion Detector Bracket	DTS-MDB
Optics Accessories	page 115
Photogate Bracket	PGB-VDS
Pulley Bracket	B-SPA
Vernier Dynamics System Replacement Parts Kit	VDS-RPK
For Dynamics Cart and Track Systems Only (Plastic Carts)	
DFS/Accelerometer Fasteners	DTS-ACC
Eddy Current Brake	DTS-ECB
Friction Pad DTS (for plastic carts)	DTS-PAD
Mass DTS (hexagonal bars)	DTS-MASS
Motion Detector Reflector Flag	DTS-FLAG
For Vernier Dynamics Systems Only (Metal Carts)	
Friction Pad (for metal carts)	PAD-VDS
Mass for Dynamics Carts (500 g block)	MASS

Go Direct

Part Name	Order Code
Go Direct Charge Station	GDX-CRG
Go Direct Sensor Clamp	GDX-CLAMP
Go Direct USB Radio	GDX-RADIO
Vernier Micro USB Cable	CB-USB-MICRO
Vernier USB Type C to Micro USB Cable	CB-USB-C-MICRO

LabQuest 2 and Original LabQuest

Part Name	Order Code
For LabQuest® 2 and Original LabQuest	
LabQuest Charge Station	LQ2-CRG
LabQuest Power Supply	LQ-PS
LabQuest Tether (pkg. of 5)	LQ-TETH-5
LabQuest Lanyard	LQ-LAN
LabQuest Battery Boost 3	LQ-BOOST3
LabQuest SD Card	LQ-SD
Vernier Mini USB Cable	CB-USB-MINI
Vernier USB Type C to Mini USB Cable	CB-USB-C-MINI
For LabQuest 2 Only	
LabQuest 2 Lab Armor	LQ2-ARMOR
LabQuest 2 Stand	LQ2-STN
LabQuest 2 Battery	LQ2-BAT
LabQuest 2 Stylus (pkg. of 5)	LQ2-STYL-5
For Original LabQuest Only	
Original LabQuest Battery	LQ-BAT
Original LabQuest Stylus (pkg. of 5)	LQ-STYL-5

Cables/Adapters/Power Supplies

Part Name	Order Code
BTA/BTD Cables and Adapters	
Analog Bare Wire Cable	CB-BTA
Digital Bare Wire Cable	CB-BTD
Analog Breadboard Cable	BB-BTA
Digital Breadboard Cable	BB-BTD
Analog Protoboard Adapter	BTA-ELV
Digital Protoboard Adapter	BTD-ELV
Analog Sensor Extension Cable (2 m)	EXT-BTA
Digital Sensor Extension Cable (2 m)	EXT-BTD
For LabPro®	
AC Adapter (for LabPro, CBL 2, or DCU)	IPS
LabPro USB Cable	CB-USB

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Index

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

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Fran Poodry,
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In Customer Service, I take phone orders and answer questions regarding order status. Educators are often on tight budgets; I love helping them get the items they want for their students!

Gladys Lalic,
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