PASCO

Technology Solutions

SPARK LX & LXi

Next gen science devices with apps for data collection and analysis (page 5)

essential SCIENCE

Hands-on labs, equipment and probeware for Physics and Chemistry (pages 6-9)

THE AMAZING

Smart Cart (page 85)

The ultimate tool for your physics lab with built-in sensors that measure force, position, velocity, and acceleration

FREE APP! (page 84)

MatchGraph!™

This software helps students interpret position and velocity.

New!

Building Better Bridges Kit *(page 98)*

SPARK LX & LXi Next Gen Dataloggers

Use these rugged handhelds in the lab or field with PASCO wireless or PASPORT sensors. *(page 5)*

SPARK LX & LXi Charging Stations

With removable partitions, these can be configured to charge all PASCO wireless sensors. *(page 91)*

SPARKvue 4.0 features now include new entry screen, templates, Quick Start labs, and Live Data Bar.
(pages 94-95)

Table of Contents

reimagined
remarkably easy
redesigned

New Wireless Sensors!

Our expanding line of wireless sensors now includes the **Motion Sensor, Optical Dissolved O_2 Sensor, Drop Counter, Rotary Motion, Blood Pressure, 3-Axis Magnetic Field, O_2 Gas,** and **Acceleration/Altimeter**. All our wireless sensors work with your existing classroom technology, and our app is free for iOS®, Android™, and Chrome™.

PASCO... science learning for the digital age

PASCO Scientific has been designing, developing, and supporting innovative teaching and learning solutions for science education since 1964. As the world leader in wireless datalogging technology, software, and curriculum, PASCO is transforming science education. Today teachers and students in over 100 countries use PASCO solutions on their own devices and on their new SPARK dataloggers for physics, biology, chemistry, earth and environmental sciences, programming, and robotics.

877.373.0300 (inside US) 916.462.8383 (outside US)

PASCO Science Solutions

Probeware and Sensing Technology Our innovative sensors, including our award-winning wireless sensors, are low-cost, rugged, and easy-to-use.

Standards-Based Curricula and Labs These support Biology, Chemistry, Earth & Environmental Sciences, Physical Science, and Physics, as well as AP® Biology, AP® Chemistry, and AP® Physics.

Data Collection Software on Your Devices Intuitive SPARKvue works on iOS, Android™, and Chrome™, as well as Mac® and Windows® computers.

Lab Equipment and Apparatus PASCO is the premier developer of tools for your science lab, including our Molecular Modeling Kit, the latest water quality tools, our Smart Cart, and more.

New SPARK LX & LXi ruggedized portable dataloggers These science-dedicated handhelds blend PASCO probeware with SPARKvue data collection and analysis software plus our new Lab Manager application.

Professional Development Our PD is relevant for teachers at all grade levels, is fully customizable, and includes ongoing teacher support.

GESS EDUCATION AWARDS WINNER 2017

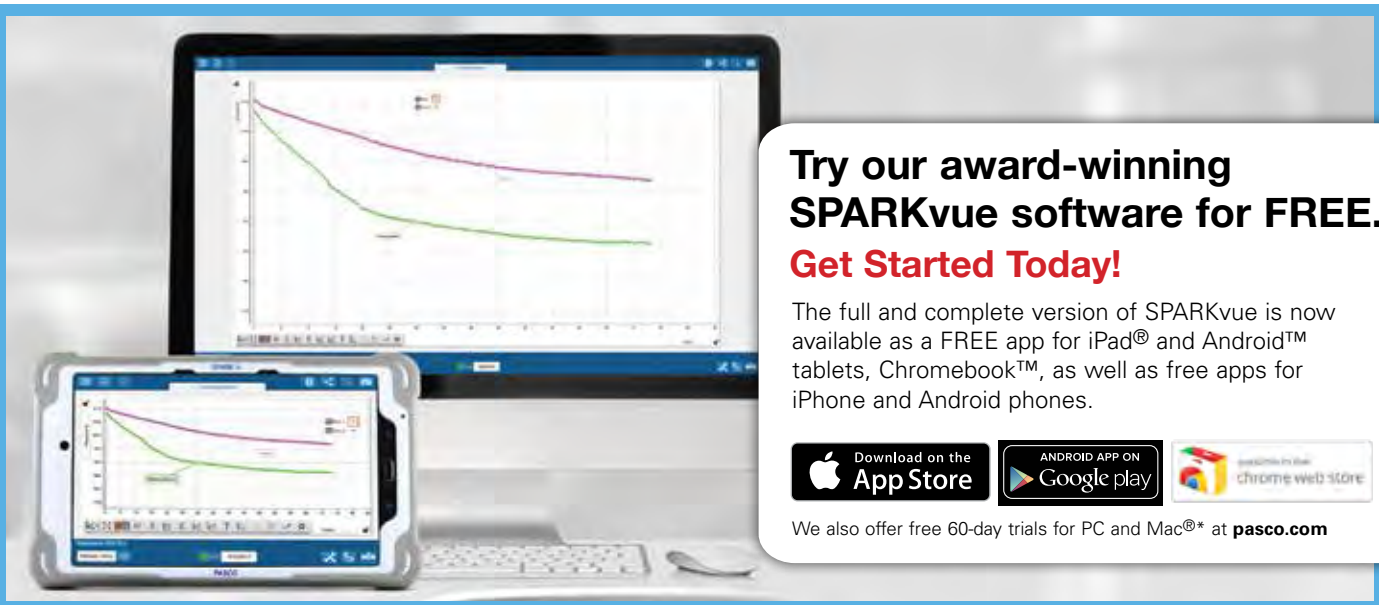
Our award-winning products... Including our Wireless Temperature Sensor, Smart Cart, and Spectrometer.

NEW SPARKvue 4.0

you choose

reimagined
remarkably easy
redesigned

- New Welcome screen allows you to start a new activity or open an experiment, with one click.
- Jump right into most common labs using Templates and Quick Start labs.
- Monitor sensor data without recording using the Live Data Bar.
- Configure, calibrate, and edit sensor properties with Hardware Setup button.
- Share experiment files directly to Cloud services such as Google Drive.



Try our award-winning SPARKvue software for FREE.

Get Started Today!

The full and complete version of SPARKvue is now available as a FREE app for iPad® and Android™ tablets, Chromebook™, as well as free apps for iPhone and Android phones.

Download on the App Store | ANDROID APP ON Google play | chrome web store

We also offer free 60-day trials for PC and Mac®* at **pasco.com**

SPARKvue (single user license)

PS-2401

SPARKvue (site license)

PS-2400

SPARKvue App

Download:

Download on the App Store | chrome web store | ANDROID APP ON Google play

877.373.0300 (inside US) 916.462.8383 (outside US)

SPARK LX & LXi

NEW

PASCO's NEXT GEN SCIENCE DATALOGGERS for indoor and outdoor use

These innovative science handhelds blend PASCO probeware with SPARKvue data collection and analysis software plus our new lab management application: Lab Manager. They are durable, splash-proof, and work seamlessly with our PASPORT and wireless sensors.

Choose from Two Models	SPARK LX PS-3601	SPARK LXi PS-3600
Ruggedized case for indoor/outdoor and wet/dry lab use	✔	✔
9.6" full-color touchscreen	✔	✔
Lab Manager application	✔	✔
Simultaneously connects up to 5 wireless sensors	✔	✔
Includes 2 PASPORT ports		✔
Includes Voltage Probe and port		✔
Includes Temp Probe and port		✔
Can connect more PASPORT sensors with the AirLink, SPARKlink Air, and 550 Universal Interface	✔	✔
Installed software		
PASCO SPARKvue, MatchGraph!, and Spectrometry	✔	✔
Microsoft Office Suite	✔	✔
Google Suite	✔	✔
Hands-free stand	✔	✔

Lab Manager software allows teachers to:

- Monitor student screens (or lock student screens to get students' attention).
- Broadcast teacher or student screens to class.
- Control student devices for guidance.
- Quiz students and view responses in real time.
- Message all student devices.
- Easily send and collect any file to and from student devices.

SPARK LX

PS-3601

Use with PASCO Wireless sensors (or for use with PASPORT sensors + an AirLink, SPARKlink® Air, or 550 Universal Interface). The SPARK LX can simultaneously connect up to five wireless sensors.

Also available:
SPARK LX Charging Station
PS-3603

SPARK LXi

PS-3600

Use with wired and wireless sensors, the SPARK LXi can simultaneously accommodate up to five wireless sensors. It also includes two ports for blue PASPORT sensors, plus two ports for the included Fast Response Temp Probe and the Voltage Probe.

Also available:
SPARK LXi Charging Station
PS-3602

Essential Chemistry and *Essential Physics*

Complete and Affordable Curriculum Solutions for Chemistry and Physics that include Textbook, e-Book, Digital Teacher Edition, and Equipment

877.373.0300 (inside US) 916.462.8383 (outside US)

The *Essential Chemistry and Essential Physics* curricula **cover your state standards** for honors and general chemistry and physics programs.

- **Rigorous yet accessible content**
- **Interactive simulations and equations**
- **Lessons follow the 5E design**
- **Access to the Infinite Test Bank**
- **Award-winning PASCO lab equipment**
- **Works with your LMS and Google Classroom**

Multiplatform

iOS, Android™, Chrome™, Windows®, PC, and Mac®

- ***24/7 online/offline access***
- ***No Internet required***

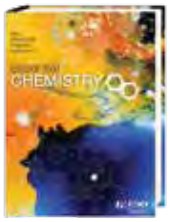
Complete Curriculum Solutions

Both *Essential Physics* and *Essential Chemistry* are affordable curriculum solutions that include a Textbook, e-Book, Digital Teacher Edition, and PASCO's award-winning equipment.

About the Author

Dr. Tom Hsu, former research physicist at MIT, is author of seven science textbooks including *Essential Physics* and *Essential Chemistry*. His teaching methods have been used successfully across the United States since 1991. He also develops physics apparatus that promotes discovery through active hands-on investigations.

Essential Chemistry



Student Textbook

EC-6350

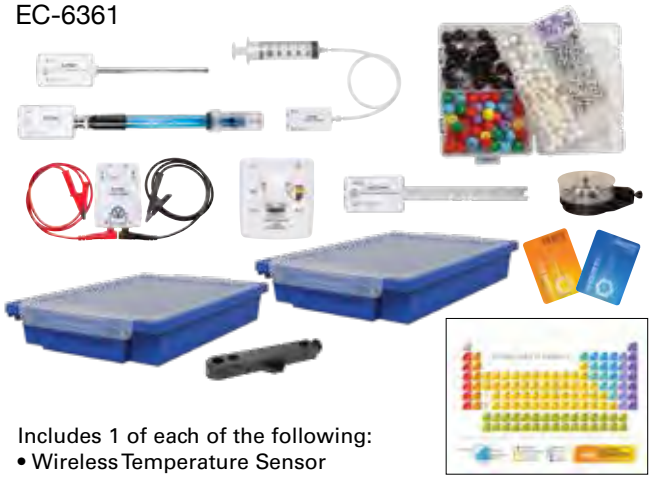
Student e-Book
5-year access
EC-6350-EB5
1-year access
EC-6350-EB1

Teacher Resources

EC-6351

Essential Chemistry Standard Equipment Kit

EC-6361



Includes 1 of each of the following:
- Wireless Temperature Sensor
- Wireless pH Sensor
- Wireless Conductivity Sensor
- Wireless Pressure Sensor
- Wireless Voltage Sensor
- Wireless Colorimeter and Turbidity Sensor
- Molecular Model Set
- Electrode Support
- Condenser
- Periodic Trend Cards
- Spectrum Cards
- Periodic Table
- Gratnells® Storage Case (2)

This equipment kit supports 47 *Essential Chemistry* labs. The other labs in the textbook can be performed using typical equipment found in your chemistry lab.

See pages 30-35 for more *Essential Chemistry* information.

Essential Physics

Student Textbook

EP-6323

Student e-Book
5-year access
EP-6323-EB5
1-year access
EP-6323-EB1

Teacher Resources

EP-6324

Comprehensive Physics Equipment Kit

EP-6490

This comprehensive kit includes:
- Forces and Motion Kit
- Oscillations, Waves, and Sound Kit
- Light, Color, and Optics Kit
- Simple Machines Engineering Kit
- Modular Circuits Kit

Also available:

Standard Physics Equipment Kit EP-3567A

Includes:

Forces and Motion Kit:
- Wireless Smart Cart
- 1.2 m Track
- Dynamics Accessories

Modular Circuits Kit:
- Wireless Current Module
- Wireless Voltage Sensor
- Circuits Modules
- Circuits Accessories

See pages 74-77 for more *Essential Physics* information.

Call your PASCO Education Specialist for more info:
877-373-0300 (inside US) or **916-462-8383** (outside US).

PASCO's Sensor-based Solutions for Biology

Quantifying biological processes can be challenging, but with PASCO sensors, wireless technology, and SPARKvue software, it's easy to collect reliable data. Using PASCO for Biology makes it easy to study topics such as photosynthesis, cellular respiration, enzymatic reactions, diffusion and osmosis, human physiology, and more.

Biology Index

World Class Support & Professional Development

Committed to Your Success

We want you to have all the support, guidance, and training you need. Just let us know how we can help.

For more details, see page 160.

CONTACT US TODAY
pasco.com

The latest sensors for Biology!

Wireless CO_2 Sensor

PS-3208 *(page 15)*

Includes 250-ml sampling bottle and USB charging cable.

Use this wireless sensor to measure the concentration of CO_2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile probe. CO_2 data can be logged directly on the device for long-term life science and environmental science studies.

Wireless Weather Sensor with GPS

PS-3209 *(page 16)*

Includes USB charging cable.

Use this multimeasure sensor to monitor 19 different measurements including common weather, location, and light. Study microclimates, monitor environmental conditions during indoor or outdoor labs, or place the sensor outside for extended monitoring, because of its durable, water-resistant design and internal memory.

Wireless Hand-Grip Heart Rate Sensor

PS-3206 *(page 19)*

Includes hand-grips and Bluetooth® heart rate module with one coin-cell battery.

With these wireless hand grips, conducting physiology labs on the cardiovascular system or homeostasis is easier than ever before. Continuously monitor heart rate during exercise, or use the sensor to take initial and final measurements with fast and reliable heart-rate detection.

Wireless Oxygen Gas Sensor

PS-3217 *(page 22)*

Includes USB charging cable, 250-mL sampling bottle

The Wireless Oxygen Gas Sensor is accurate and easy to use, which makes it the perfect sensor to study photosynthesis, respiration, and oxygen cycling in the environment. With remote logging, simultaneous measurement of humidity and temperature experiments can go beyond the lab period and easily give students hours or days of data for analysis.

Wireless Blood Pressure Sensor

PS-3218 *(page 24)*

Includes Blood Pressure Sensor, standard-size arm cuff, bladder and pressure release valve,

PASCO's new Wireless Blood Pressure Sensor has all the features of our PASPORT Blood Pressure Sensor, with the added convenience of collecting data wirelessly. With this sensor, students can quickly and easily measure both systolic and diastolic arterial blood pressure (mmHg) as well as heart rate (pulse in bpm).

Wireless Optical Dissolved Oxygen Sensor

PS-3224 *(page 21)*

Includes USB charging cable

The Wireless Optical Dissolved Oxygen (DO) Sensor is the perfect solution to monitor DO in the lab or the field. Optical technology is accurate, fast, and does not require flow or calibration. With built-in memory, you can log data for hours or days to capture day/night nutrient cycles and changes in metabolic processes. With the included cover, the sensor has a fully waterproof design and is submersible to 10 m.

FREE Advanced Biology Inquiry Labs for AP® & IB® Courses

available at pasco.com

These advanced biology labs have been redesigned to take advantage of wireless sensors! There are **19** labs available for **FREE** in the **PASCO Digital Library**. The labs are specifically designed to support student inquiry and the College Board AP Biology curriculum framework*.

- Most labs can be completed in 45-minute blocks with readily available materials.
- The flexible format provides teachers and students with guided-inquiry opportunities and scaffolding to successfully move students toward creating experiments of their design.
  1. *Structured:* Initial introduction includes step-by-step procedure, questions, and analysis.
  2. *Guided:* A set of questions for students to design a lab and organize their planning process
  3. *Open:* Includes Student Experiment Planning worksheet to organize, plan, and enable quick teacher assessment.
- Easy and meaningful data collection leads to increased time for data analysis and open inquiry. Labs integrate high-order analysis questions and synthesis questions.
- Includes sample data for investigations and inquiry, answers to analysis and synthesis questions, an assessment rubric, teacher tips and lab preparation information, and more.

These labs are available for **FREE** in the **PASCO Digital Library**. Each lab includes an editable student lab, SPARKvue configuration file, and teacher notes with lab prep.

Experiment	Wireless Sensors									AP® Big Ideas*	IB® Standards**
	CO_2 Gas	Temperature	Pressure	pH	Conductivity	Colorimeter	Weather/GPS	Oxygen	Ethanol		
1. Enzyme Activity			●					▲		1, 2, 4	2.5
2. Diffusion				●	▲					2	1.4, 10.3
3. Osmosis						●				2, 3	1.4
4. Plasmolysis					●					2	1.4
5. Cell Size					●					1, 2	1.1
6. Homeostasis		●								3, 4	N/A
7. Cellular Respiration	●							▲		1, 2, 4	2.8
8. Fermentation								▲	●	2, 4	2.1, 2.8
9. Photosynthesis	●						▲	▲		2, 4	2.9
10. Plant Pigments						●				2, 4	2.9
11. Transpiration			●				●			2, 4	9.1
12. Energy Dynamics	●						▲	▲		2, 4	4.2
13. Artificial Selection				▲	▲		▲			1	N/A
14. Mitosis				▲	▲					3	1.6
15. Meiosis	*No sensors required.*									3	3.3, 10.1
16. BLAST Bioinformatics										1	3.1, B.5
17. Population Genetics										1	10.3
18. Mathematical Modeling of Evolution										1	10.3
19. Animal Behavior										2, 4	A.4

● **Required for use in this experiment.**
▲ **Suggested for student inquiry.**

* AP is a registered trademark of the College Board, which was not involved in the production of, and does not endorse, this product.

**IB is a registered trademark of the International Baccalaureate Organization, which was not involved in the production of, and does not endorse, this product. Students in Group 4 Experimental Sciences are required to use datalogging in an experiment and software for graph plotting.

Advanced Biology through Inquiry Teacher Guide

PS-2852

Includes a printed manual and an electronic version. Manual contains detailed teacher version complete with guided inquiry lab activities, suggested answers, and much more. Electronic version contains a PDF of the full teacher edition and an editable MS Word version of student handouts.

FREE General Biology & Physiology Lab Activities

available at pasco.com

These general biology labs have been redesigned to take advantage of wireless sensors. The labs are **FREE** to download in the **PASCO Digital library**. They include an editable student lab, SPARKvue configuration files, and teacher notes with prep instructions. Each lab gives students critical background information, a structured-inquiry procedure, analysis questions, and inquiry extensions.

	Wireless Sensors							
Experiment	CO_2 Gas	Temperature	Pressure	pH	Conductivity	Colorimeter	Weather/GPS	Oxygen
Biology								
Energy Content of Food		●						
Buffers in Biological Systems				●				
Membrane Permeability				●				
Osmosis			●					
Cellular Respiration in Yeast								●
Plant Respiration and Photosynthesis	●							
Respiration of Germinating Seeds	●							
Photosynthesis of Aquatic Plants								●
Water and pH				●	●			
Organisms and pH				●				
Acid Rain				●				
Metabolism of Yeast	●							
Soil pH				●				
Transpiration			●					
Water Purification				●	●			
Weather in a Terrarium							●	

	Wireless Sensors				Requires AirLink	
	Temperature	Hand-Grip Heart Rate	Pressure	Blood Pressure	Spirometer	EKG
Physiology						
EKG: Factors That Affect the Heart						●
Exercise and Heart Rate		●				
Muscle Fatigue			●			
Regulation of Body Heat	●					
Volume of Breath					●	
Blood Pressure				●		

Prefer to order a printed manual?

Biology through Inquiry Teacher Resources

PS-2870C

The electronic content includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more.

SPARK LX

PS-3601

Use with PASCO wireless sensors (or for use with PASPORT sensors + an AirLink, SPARKlink® Air, or 550 Universal Interface). The SPARK LX can simultaneously connect up to five wireless sensors.

SPARK LXi

PS-3600

Use with wired and wireless sensors, the SPARK LXi can simultaneously accommodate up to five wireless sensors. It also includes two ports for blue PASPORT sensors, plus two ports for the included Fast Response Temp Probe and the Voltage Probe.

Biology Solutions

The tools you need to teach the free digital labs for Biology

Wireless Biology Starter Bundle

PS-7614

1. Wireless CO_2 PS-3208
2. Wireless Temp PS-3201
3. Wireless pH PS-3204
4. Wireless Pressure PS-3203

Advanced Biology Extension Bundle

PS-7615B

1. Wireless Weather with GPS PS-3209
2. Wireless Optical Dissolved Oxygen Sensor PS-3224
3. Wireless Conductivity PS-3210
4. Wireless Colorimeter and Turbidity PS-3215*
5. EcoChamber ME-6667

* **WARNING!** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Physiology Extension Bundle *(allows you to perform all the physiology labs in the teacher guide)*

PS-2935C

1. Wireless Hand-Grip Heart Rate PS-3206
2. EKG Sensor PS-2111
3. Spirometer PS-2152
4. Spirometer Mouth Pieces PS-2522
5. Wireless Blood Pressure PS-3218

Wireless Sensor Storage Trays for:

Temperature/pH/Conductivity Sensors
PS-3585

Pressure Sensors
PS-3586

Colorimeter & Turbidity Sensors
PS-3587

Voltage & Current Sensors
PS-3588

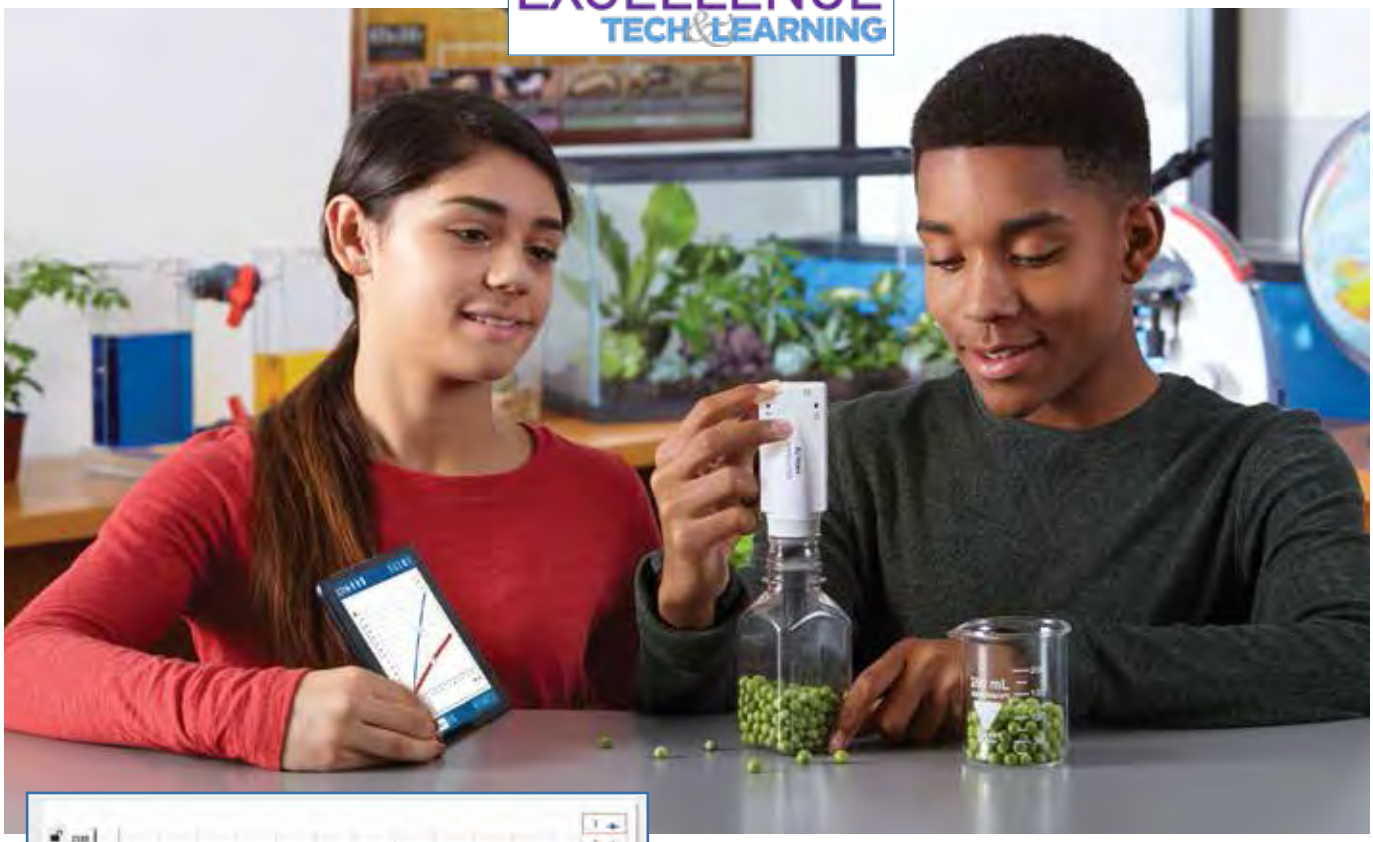
Each storage tray holds up to ten sensors; sensors sold separately.

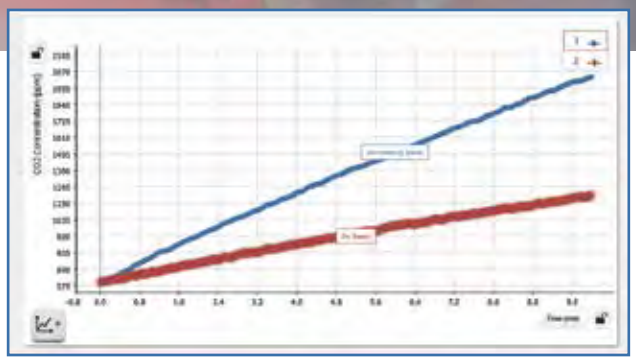
Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Wireless CO_2 Sensor

PS-3208

2017 AWARDS of EXCELLENCE TECH & LEARNING





Compare the respiration rate of germinating and dry seeds.

Use this wireless sensor to measure the concentration of CO_2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile sensor. CO_2 data can be logged directly on the device for long-term studies and monitoring.

Wireless CO_2 Sensor

PS-3208

Includes 250-ml sampling bottle and USB charging cable.

Dissolved CO_2 Waterproof Sleeve

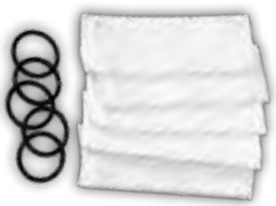
PS-3545

The Wireless CO_2 Sensor can be equipped for aqueous measurements using this semipermeable sleeve. The sleeve is waterproof but allows CO_2 gas to pass through the membrane, creating a headspace around the sensor. Monitor photosynthesis and respiration of aquatic plants or animals with the sample bottle or with other chambers. (Please note: Improper use will void sensor warranty.)

Dissolved CO_2 Waterproof Sleeve

PS-3545

Includes 5 sleeves and 5 O-rings



Wireless Weather Sensor with GPS

PS-3209 *Includes USB charging cable.*

Here is an all-in-one instrument for monitoring environmental conditions. By incorporating several sensing elements into a single unit, this wireless sensor provides up to **19 different measurements!** Use it in logging mode with the Weather Vane Accessory for long-term monitoring, or use it as a handheld instrument to study microclimates and record ambient conditions relevant to many biological and environmental phenomena.

Measurements

Weather
1. Ambient Temperature
2. Barometric Pressure
3. Wind Speed
4. Wind Direction (true)
5. Relative Humidity
6. Absolute Humidity
7. Dew Point
8. Wind Chill
9. Heat Stress Index

Light
10. Ambient Light (lux)
11. UV Index
12. PAR
13. Irradiance

GPS
14. Latitude
15. Longitude
16. Altitude
17. Speed
18. Magnetic Direction
19. True Direction

Specifications:

Battery: Rechargeable lithium polymer
Please see pasco.com for detailed specifications.

Weather Vane Accessory

PS-3553

Includes tripod, tripod adapter, and weather vane.

Equip your Wireless Weather Sensor for extended environmental monitoring with the Weather Vane Accessory. Once deployed the sensor will freely rotate to capture wind speed and direction, whether you are monitoring data in real time or using the sensor in logging mode to capture hours (or days!) of data for later analysis.

Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable.

Weather Vane Accessory

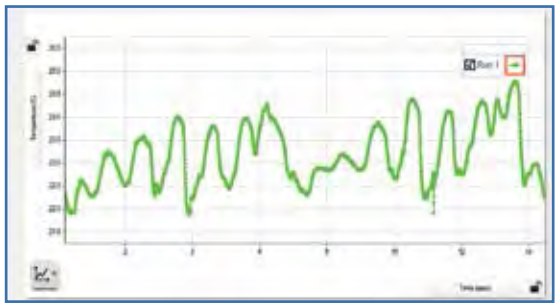
PS-3553

Includes tripod, tripod adapter, and weather vane.

Wireless Temperature Sensor

PS-3201

Welcome to the modern thermometer. With its waterproof, rugged design, this sensor functions in the lab or out in the field. Study evaporative cooling, homeostasis, monitor a water bath, or store weeks of environmental data on the sensor with this one device.



Monitoring ambient temperature in a classroom terrarium over two weeks with datalogging

The versatile Wireless Temperature Sensor works well, both in the lab and out of doors.

Specifications:

Range: -40°C to 125°C
Resolution: 0.05°C
Accuracy: 0.5°C
Waterproof: IP-X7 (1 m for 30 min)
Battery: Coin cell (expected life >1 yr)

Wireless Temperature Sensor

PS-3201

Includes 1 coin cell battery.

Wireless Colorimeter and Turbidity Sensor

PS-3215

The Wireless Colorimeter simultaneously measures the absorbance and transmittance of six different wavelengths. The sensor can be used to study enzyme activity, photosynthesis, and the rates of chemical reactions.

By using the accessory cuvettes and a calibration standard, the colorimeter also functions as a turbidimeter for water quality analysis.

Specifications:

Color detection/peak wavelengths detected: 650 nm (red), 600 nm (orange), 570 nm (yellow), 550 nm (green), 500 nm (blue), 450 nm (violet)
Detector ranges: +25 nm from peak
Absorbance: 0-3 Abs units; useful range (0.05 -1.5 Abs)
Transmittance: 0-100%
Turbidity range: 0-400 NTU
Accuracy: ±5% NTU

Wireless Colorimeter and Turbidity

PS-3215

Includes USB charging cable, 9 cuvettes, 2 cuvette racks, and one 100 NTU calibration cuvette.

WARNING! This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Cuvette Rack

EC-3590

A small rack that is used to hold the 3.5 mL cuvettes used with the Wireless Colorimeter and Turbidity. Avoid spills and messes and help organize activities using multiple samples.

Cuvettes and Caps

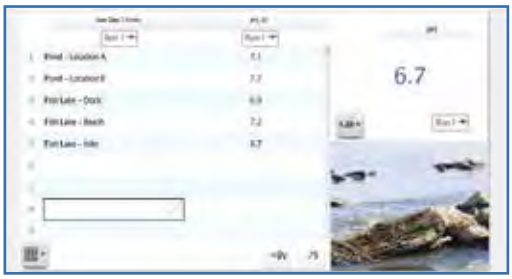
SE-8739

A set of 100 identical 3.5 mL polystyrene cuvettes and caps. Replacement Cuvettes and Caps for the Wireless Colorimeter and Turbidity. Includes 100 cuvettes and 100 caps. T

Wireless pH Sensor

PS-3204

Here's the best tool for measuring pH since litmus paper. Students can quickly obtain accurate pH readings but also log data to their connected device and even program the sensor to collect data autonomously for hours or weeks. Use the sensor to study water quality, environmental monitoring, test solutions, and monitor chemical reactions.



Measure the pH in the lab or field.

Specifications:

Range: 0-14 pH units
Resolution: 0.02 pH
Accuracy: 0.1 pH units
Water-resistance: IP-X7 (1 m for 30 min)
Battery: Coin cell (expected life >1 yr)

With the Wireless pH Sensor, students can collect data anywhere!

Wireless pH Sensor

PS-3204

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

Electrode Support

PS-3505

Wireless Conductivity Sensor

PS-3210

Use the Wireless Conductivity Sensor to measure the electrical conductivity or Total Dissolved Solids (TDS) of a solution. Investigate diffusion, osmosis, chemical reactions, and monitor water quality.

Specifications:

Range: 0 to 20,000 µS/cm
Accuracy: ±10% of value from 200 µS/cm to 20,000 µS/cm
Resolution: 0.1 µS/cm
Battery: Coin cell (expected life >1 yr)
Waterproof: IP-X7 (1 m for 30min)
Temperature compensated

Wireless Conductivity Sensor

PS-3210

Includes 1 coin cell battery.

Wireless Pressure Sensor

PS-3203

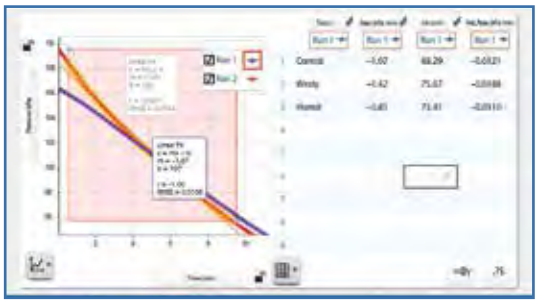
With the new Wireless Pressure Sensor you can make accurate and consistent measurements of gas pressure, and explore transpiration, enzyme activity, osmosis and more!

Features

- Measures pressure even when the pressure within the system drops below ambient pressure.
- Supports common units (kPa, atm, psi, mmHg, or N/m2) for many applications.
- Features Bluetooth® wireless connectivity and long-lasting rechargeable battery.

Specifications:

Range: 0-400 kPa
Resolution: 0.1 kPa
Accuracy: 2 kPa
Battery: Rechargeable



Investigate transpiration under different conditions using a potometer setup

Wireless Pressure Sensor

PS-3203

Includes 2 feet of polyurethane plastic tubing, 1 tube connector, 2 male barbed luer locks, 1 female barbed luer lock, 1 60cc syringe, a lithium-ion battery, and a USB cable.

Wireless Light Sensor

PS-3213

The Wireless Light Sensor is a great addition to any biology lab to study the relationship between light intensity or color and photosynthetic activity, transpiration, or investigate UV radiation. This single sensor has two different detectors for a variety of applications and measurements: Spot Detector (measures red, green, blue, and white relative intensities) and Ambient Detector (measures Illuminance/lux), UVA, UVB, UV index, solar PAR, and solar irradiance).

Specifications:

Spectral response: 300 nm to 1100 nm
Range: 0–130,000 lux
Battery: Coin cell (expected life >1 yr)

Monitor light conditions when investigating photosynthesis, transpiration, and more!

Wireless Light Sensor

PS-3213

Includes 1 coin cell battery.

Wireless Hand-Grip Heart Rate and Exercise Heart Rate Sensors

Using the new wireless Hand-Grip Heart Rate Sensor, it's easier than ever before to conduct physiology labs on the cardiovascular system or homeostasis. Use this sensor for a quick and easy way to acquire wireless measurement for either continuous monitoring or initial vs. final data points. When the activity requires students to use their hands, the Wireless Exercise Heart Rate Sensor has a chest strap and will transmit data wirelessly up to 10 m away!

Wireless Hand-Grip Heart Rate Sensor

PS-3206

Includes hand-grips and Bluetooth® Heart Rate Module with one coin-cell battery.

Wireless Exercise Heart Rate Sensor

PS-3207

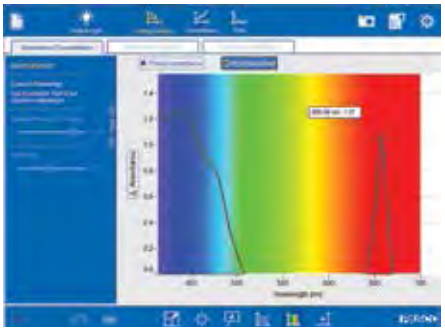
Includes Bluetooth® Heart Rate Module with one coin-cell battery and chest strap (M-XXL).

Award-Winning Wireless Spectrometry

for iOS®, Android™, Chrome*, PC, and Mac®

Wirelessly measure intensity, absorbance, transmittance, and fluorescence. The Bluetooth® and USB connectivity enable use with your tablets and computers, which makes this a powerful and intuitive tool for your spectrometry needs.

*Go to **pasco.com/compatibility** to see our ever-expanding list of supported Chromebooks™.



Absorbance spectrum of chlorophyll

Perform these labs with the PASCO Spectrometer:

- Photosynthesis with DPIP
- Absorption spectra of plant pigments
- Concentration of proteins in solution
- Rate of an enzyme-catalyzed reaction
- Growth of a cell culture

Specifications:

- Bluetooth® and USB connectivity
- 2–3 nm FWHM resolution
- 380–950 nm range
- 2 fluorescence excitation wavelengths at 405 nm and 500 nm
- LED-boosted tungsten light source

winner! 2016 AWARDS OF EXCELLENCE TECH & LEARNING

//CODiE// 2017 SIIA CODiE WINNER

bett AWARDS 2017 FINALIST

The PASCO Spectrometer comes with **PASCO's FREE Spectrometry software.**

- Windows® and Mac® versions included with purchase.
- FREE for iOS®, Android™ , and Chrome™.
- Designed specifically for introductory spectrometry experiments.

Wireless Spectrometer

PS-2600

Includes Wireless Spectrometer, 10 cuvettes, and Spectrometry software.

Also available:

Optional Fiber Optic Cable
PS-2601

Cuvettes & Caps
SE-8739

Cuvette Rack
EC-3590

877.373.0300 (inside US) 916.462.8383 (outside US)

Wireless Optical Dissolved Oxygen Sensor

PS-3224

The Wireless Optical Dissolved Oxygen (DO) Sensor is the perfect solution to monitor DO in the lab or the field. Optical technology is accurate, fast, and does not require flow or calibration. With built-in memory, you can log data for hours or days to capture day/night nutrient cycles and changes in metabolic processes. With the included cover, the sensor has a fully waterproof design and is submersible to 10 m.

Perform these labs with the sensor:

- Photosynthesis, respiration, and fermentation
- Monitor water quality
- Measure net primary productivity
- Model ecosystems

Specifications:

Bluetooth® and USB connectivity

Response Time: 90% in 25 sec

Operating Temperature: 0–50°C

Range: 0–20 mg/L or 0–300% saturation
Reports solution temperature and ambient pressure

Accuracy: ±0.2 mg/L or 1% (whichever is greater) with user calibration; ±0.5 mg/L or 3% (whichever is greater without user calibration; >200% saturation ±10%

Wireless Optical Dissolved Oxygen Sensor

PS-3224

Includes USB charging cable

Wireless Optical Dissolved Oxygen Metal Guard

PS-3604

This stainless steel metal guard has been designed to protect the sensor cap and make the sensor sink. It threads easily onto the Wireless Optical Dissolved Oxygen Sensor, can withstand use in marine environments, and is strongly recommended for field applications. *(This metal guard is not compatible with our PASPORT DO sensors.)*

Wireless Optical Dissolved Oxygen Sensor Cap

PS-3605

Here is a replacement sensor cap for the Wireless Optical Dissolved Oxygen Sensor. It includes a calibration coefficient. *(This sensor cap is not compatible with our PASPORT DO sensors.)*

Wireless Temp/pH/Conductivity Sensor Storage Trays

Make lab management easy and efficient with PASCO's Wireless Sensor Storage Trays. Each Gratnells® tray stores up to 10 wireless sensors; sensors sold separately.

Wireless Sensor Storage Trays for:

Temperature/pH/Conductivity Sensors
PS-3585

Pressure Sensors
PS-3586

Colorimeter & Turbidity Sensors
PS-3587

Voltage & Current Sensors
PS-3588

Each storage tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Using Gas Sensors to Study Photosynthesis and Respiration

The Wireless CO_2 Sensor (on page 15) and the Wireless Oxygen Gas Sensor are ideal for photosynthesis experiments, respiration, and fermentation. Both provide high resolution and accuracy and are simple to use, not only with the Metabolism Chamber, but also with the EcoZone™ System or your own enclosure.

The study of cellular respiration becomes richer when students directly measure both carbon dioxide gas and oxygen gas data and see the relationship graphed in real time.

See all the details about the Wireless CO_2 Sensor on page 15.

Wireless Oxygen Gas Sensor

NEW

The Wireless Oxygen Gas Sensor is accurate and easy to use, which makes it the perfect sensor to study photosynthesis, respiration, and oxygen cycling in the environment. With remote logging, simultaneous measurement of humidity and temperature experiments can go beyond the lab period and easily give students hours or days of data for analysis.

Wireless Oxygen Gas Sensor

PS-3217

Includes USB charging cable, 250-mL sampling bottle

Wireless CO_2 Sensor

PS-3208

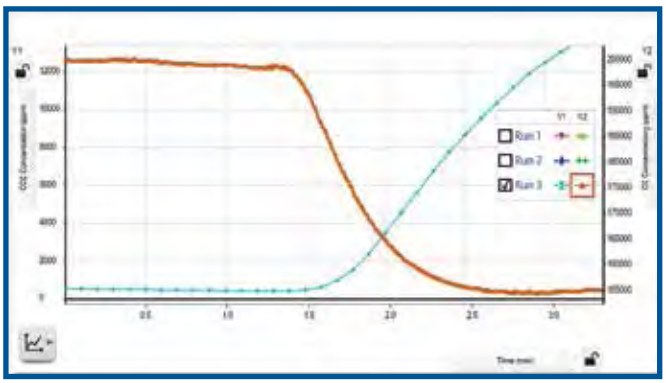
Includes 250-ml sampling bottle and USB charging cable.

Also available:

Dissolved CO_2 Waterproof Sleeve PS-3545

Get the full picture on cellular respiration.

Because of their small size, germinating peas are ideal to use to study cellular respiration. To give a full representation of the activity of the peas, both a CO_2 Sensor and an Oxygen Gas Sensor will be used. The resulting graphs will be analyzed by students who can then explain the changes in the concentrations of each gas.



Use the Metabolism Chamber to study cellular respiration and monitor CO_2 and O_2 simultaneously.

Ethanol Sensor

PS-2194

Includes PTFE tape for membrane replacement.

Make all your sensors wireless.

AirLink

PS-3200

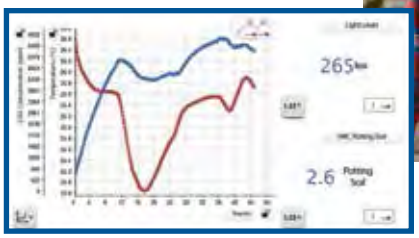
Includes one PASPORT sensor port, USB and Bluetooth connectivity, and USB cable.

EcoZone™ System

Create and monitor your own ecosystems.

The PASCO EcoZone™ System consists of three chambers that can be interconnected or used independently. Because the system remains closed and is designed to accommodate PASCO sensors, students will collect accurate data with minimal impact on the ecosystem.

Use the traditional terrestrial, aquatic, and decomposition arrangement to create your unique ecosystem and collect the data you want. The openings within the chambers allow air to circulate between the chambers, and the included cord efficiently wicks water and ions between the chambers.



Students observe carbon cycling in the EcoZone, which is taking place through photosynthesis, decomposition, and respiration.

Features

- Connect three chambers to model interactions between environments (e.g., terrestrial, aquatic, and decomposition chamber).
- Add small animals such as insects or annelids to see how nutrient cycling is altered.
- Outfit each chamber with three (or more!) sensors.
- Here's an excellent way to model nutrient and energy cycling and engage students in inquiry.

EcoZone™ System

ME-6668

Includes 3 EcoChambers, tray, rubber stoppers, syringe, plastic tubing and wicking cord.

Photosynthesis Tank

With this tank, students can measure the dissolved oxygen content in the environment of an aquatic plant, thereby directly measuring its photosynthetic activity. Water in the outer tank is used to control fluctuations. Turning the light on and off creates an easily analyzed graph in real-time, showing the relationship between light and the rate of oxygen production. Students can further their understanding of photosynthetic rates by adding dyes as colored filters.

Photosynthesis Tank

PS-2521B

Includes Photosynthesis Tank, large #14 stopper with sensor ports, and 2 small #3 stoppers.

EcoChamber

The sturdy design of PASCO's EcoChamber makes it a versatile, easy-to-use, easy-to-clean science learning tool. It is an acrylic chamber specially designed to accommodate up to three PASCO sensors so that students can model and understand the workings of an ecosystem. In addition to being used as a fermentation chamber, it can serve to conduct larger scale photosynthesis and respiration experiments.

Metabolism Chamber

ME-6936

Includes 250 mL sampling bottle with cap.

Also available:

Metabolism Chamber
4-pack
SE-6938

Includes four 250 mL sampling bottles with caps.

EcoChamber

ME-6667

Includes EcoChamber tank with lid, 7 stoppers of various sizes, 5 probe stoppers, syringe and plastic tubing with connector.

Wireless Blood Pressure Sensor

PS-3218

PASCO's new Wireless Blood Pressure Sensor has all the features of our PASPORT Blood Pressure Sensor, with the added convenience of collecting data wirelessly. With this sensor, students can quickly and easily measure both systolic and diastolic arterial blood pressure (mmHg) as well as heart rate (pulse in bpm). Students gain a contextual understanding of the physiology of blood pressure, as they compare the digits display for systolic and diastolic pressure with the display of blood pressure from the real-time graph.

A clear and easy way to observe heart rate plus systolic and diastolic blood pressure.

Typical Applications

- Determine the effects of exercise on blood pressure and heart rate
- Compare the blood pressure and heart rate of different students in the class
- Explore the effects of body position on blood pressure and heart rate

Not only can students quickly measure systolic and diastolic pressure, but they learn the actual concepts behind blood pressure measurement.

Wireless Blood Pressure Sensor

PS-3218

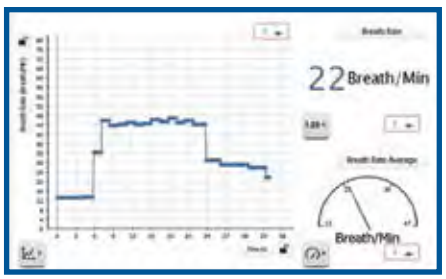
Includes Blood Pressure Sensor, standard-size arm cuff, bladder and pressure release valve.

Also available:

Small Blood Pressure Cuff
PS-3591
Standard Blood Pressure Cuff
PS-3592
Large Blood Pressure Cuff
PS-3593

Breath Rate Sensor

The Breath Rate Sensor measures breathing rate by detecting the air pressure in a mask worn by the student and measuring the time between exhalations. The sensor has two modes: one reading for every breath, and one for a running average over the last four breaths.



Student's breath rate before, during, and after exercise

With the Breath Rate Sensor, students can use a sensor instead of simply counting the number of breaths per minute.

Breath Rate Sensor

PS-2187

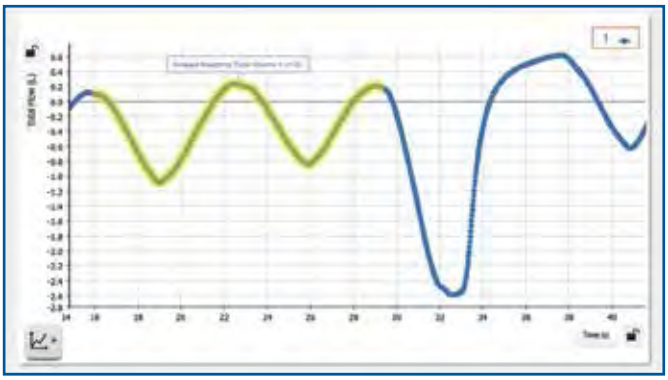
Includes 10 masks and 10 clips

Also available:

Replacement Masks (10 pack)
PS-2567
Replacement Clips (10 pack)
PS-2568

Spirometer Sensor... test your lung power and learn about the respiratory system.

With the Spirometer Sensor students can collect accurate airflow data from a pulmonary function test and create graphs to measure airflow, pressure, duration, and lung volume. The mouth piece and sensor are designed for safely and accurately measuring both airflow out (expiration) and airflow in (inspiration). Compare airflow before and after exercise or even determine total lung capacity.



The volume of the lungs increases when inhaling air into the lungs.

A student uses the spirometer to measure his lung volume. He observes the difference in the volume of his lungs when breathing normally vs. forced breathing.

Spirometer

PS-2152

Includes 2 disposable mouth pieces

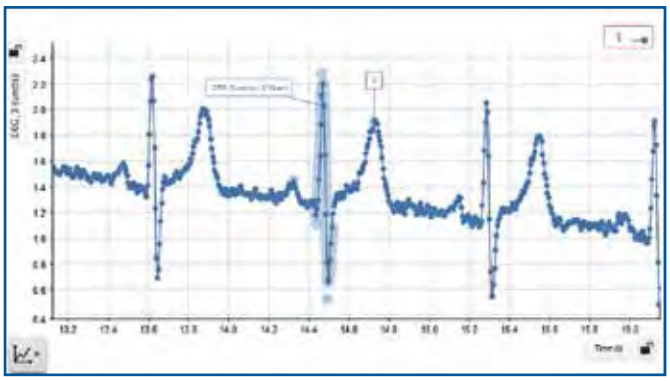
Also available:
Replacement Mouth Pieces (10)
PS-2522

Measure EKG in a heartbeat

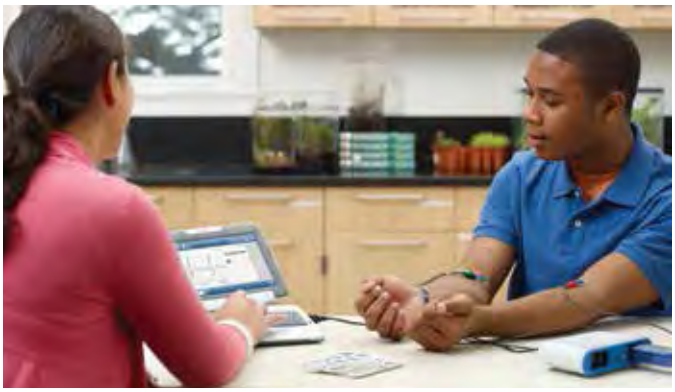
Take the mystery out of an EKG test by letting students measure and record the electrical signals produced by the heart. Students can use this sensor measure their heart rate, and then explore the effects mild exercise has on heart rate.

The Teaching Advantage

- Three-electrode design is easy to use.
- Electrodes are contained in disposable stick-on pads, eliminating the need for messy gels.



Clear data helps students better understand the electrical signals of the heart.



Easy setup and quick data collection make it possible for students to see their heartbeat in a class period.

EKG Sensor

PS-2111

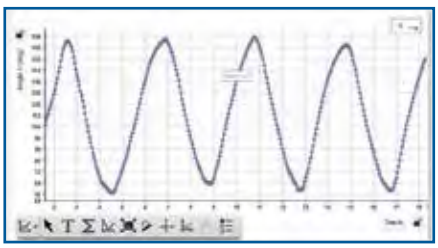
Includes 100 self-adhesive electrode patches.

Also available:
EKG Sensor Electrode Patches (100-pack; one-year shelf life)
CI-6620

Goniometer Sensor

Use the Goniometer Sensor to study how arms and legs move. Compare normal motion to that of moderate exercise and athletic activity. Use it with a force sensor to analyze energy expenditure when lifting weights or climbing stairs. Sensor simply straps on with Velcro®, making it easy to put on and take off.

See every flex and extension as your students become part of the experiment.



Measure the extent of movement and changes in velocity during normal actions.

Goniometer Sensor

PS-2137

Includes an Angle Sensor and 1 Goniometer Probe with Velcro® connection kit.

Measure two joints simultaneously. Just add an additional probe:

Goniometer Probe PS-2138

Includes probe and Velcro® connection kit.

Human Arm Model

The Human Arm Model simulates the muscles and motion of an actual human arm. To activate the arm motion, students pull on the cord with a Force Sensor. Changes in position are measured at the shoulder and elbow using the two built-in potentiometers plugged into one Angle Sensor (PS-2139), included with PS-2611.

Human Arm Model

PS-2611

Includes Human Arm Model and Angle Sensor PS-2139

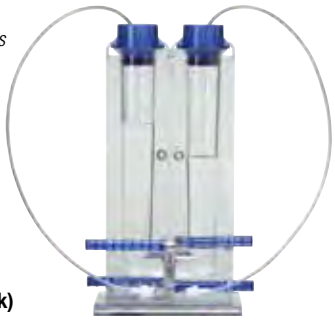
Diffusion/Osmosis Kit

While every biology student has seen a U-shaped tube with a permeable membrane separating a hypotonic and hypertonic solution, few have actually used this simple and elegant design for lab work. The Diffusion/Osmosis Kit contains the apparatus and a Dual Pressure Sensor that allow students to explore the rate of water movement. Students can quantify pressure changes accurately and easily compare solute concentration at the end of the experiment.

Diffusion/Osmosis Kit

ME-6942

Includes Diffusion/Osmosis Apparatus (20 membranes and mounting stud), Dual Pressure Sensor PS-2181, tubing and connectors.



Also available:

Diffusion/Osmosis Apparatus (no sensor) ME-6940

Replacement Membranes (20-pack) ME-6941

Wireless Temperature Link

PS-3222

Includes Fast Response Temperature Probe

The Wireless Temperature Link enables wireless connection for any PASCO temperature probe with a 3.5 mm connection. The link comes with a Fast Response Temperature Probe, but it can also connect to the Stainless Steel Temperature Probe, Skin/Surface Temperature Probe, the Absolute Zero Sphere, and the Ideal Gas Law Apparatus.

Microscope Cameras & Microscopes

PASCO's excited to provide a new line of microscopy equipment for your classroom or lab. With the addition of several new products, we've got a solution to meet your needs, whether you're looking to upgrade existing equipment or add digital microscopes.

Moticam X3 with WiFi

SE-6205

The Moticam X3 is a WiFi camera that can connect to any platform for maximum portability and flexibility.

Moticam 3+ USB

SE-6204

The Moticam 3+ provides high-resolution options with a USB connection for Windows, Mac, and Chromebook.

LED Microscope with Detachable

SE-6203

The LED microscope with detachable tablet provides 40–1000x magnification with a built-in 7 in tablet that can wirelessly share images with other devices. Here's the perfect solution for general biology lab stations and teacher demos.

For more microscope information, go to ***pasco.com/microscopes***

SPARKvue 4.0 Is Here!

SPARKvue is PASCO's award-winning data collection and analysis software. New features include:

- The new Welcome screen allows you to start a new activity or open an experiment, with one click.
- Jump right into most common labs using Templates and Quick Start labs.
- Monitor sensor data without recording using the Live Data Bar.
- Configure, calibrate, and edit sensor properties with new Hardware Setup button.
- Share experiment files directly to Cloud services such as Google Drive.

SPARKvue's digital imaging capabilities support a wide variety of USB imaging devices including webcams and **ken-a-vision® digital** microscopes. Use with your Mac®, Windows®, iOS, Android™ and Chromebook™ devices and get all the advantages of digital microscopy. No need for your students to learn a new software just for microscopy. They can collect sensor data and capture and analyze images, all in SPARKvue.

- Make measurements right on the screen.
- Use digital zoom for even more magnification.
- Add labels using the text tool.
- Annotate, highlight, and more!

Award-winning SPARKvue is available for download at pasco.com/sparkvue or ***get the app for free:***

Download on the App Store | ANDROID APP ON Google play | chrome web store

SPARKvue (single user license)

PS-2401

SPARKvue (site license)

PS-2400

See the latest SPARKvue 4.0 features on pp. 94-95.

PASCO's Sensor-based Solutions for Chemistry

PASCO now has a complete Chemistry curriculum: *Essential Chemistry*! All our Chemistry solutions combine inquiry-based, hands-on activities with the latest educational technology tools to keep students engaged and increase science literacy. From our wireless sensors to the intuitive SPARKvue software, data collection and analysis have never been easier or more meaningful.

Chemistry Index

Essentials for Chemistry you can't do without!

Wireless pH Sensor

PS-3204 (page 38)

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

Instantly collect pH data with this wireless sensor. Use the probe to test household solutions, perform high-resolution acid-base titrations, or study water quality.

Perform these labs with the Wireless pH Sensor:

- **Explore acid-base titrations**
- **Investigate the chemistry of buffers**
- **Monitor water quality**

Wireless Colorimeter and Turbidity

PS-3215 (page 40)

Includes USB charging cable, 9 cuvettes, 1 Turbidity Calibration Standard, and 2 cuvette racks.

The Wireless Colorimeter and Turbidity Sensor simultaneously measures the absorbance and transmittance of six different wavelengths. The colorimeter can be used to study colored solutions, concentrations, and the rates of chemical reactions. The colorimeter can also function as a turbidimeter for water quality analysis.

Wireless Drop Counter

PS-3214 (page 39)

NEW

Includes Drop Dispenser and Micro Stir Bar plus a Stainless Steel Sensor rod for easy attachment to ring stand.

Use the new Wireless Drop Counter for more efficient and accurate titration data. Conducting a titration has never been easier!

Wireless Temperature Sensor

PS-3201 (page 42)

Includes 1 coin cell battery.

This durable, high-resolution sensor covers many temperature experiments. From chemical changes to thermochemistry, this is a lab essential. Real-time temperature measurements can be tracked in a graph, table, or digits display.

Perform these labs with the Wireless Temperature Sensor:

- **Explore heats of reaction and solution**
- **Study the evidence of a chemical reaction**
- **Investigate varying reaction rates**

winner! 2016 AWARDS EXCELLENCE TECH&LEARNING

See PASCO's New *Essential Chemistry* Curriculum on pages 30-33.

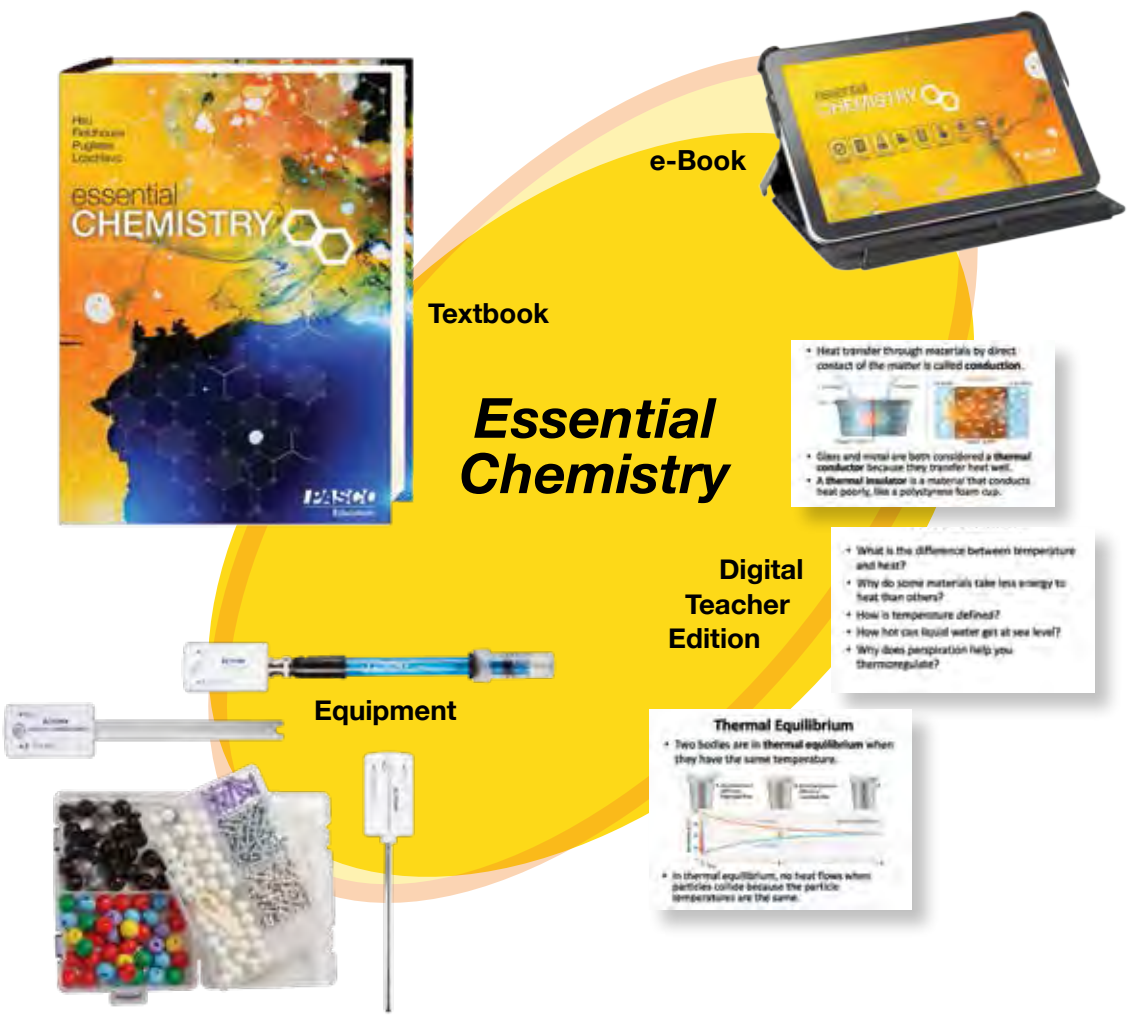
Essential Chemistry Curriculum

This complete chemistry solution includes Textbook, e-Book, Digital Teacher Edition, and Equipment!

Essential Chemistry is a comprehensive, full-color textbook paired with PASCO equipment. It is the only interactive e-Book for chemistry on the market. The program includes over 100 interactive visualizations and tools that increase student engagement and understanding. *Essential Chemistry* is focused on practical applications that connect students to the chemistry of nature as well as technology.

About the program:

- Rigorous yet accessible design
- Interactive simulations and equations
- Lessons follow the 5E design
- Strong mathematics scaffolding
- Formative and summative assessment tools
- Differentiation for advanced, below-level, and ELL students
- Works with your LMS and Google Classroom
- Includes 24/7 online/offline access. No Internet required!



Essential Chemistry is multiplatform: iOS, Android™, Chrome™, Windows®, PC, and Mac®!

877.373.0300 (inside US) 916.462.8383 (outside US)

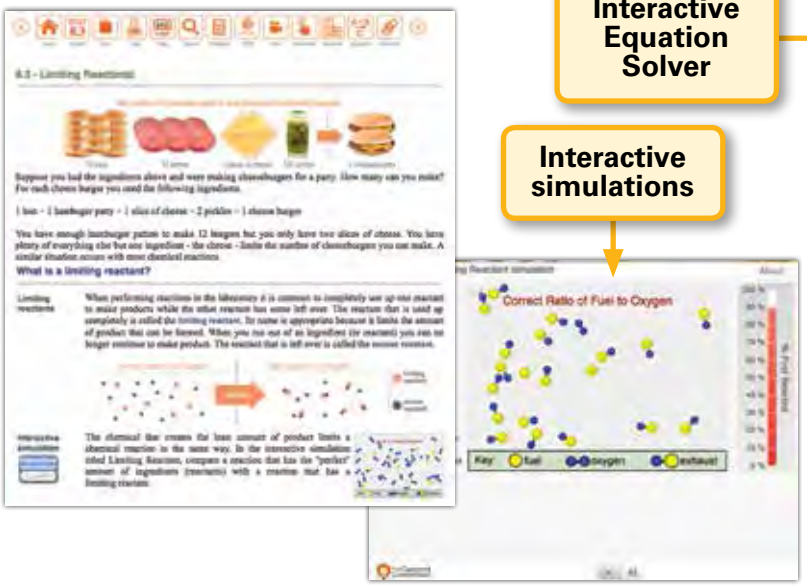
A textbook and an e-Book for all your students

What sets *Essential Chemistry* apart is the complete and interactive e-Book. Simulations, visualizations, and interactive equations bring concepts to life for students in ways that text and static images cannot. Combined with digital resources for teachers, formative and summative assessment, and equipment for lab investigations, *Essential Chemistry* forms a seamless learning system for mastering chemistry.

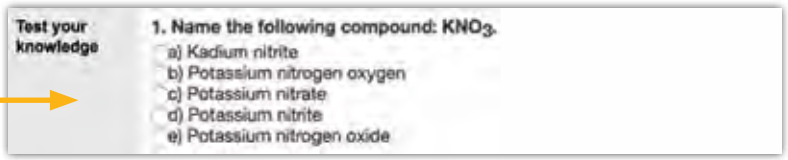
Interactive tools include:

Interactive Equation Solver

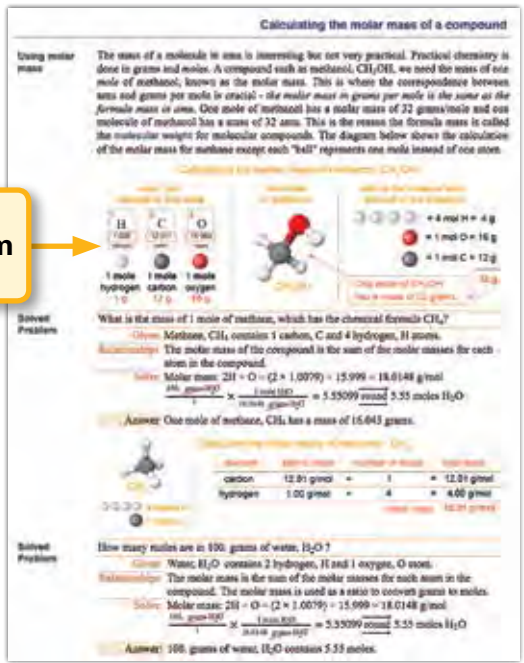
Interactive simulations



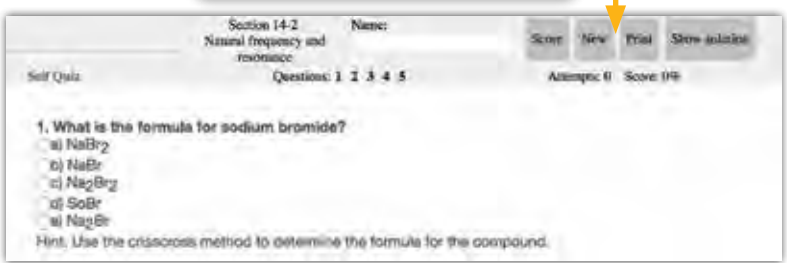
Formative assessment



Embedded solved problem with practice



Summative assessment: The Infinite Test Bank



Essential Chemistry meets your standards and supports STEM and NGSS!

The Digital Teacher Edition includes lesson plans, slide presentations, student work, and answer keys, all at point-of-use.

Equipment Kits

Standard Equipment Kit *42 labs are designed to use this equipment set.*

EC-6361

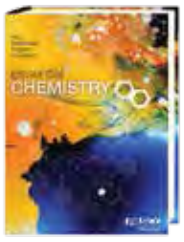
Includes 1 of each of the following:
- Wireless Temperature Sensor, PS-3201
- Wireless pH Sensor, PS-3204
- Wireless Conductivity Sensor, PS-3210
- Wireless Pressure Sensor, PS-3203
- Wireless Voltage Sensor, PS-3211
- Wireless Colorimeter and Turbidity, PS-3215*
- Molecular Model Kit, PS-3400
- Electrode Support, PS-3505
- Gratnells® Storage Tray
- Periodic Trend Cards, EC-3405
- Periodic Table, EC-3404
- Spectrum Cards, EC-3403
- Condenser, PS-3402

* **WARNING!** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Essential Chemistry Student Textbook

EC-6350

Hardbound student textbook



Essential Chemistry Student e-Book

EC-6350-EB5 (5-yr license)

EC-6350-EB1 (1-yr license)

Includes: e-Book with 24/7 online/offline access

Essential Chemistry Laboratory Investigations Student Manual

Are you looking for more hands-on chemistry labs? The Essential Chemistry Laboratory Investigations Student Manual includes over 70 labs and activities. Best of all, digital access to these Online Teacher Resources is included with purchase of the student manual:

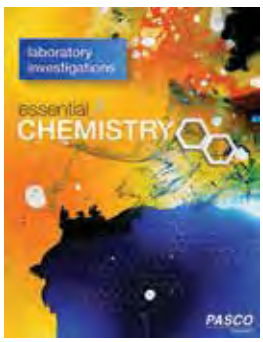
- Interactive chemical equation builder
- Molecule simulations
- Interactive periodic table
- Assessment
- Student lab sheets (blackline masters)
- Editable and printable Word and PDF versions of each lab
- Presentations of each lab in PPTX and
- PDF format
- Editable teacher answer keys in Word and PDF format
- Sample lab data

The investigations and activities in the student manual cover these topics:

- Experimental Variables
- Investigating the Temperature Scale
- Density of a Solid
- Density of a Liquid
- Chemical Formula
- Pure Substances and Mixtures
- Physical or Chemical Change
- Temperature and Thermal Energy
- Specific Heat
- Energy from Food
- Heat of Fusion
- Project: Design an Insulator
- Research Presentation:
- Insulators in the Home
- Patterns and Trends
- Naming Ionic Compounds
- Store Labels and Models
- Counting by Weighing
- Molar Mass
- Percent Composition of a Hydrate
- Empirical Formula of Magnesium Oxide
- Balancing Chemical Equations
- Chemical Reactions
- Solubility Rules
- Conservation of Mass
- Percent Yield
- Modeling Limiting Reactants
- Determining Limiting Reactants
- Project: Design an Airbag
- Research Enhancement:
- Airbags and Consumers
- Isotopic Composition
- What Is a Wave?
- Light Energy
- Flame Tests
- Types of Bonding
- Lewis Structures and VSEPR
- Surface Tension
- Evaporative Cooling
- State Changes
- Hess's Law
- Volume of a Gas
- Boyle's Law
- Charles' Law
- Electrolytes
- Solution Concentration
- Colored Solutions
- Project: Design a Purification Process
- Writing Enhancement: Water Purification
- Optimum Conditions
- Catalysts
- Reaction Equilibrium
- Le Châtelier's Principle
- What Is pH?
- Titration of an Unknown Acid
- Antacids: An Inquiry Study
- Vitamin C Titration
- Electrochemical Cells
- Electroplating
- Lemon Battery
- Project: Design a Galvanic Cell
- Writing Enhancement: Galvanic Cell
- Half-Lives
- Bonding and Organic Chemistry
- Distilling Aromatic Compounds
- Fragrant Esters
- Polymers
- Amino Acids
- Chlorophyll Extraction
- Respiration and Energy
- Greenhouse Gases
- The Water Cycle
- Ocean Currents
- Ocean Acidification
- Spectroscopy

Essential Chemistry Laboratory Investigations Student Manual

EC-6352



See page 33 for _Essential Chemistry_ Standard Equipment Kit.

SPARK LX & LXi

NEW

PASCO's NEXT GEN SCIENCE DATALOGGERS for indoor and outdoor use

These innovative science handhelds blend PASCO probeware with SPARKvue data collection and analysis software plus our new lab management application: Lab Manager. They are durable, splash-proof, and work seamlessly with our PASPORT and wireless sensors.

Lab Manager software allows teachers to:

- Monitor student screens (or lock student screens to get students' attention).
- Broadcast teacher or student screens to class.
- Control student devices for guidance.
- Quiz students and view responses in real time.
- Message all student devices.
- Easily send and collect any file to and from student devices.

Choose from Two Models

	SPARK LX PS-3601	SPARK LXi PS-3600
Ruggedized case for indoor/outdoor and wet/dry lab use	✔	✔
9.6" full-color touchscreen	✔	✔
Lab Manager application	✔	✔
Simultaneously connects up to 5 wireless sensors	✔	✔
Includes 2 PASPORT ports		✔
Includes Voltage Probe and port		✔
Includes Temp Probe and port		✔
Can connect more PASPORT sensors with the AirLink, SPARKlink Air, and 550 Universal Interface	✔	✔
Installed software		
PASCO SPARKvue, MatchGraph!, and Spectrometry	✔	✔
Microsoft Office Suite	✔	✔
Google Suite	✔	✔
Hands-free stand	✔	✔

SPARK LX

PS-3601

Use with PASCO Wireless sensors (or for use with PASPORT sensors + an AirLink, SPARKlink® Air, or 550 Universal Interface). The SPARK LX can simultaneously connect up to five wireless sensors.

Also available:
SPARK LX Charging Station
PS-3603

SPARK LXi

PS-3600

Use with wired and wireless sensors, the SPARK LXi can simultaneously accommodate up to five wireless sensors. It also includes two ports for blue PASPORT sensors, plus two ports for the included Fast Response Temp Probe and the Voltage Probe.

Also available:
SPARK LXi Charging Station
PS-3602

FREE Digital POGIL Labs for Advanced Chemistry

Suitable for AP® and IB® classes*, available at pasco.com

Advanced Chemistry Experiments and Sensors	Starter Bundle					Extension Bundle					
Experiment	**pH**	**Temperature**	**Conductivity**	**Pressure**	**Voltage**	**Colorimeter**	**High Accuracy Drop Counter**	**Current**	**Oxygen Reduction Potential Probe****	**IB Standards*****	**Targeted AP Learning Objectives**
1. Modeling Chemistry	●	●	●	●						1.1, 4.1, 4.4	3.10
2. Light, Color and Concentration						●				1.3	1.16
3. Gravimetric Analysis of a Precipitate										1.3	1.19
4. Stoichiometry in Solutions		●	●				●			1.3	3.4
5. Polar and Non-polar substances	●									4.4	2.8
6. Solubility			●							1.3	6.21
7. Empirical Formula						●				1.2	3.6
8. Measuring Vitamin C – A Redox Titration							●		●	9.1	3.9
9. Factors That Affect Reaction Rate		●		●						6.1	4.1
10. Measuring the Speed of a Reaction		●				●				16.1	4.2
11. Energy in Chemical Reactions		●								5.1-5.3	5.7
12. Chemical Equilibrium		●				●				7.1, 17.1	6.9
13. Shapes of Titrations	●						●			1.3, 8.1-8.4, 18.2, 18.3	6.12
14. Weak Acid Titration	●						●			1.3, 8.1-8.4, 18.2, 18.3	6.13
15. Introduction to Buffers	●									18.3	6.20
16. Buffer Properties	●									18.3	6.18
17. Moving Electrons					●			●		9.1, 9.2, 19.1	3.13

* AP is a registered trademark of the College Board, which was not involved in the production of, and does not endorse, this product.
** The ORP Probe requires a pH sensor.
*** IB is a registered trademark of the International Baccalaureate Organization, which was not involved in the production of, and does not endorse, this product. Students in Group 4 Experimental Sciences are required to use datalogging in an experiment and software for graph plotting.

Looking for more teacher resources?

PASCO's Advanced Chemistry Teacher Guide + POGIL is the perfect combination to help you teach AP®, IB®, Advanced Chemistry, and guided-inquiry labs!

Advanced Chemistry through Inquiry Teacher Resources

PS-2828

Includes a print lab manual.

The electronic content includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more.

Chemistry Solutions

The tools you need to teach AP®, IB®, Advanced, and General Chemistry Labs

Wireless Chemistry Starter Bundle

PS-3302

1. Wireless pH PS-3204
2. Wireless Temperature PS-3201
3. Wireless Pressure PS-3203
4. Wireless Voltage PS-3211
5. Wireless Conductivity PS-3210

Wireless Chemistry Standard Extension Bundle

PS-3303B

1. Wireless Current PS-3212
2. Wireless Drop Counter PS-3214
3. Wireless Colorimeter and Turbidity PS-3215*
4. ORP Probe PS-3515

* **WARNING!** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

This bundle allows you to perform 17 labs in the Advanced Chemistry through Inquiry Teacher Guides, as well as all the free Chemistry labs.

Wireless pH Sensor

Using PASCO's Wireless pH Sensor, students can measure the pH of different juices without the hassle or mess of indicator solutions or pH paper. And the results are incredibly accurate and readable, making it easy to compare the acidity of different samples.

The advantage of using PASCO sensors and SPARKvue software is that the ease of data collection means that there's plenty of additional time for further investigation or classroom discussion.

Display pH in digits, graphs, tables, or bar charts, so your students can get the most out of their measurements.

Measure the pH of different juices using the Wireless pH Sensor.

Specifications

- Excellent accuracy (0.01 pH) and resolution (0.02 pH)
- Dust-proof, sand-proof, and water-resistant (1 m for 30 min.)
- Battery life >1 year
- Also connect ORP or ISE electrodes

Wireless pH Sensor

PS-3204

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

Wireless Temp/pH/Conductivity Sensor Storage Trays

Make lab management easy and efficient with PASCO's Wireless Sensor Storage Trays. Each Gratnells® tray stores up to 10 wireless sensors; sensors sold separately.

NEW

Wireless Sensor Storage Trays for:

Temperature/pH/Conductivity Sensors
PS-3585

Pressure Sensors
PS-3586

Colorimeter & Turbidity Sensors
PS-3587

Voltage & Current Sensors
PS-3588

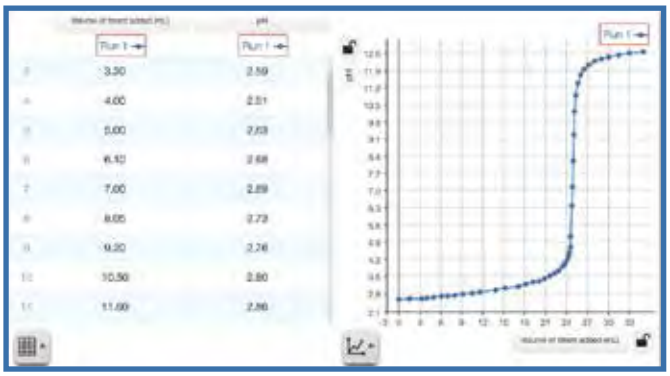
Each storage tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Get even more measurements out of the Wireless pH Sensor by using these ORP or ISE electrodes.

The Wireless pH Sensor: perform acid-base titrations and more!

Using the Wireless pH Sensor, students can easily create acid-base titration curves. They can incorporate the Wireless Drop Counter to collect more data in less time.



Easily perform pH titrations using the Wireless pH Sensor.

Wireless Drop Counter

PS-3214

Includes Drop Dispenser and Micro Stir Bar plus a Stainless Steel Sensor rod for easy attachment to ring stand.

Also available:
Drop Dispenser PS-6935

Probes and Electrodes

Oxidation Reduction Potential Probe
PS-3515

Ammonium
PS-3516 .....
Carbon Dioxide
PS-3517 .....
Calcium
PS-3518 .....
Chloride
PS-3519 .....
Potassium
PS-3520 .....
Nitrate
PS-3521 .....

Requires one of these:
Wireless pH Sensor PS-3204
or
a PASPORT pH Amplifier

Also available:
Heater-Stirrer PS-3401

Electrode Support PS-3505

Wireless Colorimeter and Turbidity Sensor

The Wireless Colorimeter can measure absorbance and transmittance at six different wavelengths. Each wavelength represents a region of the ROYGBV color wheel. Measure the colors of a solution to introduce the principles of spectroscopy, relate absorbance to concentration, and study reaction rates. The colorimeter also functions as a turbidimeter for water quality analysis by measuring the scattering effect of suspended particles.

Specifications:

Color detection/peak wavelengths detected: 650 nm (red), 600 nm (orange), 570 nm (yellow), 550 nm (green), 500 nm (blue), 450 nm (violet)

Detector ranges: ±25 nm from peak

Absorbance: 0-3 Abs units; useful range (0.05 -1.5 Abs)

Transmittance: 0-100%

Turbidity range: 0-400 NTU

Accuracy: ±5% NTU

Wireless Colorimeter and Turbidity Sensor

PS-3215

Includes USB charging cable, 9 cuvettes, 2 cuvette racks, and one 100 NTU calibration cuvette.

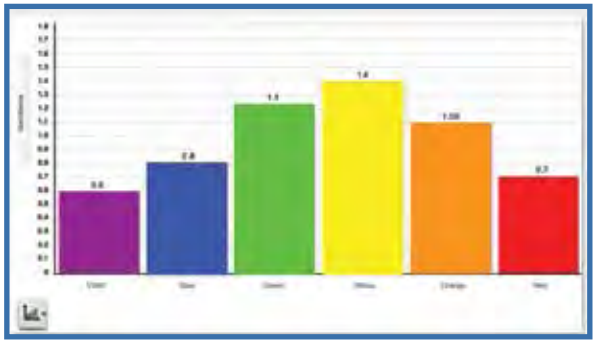
Also available:

Cuvettes & Caps
SE-8739

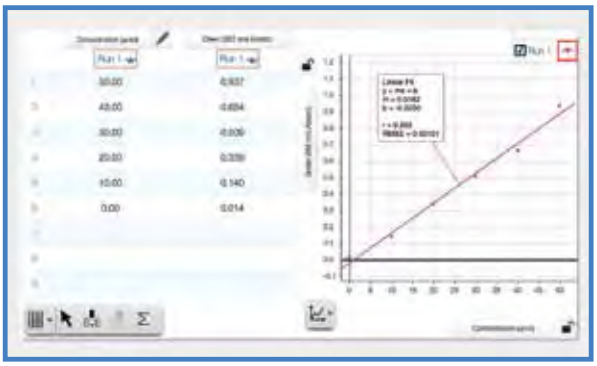
Cuvette Rack
EC-3590

WARNING! This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

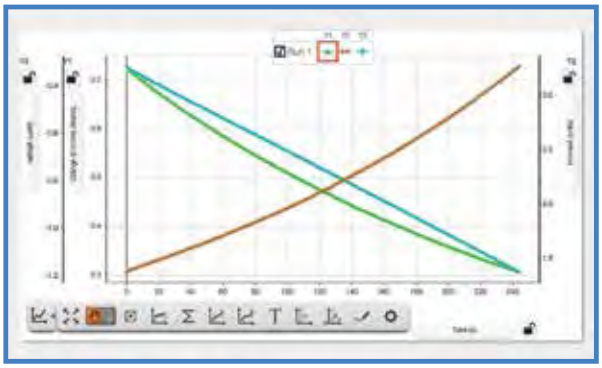
877.373.0300 (inside US) 916.462.8383 (outside US)



Measure the absorbance and transmittance of a solution at six different wavelengths... simultaneously!



Create Beer's Law plots to help students understand the relationship between absorbance and concentration.



Graphically analyze how a reaction changes over time. Use SPARKvue to see multiple measurements on the same graph.

Wireless Sensor Storage Tray for Colorimeter & Turbidity Sensors

PS-3587

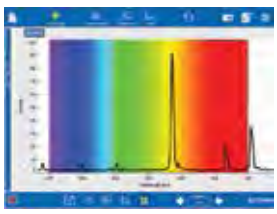
Each tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

PASCO's 5-Year Educational Warranty

To withstand the rigors of student use, PASCO products are made of the highest quality materials. They are designed and manufactured by our team of education researchers and engineers in Roseville, California. And we back up our products with a 5-year warranty, so you can be completely confident about buying PASCO solutions.

Need information about PASCO's Wireless Spectrometer?
See page 48.



Wireless Temperature Sensor

This durable, high-resolution sensor covers many temperature experiments. From chemical changes to thermochemistry, this is a lab essential. Real-time temperature measurements can be tracked in a graph, table, or digits display.

Specifications

- Range -40° to 125°C
- Leading resolution of 0.01°C
- Water-resistant (1 m for 30 min)

The Teaching Advantage

- Includes fast sampling rate for small temperature changes such as convection or skin temperature.
- No calibration required: just connect and measure.
- Features convenient Bluetooth® wireless connectivity and long-lasting coin cell battery.
- Logs temperature data directly onto the sensor for long-term experiments.

Wireless Temperature Sensor

PS-3201

Includes 1 coin cell battery.

winner! 2016 AWARDS of EXCELLENCE TECH & LEARNING

Wireless Temperature Link

PS-3222

Includes Fast Response Temperature Probe

The Wireless Temperature Link enables wireless connection for any PASCO temperature probe with a 3.5 mm connection. The link comes with a Fast Response Temperature Probe, but it can also connect to the Stainless Steel Temperature Probe, Skin/Surface Temperature Probe, the Absolute Zero Sphere, and the Ideal Gas Law Apparatus.

Wireless Temp/pH/Conductivity Sensor Storage Trays

Make lab management easy and efficient with PASCO's Wireless Sensor Storage Trays. Each Gratnells® tray stores up to 10 wireless sensors; sensors sold separately.

Wireless Sensor Storage Trays for:

Temperature/pH/Conductivity Sensors
PS-3585

Pressure Sensors
PS-3586

Colorimeter & Turbidity Sensors
PS-3587

Voltage & Current Sensors
PS-3588

Each storage tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Use the change in temperature to determine specific heat capacity of a metal sample.

Have your students explore concepts ranging from specific heat capacity to heats of solution and Hess' Law. Using PASCO's Wireless Temperature Sensor, Calorimetry Cups, and Heater-Stirrer, your students will be outfitted with the necessary equipment to perform a wide range of thermochemistry experiments.

Heater-Stirrer:

This compact Heater-Stirrer is an essential for any lab! The white ceramic top is ideal for heating and for seeing color changes when mixing solutions. It has been designed to withstand spills. Its safety features include warning labels and indicator LEDs. The included rod makes it easy to support sensors.

Calorimetry Cups:

Includes set of six Styrofoam™ cups that are 7.5 cm inside diameter, 10 cm deep, with 1.3 cm thick walls for excellent thermal properties. The lids have a hole, which is ideal for inserting a temperature probe.

Heater-Stirrer

PS-3401

Includes support rod.

Calorimetry Cups

TD-8825A

Styrofoam calorimeter cups (7.5 cm inside diameter, 10 cm deep) have 1.3 cm thick walls for excellent thermal properties.

The lids have a hole for a temperature probe. Includes set of six cups with lids.

Ideal Gas Law Apparatus

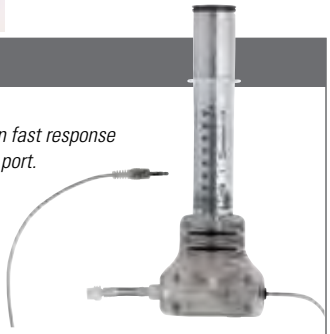
The Ideal Gas Law Apparatus has a stable design that ensures consistently repeatable results and long-term reliability. When students use it, they will be able to quantitatively investigate the relationships between pressure, temperature, and volume of a gas.

The relationship between pressure, volume, and temperature can be dynamically visualized with the Ideal Gas Law Apparatus.

Ideal Gas Law Apparatus

TD-8596A

Includes Ideal Gas Law syringe, built-in fast response thermistor, and quick connect pressure port.



Required:

Wireless Pressure Sensor
PS-3203
Wireless Temperature Link
PS-3222

Also available:

Ideal Gas Law Apparatus Wireless Bundle
PS-3310
Includes the Ideal Gas Law Apparatus, the Wireless Pressure Sensor, and the Temp Link.

Absolute Zero Sphere

The Absolute Zero Sphere has a constant volume, which makes it perfect for determining absolute zero temperature. Students immerse the sphere in water baths of different temperatures, then observe the pressure and temperature changes in real time. Once the data is collected, they can use a linear fit to extrapolate the value of absolute zero.

Immerse the sphere in water baths of several different temperatures to see pressure and temperature changes in real-time.

Absolute Zero Sphere

TD-8595

Includes built-in Fast Response Thermistor Probe and quick-connect pressure port.

Required:

Wireless Pressure Sensor
PS-3203
Wireless Temperature Link
PS-3222

Also available:

Absolute Zero Sphere Wireless Bundle
PS-3309
Includes the Absolute Zero Sphere, the Wireless Pressure Sensor, and the Temp Link.

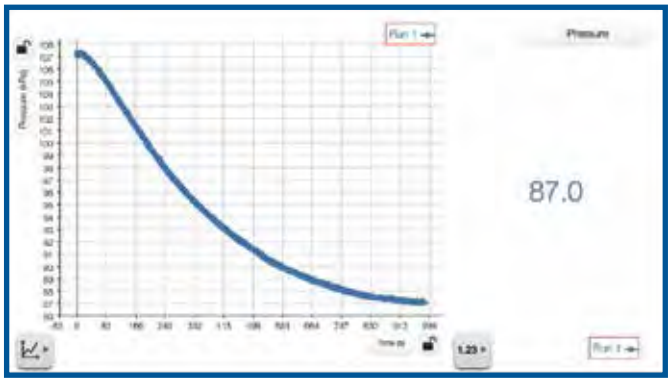
Wireless Pressure Sensor

With this wireless sensor you can make accurate and consistent measurements of gas pressure, and explore Gas Laws and chemical reactions.

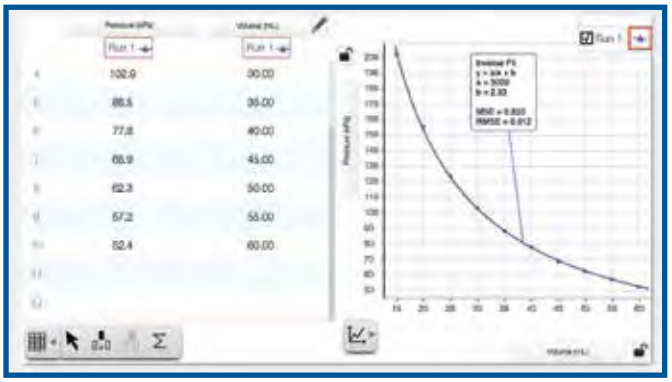
A test tube, piece of steel wool, and a Wireless Pressure Sensor are all your students need to calculate the amount of oxygen in the air.

Specifications

- Wide range 0-400 kPa for gas laws, reaction rates, osmosis, and more!
- Recharge battery just once a semester
- Includes syringe and tubing



Monitor the Pressure digit display while live data is graphed in real time as steel wool reacts with oxygen.



With the included syringe, your students can easily quantify the relationship between pressure and volume.

Wireless Pressure Sensor

PS-3203

Includes 2 feet of polyurethane plastic tubing, 1 tube connector, 2 male barb connectors, 1 female barb connector, 1 60cc syringe, a lithium-ion battery, and a USB connector.

Wireless Conductivity Sensor

Use the Wireless Conductivity Sensor to measure the electrical conductivity of a water solution. With this wireless sensor you can investigate the properties of solutions, as well as model and measure water quality.

Compare the types of bonding or the concentration of electrolytes when measuring the conductivity of solutions.

The Wireless Conductivity Sensor can measure conductivity and total dissolved solids.

Measure the conductivity of water and other water-based solutions.

Specifications

- Measure both conductivity and total dissolved solids
- Automatic temperature compensation
- Water-resistant (1 meter for 30 minutes)
- Battery life >1 year

Wireless Conductivity Sensor

PS-3210

Includes 1 coin cell battery.

Wireless Sensor Storage Trays

Make lab management easy and efficient with PASCO's Wireless Sensor Storage Trays. Each Gratnells® tray stores up to 10 wireless sensors; sensors sold separately.

Wireless Sensor Storage Trays for:

Temperature/pH/Conductivity Sensors
PS-3585

Pressure Sensors
PS-3586

Colorimeter & Turbidity Sensors
PS-3587

Voltage & Current Sensors
PS-3588

Each storage tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Electrochemistry made easy with the Wireless Current and Voltage Sensors

These wireless sensors provide the perfect solution for the electrochemistry portion of your curriculum. Using them during electrochemistry experiments, students will be able to measure voltage and current in voltaic and electrolytic cells.

Help your students reach their "potential" by measuring the voltage of electrochemical cells within different metal combinations.

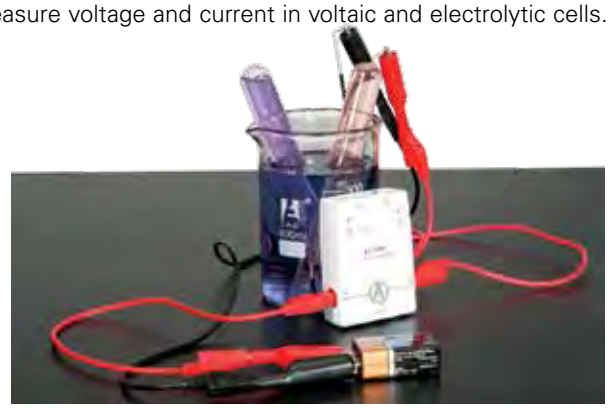
Specifications

- Range ±15 V
- Bluetooth® sampling rate of 1 kHz
- High-speed sampling via USB
- 100 kHz burst mode
- Recharge battery just once a semester

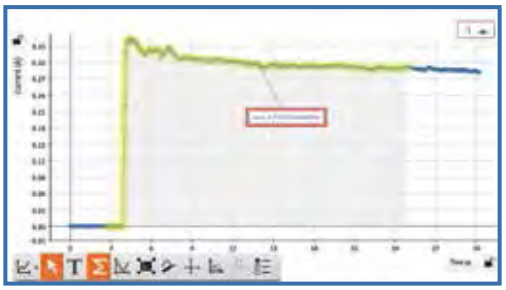
Wireless Voltage Sensor

PS-3211

Includes 1 coin cell battery.



SPARKvue's analysis tools allow you to determine the area under the curve, which is equal to the charge used in the electrolysis experiment featuring the Wireless Current Sensor.



Specifications

- Range ±1A
- Bluetooth® sampling rate of 1 kHz
- High-speed sampling via USB
- 100 kHz burst mode
- Recharge battery just once a semester

Wireless Current Sensor

PS-3212

Includes rechargeable battery and banana-clip cables.

Wireless Sensor Storage Trays for:

Voltage & Current Sensors
PS-3588

Each storage tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Molecular Model Set

The Molecular Model Set is the perfect tool to help students understand core science concepts such as the conservation of mass, chemical formulas, and balancing equations. Anything is possible for students, from creating simple water or carbon dioxide molecules to complex biochemicals such as amino acids, as they make models while they study Chemistry and Biochemistry.

Molecular Model Set

PS-3400

Includes 86 atoms and 153 bonds.

Two Density Sets from PASCO

The Discover Density Set (SE-9719) has 22 pieces and allows students to discover the relationship between density, volume, and dimensions.

The Density Set (ME-8569A) allows you to investigate irregular objects by water displacement and specific heat.

Discover Density Set

SE-9719A

Includes

Cylinders of same length and different diameters (4)

Cylinders of same diameter and different lengths (4)

Spheres with different diameters (4)

Rectangular shapes of various sizes and materials (10)

Instruction manual

Density Set

ME-8569A

Includes one irregular aluminum shape, two blocks, (aluminum and brass), three identically-sized cylinders (aluminum, brass and plastic).

Specific Heat Set

Comes with five different materials (aluminum, brass, stainless steel, zinc, and copper), each with a mass of 80 g. Each has a hole to tie a loop of string, so it can be suspended in a liquid.

Specific Heat Set

SE-6849

This specific heat set has five different materials, all having the same mass (80 g). Each has a hole to tie a loop of string to hang the samples in water.

Award-Winning Wireless Spectrometry for iOS®, Android™, Computers, and Chromebooks*

Measure intensity, absorbance, transmittance, and fluorescence.

This one apparatus allows you to measure these four parameters… all wirelessly. The Bluetooth® and USB connectivity enable use with your iPad, tablets, and computers, making this a powerful tool for your spectrometry needs.

Our list of compatible Chromebooks is expanding rapidly. Check **pasco.com/compatibility for the latest updates.*

Now has the same functionality as the Spec 20, and more!

Spectrometer Specifications:

- Bluetooth and USB connectivity
- 2–3 nm FWHM resolution
- 380–950 nm range
- 2 fluorescence excitation wavelengths at 405 nm and 500 nm
- LED-boosted tungsten light source

You can perform these labs with the Wireless Spectrometer:

- Emission Spectra of Light
- Absorbance Spectra
- Beer's Law
- Kinetics
- Fluorescence

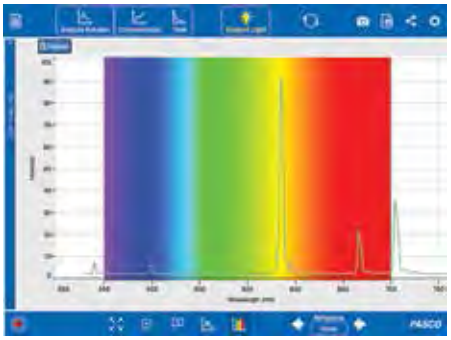
//CODiE// 2017 SIIA CODiE WINNER

winner! 2016 AWARDS of EXCELLENCE TECH&LEARNING

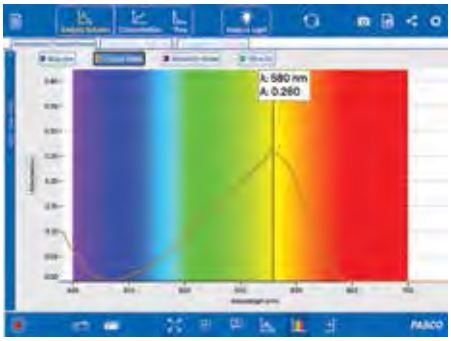
bett AWARDS 2017 FINALIST

The Wireless Spectrometer comes with **PASCO's FREE Spectrometry software.**

- Windows® and Mac® versions included with purchase.
- FREE for iOS®, Android™ , and Chrome™.
- Designed specifically for introductory spectrometry experiments.



Analyze light sources with the optional Fiber Optic Cable. Easily compare the spectrum to known reference lines in the software.



Full visible spectrum analysis of solutions with a large digits display helps set the wavelength and see the absorbance.

Wireless Spectrometer

PS-2600

Includes Wireless Spectrometer, 10 cuvettes, and Spectrometry software.

Also available:

Optional Fiber Optic Cable
PS-2601

Cuvettes & Caps
SE-8739

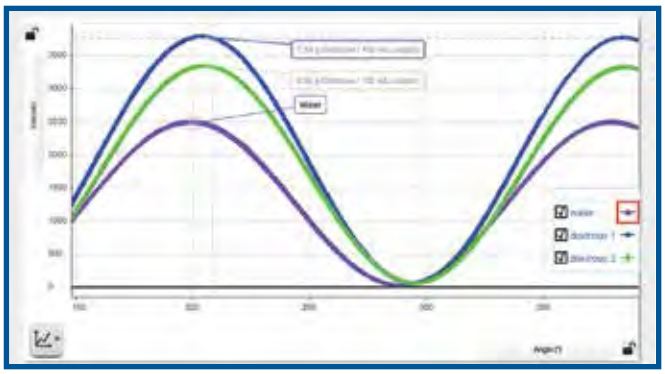
Cuvette Rack
EC-3590

PASCO Polarimeter for your Chromebook™, iPad®, Tablets, and Computers

Measure the optical rotation of chiral compounds.

PASCO's Polarimeter has both Bluetooth® and USB connectivity, so it works on your iPad®, Chromebook™, tablets, and computers. It is ideal for introductory Organic and Biochemistry experiments with chiral compounds.

In this new device, plane polarized light is passed through a sample, which contains a chiral compound, to an analyzer and a detector. The degree of optical rotation of the plane polarized light is based on the type and amount of sample present. Determine the concentration of a sugar solution based on the optical rotation of plane polarized light.



Optical rotation of sucrose

Determine the concentration of a sugar solution based on the optical rotation of plane polarized light.

Specifications:

- Bluetooth® and USB connectivity
- 589 nm LED light source
- Accuracy = ± 0.09° optical rotation
- SPARKvue- and Capstone-compatible
- Industry-standard, horizontal polarimeter sample cell (100 mm)

Polarimeter

PS-2235

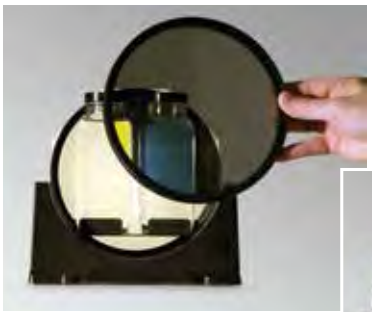
Includes 1 Sample Cell

Also available:

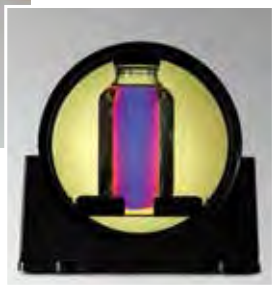
Polarimetry Sample Cell Replacement
PS-2234

Polarizer Demonstrator

OS-9477A



Introduce the concept of polarization with this colorful and meaningful demonstration.



Includes two round polarizer discs with stands.

Also available:

Polarizer Demonstrator Accessory
OS-8172

Linear Polarizer (2-pack) OS-8549

PASCO's Sensor-based Solutions for Earth and Environmental Sciences

PASCO sensors, wireless technology, and SPARKvue software make collecting reliable data in the field a breeze. Measuring water quality metrics, location data, and enhanced visual observation are all possible with our easy-to-use solutions. For controlled experiments, model ecosystems with the EcoZone™ that works with probeware.

Earth & Environmental Sciences Index

World Class Support & Professional Development
Committed to Your Success

For more details, see pages 180-181.

CONTACT US TODAY
www.pasco.com

Wireless Optical Dissolved Oxygen Sensor

PS-3224 (page 59)

Includes USB charging cable

The Wireless Optical Dissolved Oxygen (DO) Sensor is the perfect solution to monitor DO in the lab or the field. Optical technology is accurate, fast, and does not require flow or calibration. With built-in memory, you can log data for hours or days to capture day/night nutrient cycles and changes in metabolic processes. With the included cover, the sensor has a fully waterproof design and is submersible to 10 m.

Wireless Weather Sensor with GPS

PS-3209 (page 55)

Use this multimeasure sensor to monitor 17 different measurements including common weather, location, and light. Study microclimates, monitor environmental conditions during indoor or outdoor labs, or place the sensor outside for extended monitoring, because of its durable, water-resistant design and internal memory.

Includes USB charging cable.

Wireless CO_2 Sensor

PS-3208 (page 54)

Use this wireless sensor to measure the concentration of CO_2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile probe. CO_2 data can be logged directly on the device for long-term life science and environmental science studies.

Includes 250-ml sampling bottle and USB charging cable.

Wireless Temperature Sensor

PS-3201 (page 56)

Includes 1 coin cell battery.

Welcome to the modern thermometer. Students can access instant temperature readings but also continuously monitor, log, and plot temperature data in SPARKvue on nearly any connected device. When class-time ends but the experiment continues, students can set the sensor to log data autonomously for days or weeks and then download the data for analysis.

The versatile Wireless Temperature Sensor works well, both in the lab and out of doors.

Wireless pH Sensor

PS-3204 (page 56)

Wirelessly monitor pH in the field or lab with this durable, accurate sensor. Study water quality, pollution, and environmental monitoring with ease. Log data to the sensor for extended studies that can go for days or weeks before collecting your data (see page 68 for full details).

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

With the Wireless pH Sensor, students can collect data anywhere!

FREE Digital Labs for Earth & Environmental Sciences

available at pasco.com

There are 22 Earth and Environmental Science labs available for FREE in the PASCO Digital Library. Each lab includes an editable student lab, SPARKvue configuration files, and detailed teacher notes on preparation, background, and sample answers.

Experiments and Sensors Used

	Wireless Sensors									
Experiments	CO_2 Gas	Temperature	Pressure	pH	Conductivity	Colorimeter & Turbidimeter	Light	Weather/GPS	Magnetic Field	Oxygen
1. Determining Soil Quality	●			●	●					
2. Insolation and the Seasons		●								
3. Investigating Specific Heat		●								
4. Monitoring Microclimates								●		
5. Sunlight Intensity and Reflectivity		●					●			
6. Tracking Weather								●		
7. Earth's Magnetic Field									●	
8. Radiation Energy Transfer		●								
9. Seafloor Spread Plate Tectonics									●	
10. Modeling an Ecosystem	●	●		●	●			●		●
11. Photosynthesis and Primary Productivity										●
12. Photosynthesis and Cell Respiration	●	●								●
13. Cellular Respiration and Carbon Cycle	●									
14. Energy Content of Food		●								
15. Weather in a Terrarium								●		
16. Yeast Respiration	●	●								●
17. Properties of Water		●								
18. Air Pollution and Acid Rain				●						
19. Monitoring Water Quality		●		●	●	●		●		●
20. Toxicology Using Yeast	●			●						
21. Water Treatment				●	●	●				
22. Greenhouse Gases		●								

Earth & Environmental Teacher Resources

PS-2979

The electronic content includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more.

Water Quality Field Guide

PS-2829A

This handy guide includes a spiral bound field guide and a USB flash drive with editable Word® files.

Biosphere Module

Teacher License
PS-2980

One per teacher (one license for all your classes). Includes spiral-bound teacher manual.

Recommended:
Wireless CO_2 Sensor PS-3208

See our new Digital Ag Science Labs for Earth & Environmental Sciences on page 63.

Earth and Environmental Sciences Solutions

The tools you need to teach the free digital labs for Earth and Environmental Sciences

Wireless Earth and Advanced Environmental Starter Bundle

PS-7616A

1. Wireless Weather with GPS PS-3209
2. Wireless Temperature PS-3201
3. Wireless pH PS-3204
4. Wireless Conductivity PS-3210

Wireless Advanced Environmental Science Extension Bundle

PS-7617B

1. Wireless Optical Dissolved Oxygen Sensor PS-3224
2. Wireless Light PS-3213
3. Wireless CO_2 PS-3208
4. Wireless Colorimeter & Turbidity Sensor PS-3215*
5. EcoZone ME-6668

* **WARNING!** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Water Quality Extension Bundle

PS-2612E

1. Wireless Temperature PS-3201
2. Wireless pH PS-3204
3. Wireless Conductivity PS-3210
4. Wireless Colorimeter & Turbidity Sensor PS-3215*
5. Wireless Optical Dissolved Oxygen PS-3224

* **WARNING!** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Most computing devices will connect directly to PASCO Bluetooth® 4.0 wireless products. Please go to pasco.com/compatibility to determine your direct-connect compatibility. PASCO offers the PS-3500 USB Bluetooth® Adapter for computing devices that do not support direct-connect.

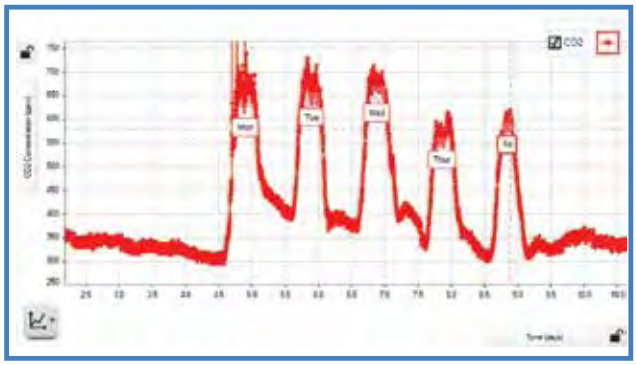
USB Bluetooth® 4.0 Adapter
PS-3500

10-port USB Charging Station
PS-3501

Wireless CO_2 Sensor

PS-3208

Use this wireless sensor to measure the concentration of CO_2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile probe. CO_2 data can be logged directly on the device for long-term life science and environmental science studies.



Using the logging function, CO_2 air quality was captured in PASCO offices for 24 days straight! When logging date for an entire work week, it's easy to see how the CO_2 levels increase as the days progress.

Wireless CO_2 Sensor

PS-3208

Includes 250-ml sampling bottle and USB charging cable.

Wireless Sensor Storage Trays for:

Weather Sensor with GPS
PS-3596

CO_2 Sensor
PS-3598

Each storage tray holds up to ten sensors; sensors sold separately.

NEW

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Dissolved CO_2 Waterproof Sleeve

PS-3545

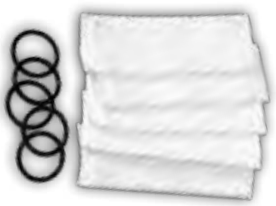
(shown with Wireless CO_2 Sensor; sold separately)

The Wireless CO_2 Sensor can be equipped for aqueous measurements using this semipermeable sleeve. The sleeve is waterproof but allows CO_2 gas to pass through the membrane, creating a headspace around the sensor. Monitor photosynthesis and respiration of aquatic plants or animals with the sample bottle or other chambers.
(***Please note***: Improper use will void sensor warranty.)

Dissolved CO_2 Waterproof Sleeve

PS-3545

Includes 5 sleeves and 5 O-rings



Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable

The Wireless Weather Sensor is an all-in-one instrument for monitoring environmental conditions. By incorporating several sensing elements into a single unit, the sensor provides up to **19 different measurements!** Use the sensor in logging mode with the Weather Vane Accessory for long-term monitoring, or use it as a handheld instrument to study microclimates and record ambient conditions relevant to many biological and environmental phenomena.

Measurements

Weather

1. Ambient Temperature
2. Barometric Pressure
3. Wind Speed
4. Wind Direction (true)
5. Relative Humidity
6. Absolute Humidity
7. Dew Point
8. Wind Chill
9. Heat Stress Index

Light

10. Ambient Light (lux)
11. UV Index
12. PAR
13. Irradiance

GPS

14. Latitude
15. Longitude
16. Altitude
17. Speed
18. Magnetic Direction
19. True Direction

This sensor can measure latitude, longitude, and other GPS functions!

Specifications:

Battery: Rechargeable

Water-resistant

(Please see pasco.com for detailed specifications.)

Weather Vane Accessory

PS-3553

Includes tripod, tripod adapter, and weather vane.

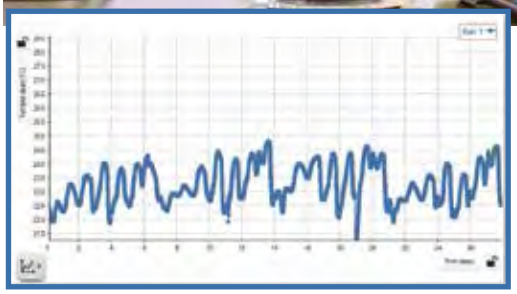
Equip your Wireless Weather Sensor for extended environmental monitoring with the Weather Vane Accessory. Once deployed the sensor will freely rotate to capture wind speed and direction, whether you are monitoring data in real time or using the sensor in logging mode to capture hours (or days!) of data for later analysis.

Weather Vane Accessory

PS-3553

Wireless Temperature Sensor

PS-3201



The versatile Wireless Temperature Sensor works well, both in the lab and out of doors.

See more than 4 weeks of data stored on the sensor!

Welcome to the modern thermometer. Students can access instant temperature readings but also continuously monitor, log, and plot temperature data in SPARKvue on nearly any connected device. When class-time ends but the experiment continues, students can set the sensor to log data autonomously for days or weeks and then download the data for analysis.

Specifications:

Range: -40°C to 125°C
Resolution: 0.05°C
Accuracy: 0.5°C
Battery: Coin cell (>500,000 samples)
Logging: Yes
Bluetooth: BT 4.0

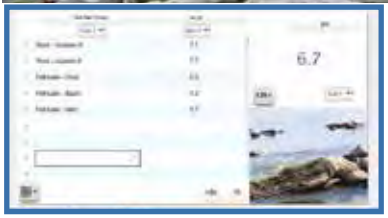
Wireless Temperature Sensor

PS-3201

Includes 1 coin cell battery.

Wireless pH Sensor

PS-3204



With the Wireless pH Sensor, students can collect data anywhere!

Measure pH of water at different locations and annotate with text and images.

Here's the best tool for measuring pH since litmus paper. Students can quickly obtain accurate pH readings but also log data to their connected device and even program the sensor to collect data autonomously for hours or weeks. Use the sensor to study water quality, environmental monitoring, testing solutions, and chemical reactions.

Specifications:

Range: 0-14 pH units
Resolution: 0.02 pH
Accuracy: 0.1 pH units
Battery: Coin cell
Logging: Yes
Bluetooth: BT 4.0

Wireless pH Sensor

PS-3204

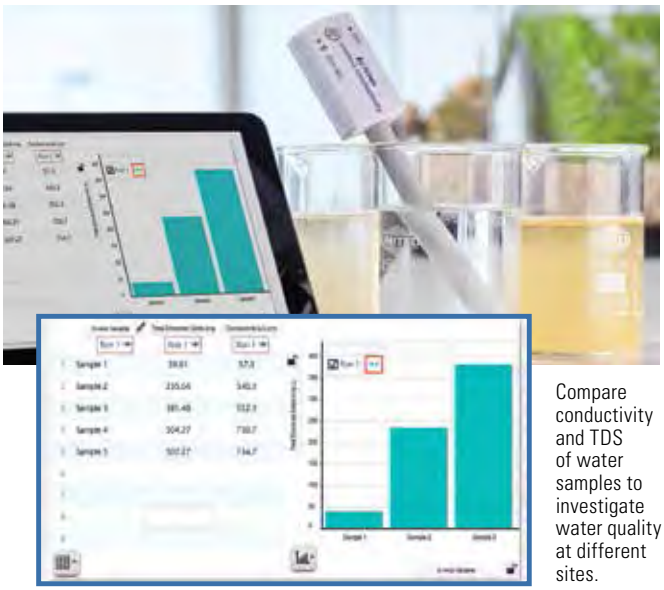
Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

Electrode Support

PS-3505

Wireless Conductivity Sensor

PS-3210



Compare conductivity and TDS of water samples to investigate water quality at different sites.

Use the Wireless Conductivity Sensor to measure the electrical conductivity or Total Dissolved Solids (TDS) of a solution. Investigate diffusion, osmosis, chemical reactions, and monitor water quality.

Specifications:

Range: 0–20,000 µS/cm
Accuracy: ±10% of value from 200–20,000 µS/cm
Resolution: 0.1 µS/cm
Battery: Coin cell (expected life >1 yr)
Waterproof: IP-X7 (1 m for 30 min)
Temperature compensated

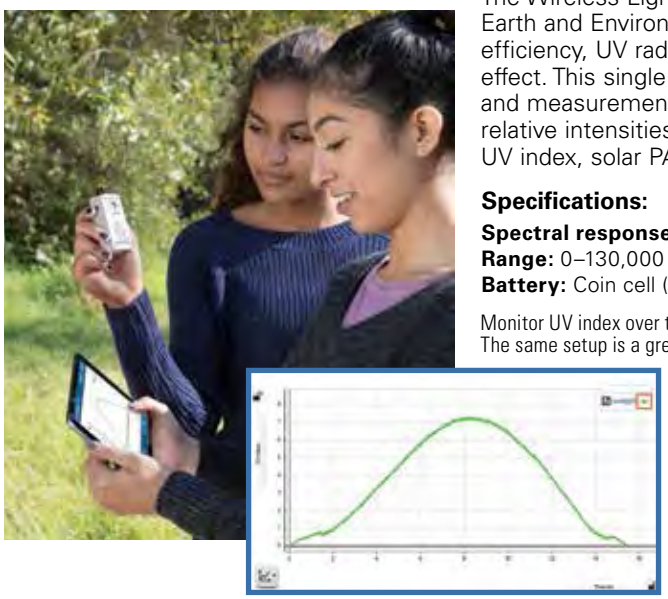
Wireless Conductivity Sensor

PS-3210

Includes 1 coin cell battery.

Wireless Light Sensor

PS-3213



The Wireless Light Sensor is a great tool for explorations of phenomena in Earth and Environmental Science. Study insolation and the seasons, solar panel efficiency, UV radiation, and the impact of light intensity on the greenhouse effect. This single sensor has two different detectors for a variety of applications and measurements: the Spot Detector measures red, green, blue, and white relative intensities; the Ambient Detector measures illuminance (lux), UVA, UVB, UV index, solar PAR, and solar irradiance.

Specifications:

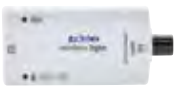
Spectral response: 300 nm–1100 nm
Range: 0–130,000 lux
Battery: Coin cell (expected life >1 yr)

Monitor UV index over the course of a day using the sensor parallel to the horizon in logging mode. The same setup is a great way to compare daylight duration and intensity over the course of a year.

Wireless Light Sensor

PS-3213

Includes 1 coin cell battery.



Wireless Sensor Storage Trays for:

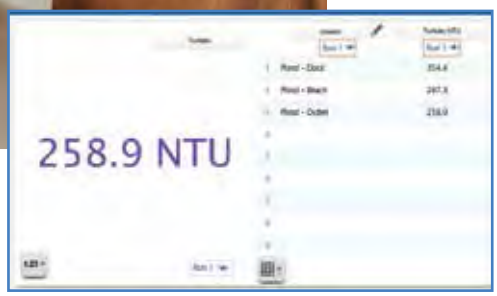
Temperature/pH/Conductivity Sensors
PS-3585

Light Sensors
PS-3594

Each storage tray holds up to ten sensors; sensors sold separately.

Also available:
Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Wireless Colorimeter and Turbidity Sensor



The Wireless Colorimeter simultaneously measures the absorbance and transmittance of six different wavelengths. The colorimeter can be used to study concentrations of solutions and the rates of chemical reactions. Using accessory cuvettes and a calibration standard, the colorimeter also functions as a turbidimeter for water quality analysis. With the wireless, rugged design, it's easy to take this instrument into the field or use it in the lab.

Specifications:

Color detection/peak wavelengths detected: 650 nm (red), 600 nm (orange), 570 nm (yellow), 550 nm (green), 500 nm (blue), 450 nm (violet)

Detector ranges: +25 nm from peak

Absorbance: 0-3 Abs units; useful range (0.05 -1.5 Abs)

Transmittance: 0-100%

Turbidity range: 0-400 NTU

Accuracy: +5% NTU

WARNING! This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Wireless Colorimeter and Turbidity

PS-3215

Includes USB charging cable, 9 cuvettes, 2 cuvette racks, and one 100 NTU calibration cuvette.

Also available:

Cuvettes & Caps
SE-8739

Cuvette Rack
EC-3590

Wireless Temp/pH/Conductivity Sensor Storage Trays

NEW

Make lab management easy and efficient with PASCO's Wireless Sensor Storage Trays. Each Gratnells® tray stores up to 10 wireless sensors; sensors sold separately.

Wireless Sensor Storage Trays for:

Temperature/pH/Conductivity Sensors
PS-3585

Pressure Sensors
PS-3586

Colorimeter & Turbidity Sensors
PS-3587

Voltage & Current Sensors
PS-3588

Each storage tray holds up to ten sensors; sensors sold separately.

Also available:

Extra Wireless Storage; see our Trays and Rolling Storage Carts at **pasco.com/storage**

Wireless Optical Dissolved Oxygen Sensor

PS-3224 *(See page 21 for full details.)*

The Wireless Optical Dissolved Oxygen (DO) Sensor is the perfect solution to monitor DO in the lab or the field. Optical technology is accurate, fast, and does not require flow or calibration. With built-in memory, you can log data for hours or days to capture day/night nutrient cycles and changes in metabolic processes. The sensor also reports qualitative measurement of oxygen gas concentration in air for use in a sample bottle or other high-humidity enclosures. With the included cover, the sensor has a fully waterproof design and is submersible to 10 m.

Specifications:

Bluetooth® and USB connectivity

Response Time: 90% in 25 sec

Operating Temperature: 0–50°C

Range: 0–20 mg/L or 0–300% saturation
Reports solution temperature and ambient pressure

Accuracy: ±0.2 mg/L or 1% (whichever is greater) with user calibration; ±0.5 mg/L or 3% (whichever is greater without user calibration; >200% saturation ±10%

Wireless Optical Dissolved Oxygen Sensor

PS-3224

Includes USB charging cable

Wireless Optical Dissolved Oxygen Metal Guard

PS-3604

This stainless steel metal guard has been designed to protect the sensor cap and make the sensor sink. It threads easily onto the Wireless Optical Dissolved Oxygen Sensor, can withstand use in marine environments, and is strongly recommended for field applications. *(This metal guard is not compatible with our PASPORT DO sensors.)*

Wireless Optical Dissolved Oxygen Sensor Cap

PS-3605

Here is a replacement sensor cap for the Wireless Optical Dissolved Oxygen Sensor. It includes a calibration coefficient. *(This sensor cap is not compatible with our PASPORT DO sensors.)*

Salinity Sensor

PS-2195

With PASCO's Salinity Sensor you now can explore your local coastal ecosystems. Study estuaries and even ocean and brine environments. Explore transition areas where fresh water and salt water mix — even map them for yourself using the GPS Position Sensor.

The Salinity Sensor is calibrated to global standards — once you have identified the salinity of your local ecosystem, you can compare your data to similar saltwater ecosystems around the world.

Salinity level of sample taken from a bay

Features

- Measures salinity, conductivity and temperature
- Automatically temperature-compensates based on Practical Salinity Standard

Salinity Sensor

PS-2195

Make all your sensors wireless!

AirLink

PS-3200

Includes one PASPORT sensor port, USB and Bluetooth connectivity, and USB cable.

Flow Rate/Temperature Sensor

PS-2130

Chemical Water Quality Testing in the Field

PASCO's ezSample water quality test kits simplify the chemical testing of water sources. Avoid the mess and difficulty of handling chemicals directly and get great results, even in the field.

Colorimetric Analysis

Conduct colorimetric tests in the field and avoid the mess and tedium of mixing chemicals. These ezSample Snap Vials contain a pre-formulated reagent to test a variety of water quality parameters. No more guessing at color variations—drop the vial into the Water Quality Colorimeter and read the concentration.

Snap tip of the vial and...

...sample instantly flows into tube, mixing with the reagent.

Place in Water Quality Colorimeter and read your results.

Water Quality Colorimeter

PS-2179

Includes Sensor Extension Cable.

Iron concentration using ezSample Snap Vial and Water Quality Colorimeter.

ezSample™ Snap Vial Kits

Ammonia EZ-2334A
Chlorine EZ-2339A
Iron EZ-2331
Nitrate EZ-2333B*
Phosphate EZ-2337

Each kit contains 30 tests.

Requires:

Water Quality Colorimeter PS-2179

* **WARNING!** This product can expose you to chemicals including ethylene glycol, which is known to the State of California to cause birth defects or other reproductive harm.
For more information go to www.P65Warnings.ca.gov.

ezSample™ Field Titrator Kits

Alkalinity EZ-2340
Carbon Dioxide EZ-2341*
Total Hardness EZ-2338

Each kit contains 30 tests.

* **WARNING!** This product can expose you to chemicals including phenolphthalein, which is known to the State of California to cause cancer, and methanol, which is known to the State of California to cause birth defects or other reproductive harm.
For more information go to www.P65Warnings.ca.gov.

EcoZone™ System

The EcoZone System is designed specifically to accommodate PASCO sensors for effective measurement of your model environment. Select from a wealth of sensor measurements for monitoring soil, oxygen, carbon dioxide, water quality, and ecosystem "weather"conditions. Even use the included syringe to extract water samples for chemical-based testing using the ezSample water quality test kits (see page 60).

EcoZone™ System

ME-6668

Includes 3 EcoChambers, tray, rubber stoppers, syringe, plastic tubing and wicking cord.

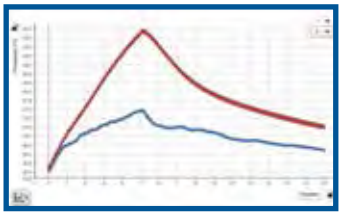
Easily create interconnected ecosystems (aquatic, terrestrial and decomposition) with live, continuous sensor monitoring. See pages 54-55 for more information on the Wireless CO_2, pH, Temperature, and Conductivity Sensors shown.

EcoChamber: Use it to build a greenhouse gas model.

Students create a model environment with the EcoChamber, which supports sensor-based measurement of a closed system. This environment is monitored by a Fast Response Temperature Probe as the lamp's "solar energy" is absorbed by the rocks, re-radiated into the chamber, and absorbed by the gas in the chamber.

Canned dust remover is an efficient greenhouse gas. By filling the EcoChamber, students can model the greenhouse effect caused by the earth/sun relationship.

Two trials – one control, one with greenhouse gas: The greenhouse-gas trial resulted in a higher temperature and a longer cooling-off period.



EcoChamber

ME-6667

Includes acrylic chamber, 7 stoppers of various sizes, 5 probe stoppers, 20 cc calibrated syringe and sample tube with connector.

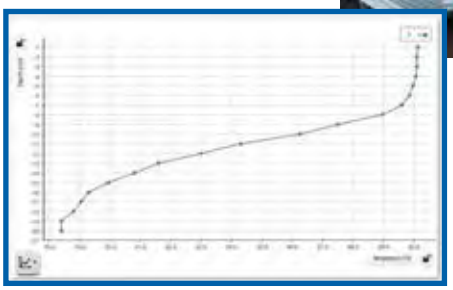
Density Circulation Model

The PASCO Density Circulation Model helps students understand the complex density-driven circulation associated with heat transfer through convection. Specifically, students simulate vertical ocean currents driven by water bodies with density differences (the "ocean conveyor belt").

With the Density Circulation Model, students can investigate:

- Vertical ocean currents
- Tropical vs. polar water bodies
- Convection
- Upwelling
- Thermocline and haliocline
- Inversions

The student data clearly shows that the water bodies are stratified by temperature (density), with a very rapid change of temperature at the boundary between the two (the small green area where mixing does occur).



As students open the valves, convection-driven circulation begins and the water types begin to layer—even for very small temperature/density differences.

Density Circulation Model

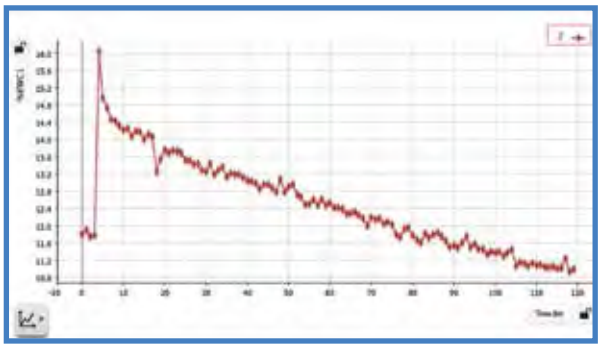
ME-6816

Investigate soil science

Soil moisture plays an important role in soil science, hydrology, and agriculture studies, since soil moisture is essential to plant growth and soil stability. The soil moisture for a given area is dependent on many factors, including the availability of water and the type and composition of the soil. Students can use the Soil Moisture Sensor in field measurements to help determine if a soil is a good candidate to suppor a certain crop or plant type. By comparing different soil types, students can construct a soil moisture map of the area and decide where the be location is for agriculture or for a building.

Students can also investigate the connection between soil moisture and transpiration. Under normal conditions the plants pull their moisture from the soil. With the Soil Moisture Sensor, students can investigate the rate at which moisture is removed from the soil in various conditions.

Study soil conditions in different settings to identify optimal environments for different plant species.



Soil moisture data over time.

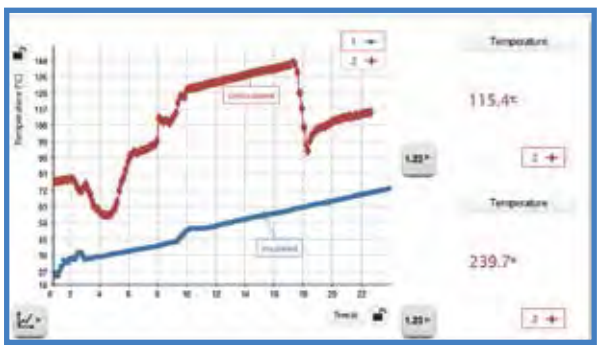
Soil Moisture Sensor

PS-2163

Non-Contact Temperature

The Non-Contact Temperature Sensor allows the measurement of surface temperatures without direct contact — for both safety and convenience. Investigate how different materials heat up under direct energy from the sun, or try to discern the inner structure of an exterior wall by measuring and mapping temperatures across its surface. Even compare surface temperatures at different locations on the body. Energy audits of home and school buildings are easy — create profiles of heat loss or heat absorption with just a scan.

Students can create a temperature profile of a surface or a building with the Non-Contact Temperature Sensor.



Investigate the surface temperature of different materials and their impact on building insulation and efficiency.

Non-Contact Temperature Sensor

PS-2197

Recommended:
Sensor Extension Cable PS-2500

FREE Ag Science Labs now in the PASCO Digital Library

There are twelve brand new labs that are designed to use wireless sensors and FREE to download. Each lab includes an editable student file and SPARKvue configuration file, which streamline data collection and enable students to spend more time on analysis and inquiry.

Experiments and Sensors Used

Experiments	Wireless Sensors						
	CO_2 Gas	Temperature	pH	Conductivity	Colorimeter & Turbidity	Weather/GPS	Dissolved O_2
1. Determining Soil Quality	●						
2. Water Treatment			●	●	●		
3. Freshwater Quality Monitoring		●	●	●			●
4. Water and pH			●	●			
5. Respiration of Germinating Seeds	●						
6. Plant Pigments and Photosynthesis					●		
7. Plant Respiration and Photosynthesis	●						
8. Modeling an Ecosystem	●		●	●	●	●	●
9. Greenhouse Gases		●					
10. Energy Content of Food		●					
11. Diffusion			●	●	●		
12. Soil and pH			●				

Ag Science Starter Bundle

PS-7621A

1. Wireless pH PS-3204
2. Wireless Conductivity PS-3210
3. Wireless CO_2 PS-3208
4. Wireless Colorimeter PS-3215*
5. Wireless Temperature Sensor PS-3201

* **WARNING!** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Ag Science Extension Bundle

PS-7622A

1. EcoZone ME-6668
2. Wireless Optical Dissolved O_2 Sensor PS-3224
3. Wireless Weather with GPS PS-3209
4. Weather Vane Accessory PS-3553

PASCO's Sensor-based Solutions for Physical Science

In today's Physical Science classroom, inquiry-based, hands-on activities combine with educational technology to keep students engaged and increase science literacy. PASCO's STEM-based Physical Science solutions do just that. Topics include mechanics, chemical reactions, properties of matter, energy transfer, and more.

Physical Science Index

MORE PHYSICS FROM PASCO

Get our latest Physics Catalog and see our extensive offering of physics teaching equipment and apparatus. Request your catalog today online at:

pasco.com/catalog

COOL!

MatchGraph!™ FREE App *(page 66)*

for Windows®, Mac®, iPad® and Android™

Engage your students with a kinesthetic experience that is centered on motion. Students gain a deeper understanding of how to interpret graphs by watching their motion graphed in real time. Choose between both position and velocity curves. Discuss with your students how the velocity graphs relate to their corresponding Position vs. Time graphs.

Wireless Motion Sensor

PS-3219 *(page 66)*

Includes rod clamp

Use with MatchGraph software to study position and velocity graphing in real time. Investigate ocean-floor mapping. Study objects in freefall. Measure dynamics carts to study kinematics, conservation of momentum, and kinetic energy.

Features

- Rotary swivel head
- USB and Bluetooth®
- Rechargeable
- 1 mm resolution

Smart Cart

ME-1240 (red) *(page 67)*
ME-1241 (blue) *(page 67)*

The wireless PASCO Smart Cart is designed to measure its own movement and the forces that are pushing or pulling on it. It is a dynamics cart with integrated force, acceleration, and position sensors that connect wirelessly through a single Bluetooth connection to a computer, tablet, or Chromebook™.

PASCO's Smart Cart connects to SPARKvue like any other PASCO wireless sensor.

Patent Pending

Wireless Light Sensor

PS-3213 *(page 69)*

Includes 1 coin cell battery.

This wireless sensor is a great tool for explorations in Earth, Life, and Physical sciences. With its ambient light detector for illuminance and UV, and its directional detector for colors, your students can explore the electromagnetic spectrum, model planetary motion, and relate photosynthesis to light color and intensity.

(front view)

Features

All these measurements in one!

- Illuminance (lux)
- UVA, UVB, and UV Index
- RGB color detection
- Battery life >1 year

(back view)

Wireless Weather Sensor with GPS

PS-3209 *(page 68)*

Use this multimeasure sensor to monitor 19 different measurements including common weather, location, and light. Study microclimates, monitor environmental conditions during indoor or outdoor labs, or place the sensor outside for extended monitoring, because of its durable, water-resistant design and internal memory.

Includes USB charging cable.

(front view)

(back view)

MatchGraph!™ FREE App

for Windows®, Mac®, iPad® and Android™

Now works with Smart Carts!

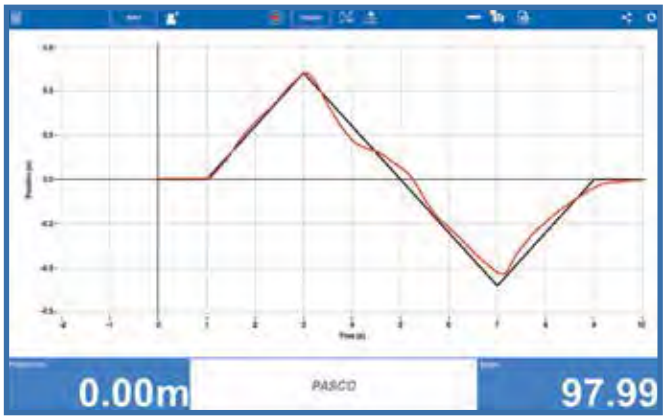
This software helps students interpret position and velocity.

With PASCO's state-of-the-art graphing app, you can engage your students with an experience that is centered on motion. Students gain a deeper understanding of how to interpret graphs by watching the motion of their Smart Carts graphed in real time. Choose between both position and velocity curves. Discuss with your students how the velocity graphs relate to their corresponding Position vs. Time graphs.

MatchGraph!™

MatchGraph features:

- **Students choose from position and velocity profiles** as they learn to relate motion to the graphs they make.
- **Students use their journals to capture images of matches**, which can be used in their lab reports.
- **Students can export their data** into SPARKvue® or PASCO Capstone™ for even more analysis.



Download the Free *MatchGraph!* App

for Mac®, Android™, and Windows® computers at **pasco.com/downloads.** Download the free iPad® or Android™ app on the App Store or Google Play.

ANDROID APP ON Google play

Download on the App Store

Wireless Motion Sensor

PS-3219

Includes rod clamp

NEW

Use with MatchGraph software to study position and velocity graphing in real time. Investigate ocean-floor mapping. Study objects in freefall. Measure dynamics carts to study kinematics, conservation of momentum, and kinetic energy.

Smart Cart

ME-1240 (red)

ME-1241 (blue)

Smart Cart

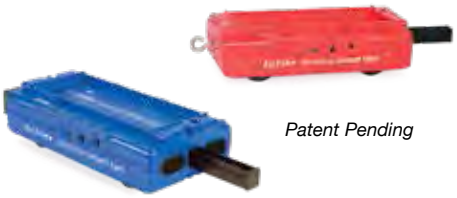
ME-1240 (red) ME-1241 (blue)

winner! 2016 AWARDS of EXCELLENCE TECH & LEARNING

GESS EDUCATION AWARDS WINNER 2017

PASCO brings Bluetooth® technology to the study of dynamics! The wireless PASCO Smart Cart is designed to measure its own movement and the forces that are pushing or pulling on it. It is a dynamics cart with integrated force, acceleration, and position sensors that connect wirelessly through a single Bluetooth connection to a computer, tablet, or Chromebook™.

PASCO's Smart Cart connects to SPARKvue like any other PASCO wireless sensor.



Patent Pending

Our Smart Cart is patent pending. Get the full details on the Smart Cart at **www.pasco.com/smartcart**

Smart Cart

ME-1240 (red)

ME-1241 (blue)

Smart Cart Charging Garage

ME-1243

Charge up to five Smart Carts at once. Provides storage for the carts and accessory bumpers. Includes power adapter.

Smart Carts not included.

PAStrack

ME-6960

Includes two-piece track, two connector clips, and six leveling feet.

Two-piece track construction for easy storage. Snap-on connector clip holds sections straight and rigid. Use the second clip (included) to connect multiple tracks!

Also available:

Basic PAScar/PAStrack System ME-5701

End Stops (2)

ME-8971

Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable

The Wireless Weather Sensor is an all-in-one instrument for monitoring environmental conditions. By incorporating several sensing elements into a single unit, the sensor provides up to **19 different measurements!** Use the sensor in logging mode with the Weather Vane Accessory for long-term monitoring, or use it as a hand-held instrument to study microclimates and record ambient conditions relevant to many biological and environmental phenomena.

Measurements

Weather
1. Ambient Temperature
2. Barometric Pressure
3. Wind Speed
4. Wind Direction (true)
5. Relative Humidity
6. Absolute Humidity
7. Dew Point
8. Wind Chill
9. Heat Stress Index

Light
10. Ambient Light (lux)
11. UV Index
12. PAR
13. Irradiance

GPS
14. Latitude
15. Longitude
16. Altitude
17. Speed
18. Magnetic Direction
19. True Direction

Specifications:

Battery: Rechargeable
Water-resistant.
(Please see pasco.com for detailed specifications.)

Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable.

Weather Vane Accessory

PS-3553

Includes tripod, tripod adapter, and weather vane.

Equip your Wireless Weather Sensor for extended environmental monitoring with the Weather Vane Accessory. Once deployed the sensor will freely rotate to capture wind speed and direction, whether you are monitoring data in real time or using the sensor in logging mode to capture hours (or days!) of data for later analysis.

Weather Vane Accessory

PS-3553

Wireless Light Sensor

This wireless sensor is a great tool for explorations in Earth, Life, and Physical sciences. With its ambient light detector for illuminance and UV, and its directional detector for colors, your students can explore the electromagnetic spectrum, model planetary motion, and relate photosynthesis to light color and intensity.

Features

All these measurements in one!

- Illuminance (lux)
- UVA, UVB, and UV Index
- RGB color detection
- Battery life >1 year
- Remote logging

Using the Wireless Light Sensor to Collect Eclipse Data

On August 21, 2017, a total solar eclipse occurred and was visible, in some degree, over much of the continental United States (see map). As the moon in its new phase passed directly in front of the sun, the moon cast a shadow on Earth. Using PASCO wireless sensors, many students across the United States viewed the total eclipse and measured the change in light level and temperature as the moon passed in front of the sun!

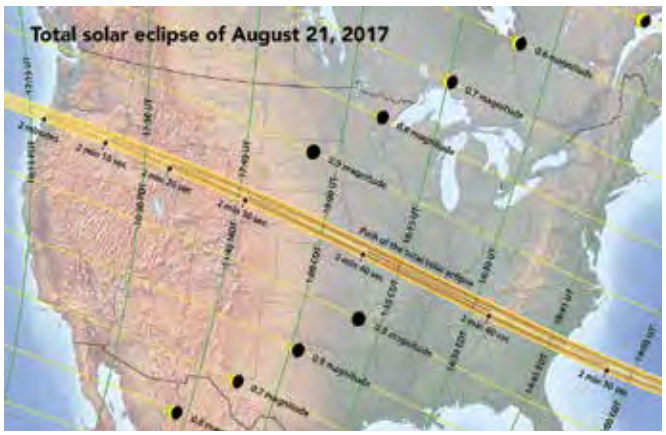
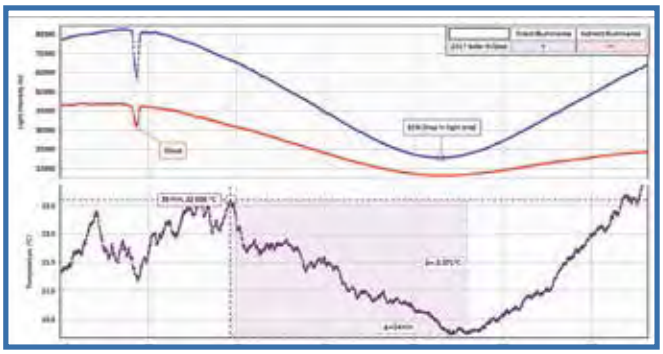


Image courtesy of GreatAmericanEclipse.com

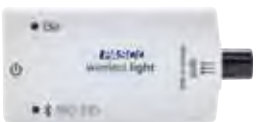


This eclipse data was collected at PASCO in Roseville, CA, on August 21, 2017.

Wireless Light Sensor

PS-3213

Includes 1 coin cell battery.



Also available:

Wireless Temperature Sensor PS-3201

Free Digital Labs for Physical Science available at pasco.com

- This collection of labs is standards-based and STEM- and Common Core-focused.
- Collection covers core topics including mechanics, chemical reactions, properties of matter, energy transfer, and the geosphere.
- The labs engage students as they make predictions, collect real-time data, use critical thinking skills to solve sequencing challenges, and answer embedded questions.

Physical Science Experiments and Sensors Used

Experiments	Pressure	Conductivity	Force	Motion	pH	Temperature	Voltage or Current	No Sensor Used
Chemical Reactions								
Endothermic or Exothermic?	●					●		
Evidence of a Chemical Reaction						●		
Ecology								
Soil pH					●			
Electricity & Magnetism								
Faraday's Law							●	
Voltage							●	
Force & Motion								
Acceleration				●				
Archimedes' Principle*			●					
Conservation of Matter								●
Introduction to Force*			●					
Newton's First Law				●				
Newton's Second Law*			●	●				
Newton's Third Law*			●					
Position Match Graph				●				
Speed & Velocity				●				
Geosphere								
Air Pollution & Acid Rain					●			
Insolation & the Seasons						●		
Radiation Energy Transfer						●		
Specific Heat of Sand vs. Water						●		
Water, the Universal Solvent*		●						
Lab Skills								
Density*								●
Percent Oxygen in Air	●							
Significant Figures*								●
Varying Reaction Rates						●		
Structure & Properties of Matter								
Electrolyte vs. Non-Electrolyte Solutions*		●						
pH of Household Chemicals					●			
Properties of Ionic & Covalent Compounds*		●						
Thermodynamics								
Boyle's Law	●							
Phase Change						●		
Temperature vs. Heat						●		

*Requires Standard Sensor Bundle

Looking for more teacher resources?

Our collection of Physical Science Teacher Resources is electronic and downloadable. It includes lab prep, teacher tips, assessment, editable student handouts, answer key, and more. And the student version is FREE!

Physical Science through Inquiry Teacher Resources

PS-2843B

The electronic content includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more.

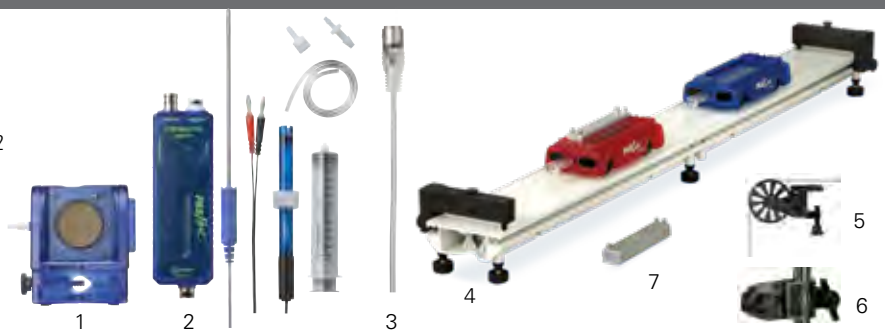
Physical Science Sensor Bundles

Physical Science Starter Sensor Bundle

PS-2845

1. Motion Sensor PS-2103A
2. Chemistry Sensor PS-2170
3. PASPORT Extension Cable PS-2500
4. Basic PAStrack Dynamics System ME-6962
5. Super Pulley with Clamp ME-9448B
6. Dynamics Track Rod Clamp ME-9836
7. 250 g Stackable Masses (2) ME-6757A

This bundle gives you the sensors you need to perform 22 labs on the opposite page.



Physical Science Standard Sensor Bundle *(Includes all Starter Bundle sensors)*

PS-2846

1. Motion Sensor PS-2103A
2. Chemistry Sensor PS-2170
3. PASPORT Extension Cable PS-2500
4. Basic PAStrack Dynamics System ME-6962
5. Super Pulley with Clamp ME-9448B
6. Dynamics Track Rod Clamp ME-9836
7. Force Sensor PS-2104
8. Conductivity Sensor PS-2116A
9. PASCO Density Set ME-8569A
10. Mass & Hanger Set ME-8979
11. Significant Figures Set – Single ME-9850
12. Overflow Can SE-8568
13. 250 g Stackable Masses (2) ME-6757A

This bundle gives you the sensors you need to perform the 31 labs on the opposite page.

Wireless Force Acceleration Sensor

PS-3202

Capable of measuring force, acceleration, and rotation, this sensor is ideal for experiments involving rotating platforms, moving carts, spring oscillations, collisions, and impulse.

Includes 1 eye bolt, 1 thumb screw, 1 bumper, a lithium-ion battery, and a USB connector. Wireless sensors connect directly to most classroom devices. See below for details.

AirLink

PS-3200

Includes one PASPORT sensor port, USB and Bluetooth connectivity, and USB cable.

Most computing devices will connect directly to PASCO Bluetooth® 4.0 wireless products. Please go to pasco.com/compatibility to determine your direct-connect compatibility. PASCO offers the PS-3500 USB Bluetooth® Adapter for computing devices that do not support direct-connect.

USB Bluetooth® 4.0 Adapter
PS-3500

10-port USB Charging Station
PS-3501

PASCO's Solutions for Physics

PASCO now has a complete Physics curriculum: Essential Physics! All our Physics solutions combine inquiry-based, hands-on activities with the latest educational technology tools to keep students engaged and increase science literacy. Topics covered include mechanics, electricity and magnetism, optics, thermodynamics, waves, and more.

Physics Index

Are you receiving our Physics Catalog? It includes our full line of Physics equipment.

Go to pasco.com/catalog

Four essentials for Physics you can't do without!

Smart Cart

ME-1240 (red)

ME-1241 (blue)

(page 85)

It is the ultimate tool for your physics lab with built-in sensors that measure force, position, velocity, and acceleration. The Smart Cart can make these measurements on or off a dynamics track and transmit the data wirelessly over Bluetooth®.

Patent Pending

Wireless Motion Sensor

PS-3219 *(page 84)*

Includes rod clamp

Use with FREE MatchGraph software to study position and velocity graphing in real time. Investigate ocean-floor mapping. Study objects in freefall. Measure dynamics carts to study kinematics, conservation of momentum, and kinetic energy.

Features

- Rotary swivel head
- USB and Bluetooth®
- Rechargeable
- 1 mm resolution

Wireless Rotary Motion Sensor

PS-3220 *(page 87)*

NEW table-top design! Measures both angular and linear position, velocity, and acceleration

Features

- 2000 div/rev; 0.18° resolution
- Built-in rod clamp
- USB and Bluetooth®
- Rechargeable

Rotational Inertia Accessory

ME-3420 *(page 87)*

Includes:

- Disks (2) + Thin Ring
- Pendulum Rod + Point Masses (2)
- Clamp-On Super Pulley
- Alignment Guides (3)

Most computing devices connect directly to PASCO Bluetooth® 4.0 wireless products. Go to pasco.com/compatibility to determine your direct-connect compatibility. PASCO offers the PS-3500 USB Bluetooth® Adapter for computing devices that do not support direct-connect.

USB Bluetooth® 4.0 Adapter
PS-3500

10-port USB Charging Station
PS-3501

Essential Physics Curriculum

This complete physics solution includes Textbook, e-Book, Digital Teacher Edition, and Equipment!

Essential Physics 3rd Edition is a comprehensive, full-color textbook paired with PASCO equipment, and it is the only e-Book for physics on the market. The program includes over 100 interactive tools that increase student engagement and understanding. *Essential Physics* is focused on practical applications that connect students to the physics of nature as well as technology.

About the program:

- Rigorous yet accessible design
- Interactive simulations and equations
- Lessons follow the 5E design
- Strong mathematics scaffolding
- Formative and summative assessment tools
- Differentiation for advanced, below-level, and ELL students
- Works seamlessly with your LMS and Google Classroom
- Includes 24/7 online/offline access. No Internet required!

Essential Physics is multiplatform: iOS, Android™, Chrome™, Windows®, and Mac®!

A textbook and e-Book for all your students

What sets *Essential Physics* apart is the complete and interactive e-Book. Animations, videos, and interactive equations and simulations bring concepts to life for students in ways that text and static images cannot. Combined with digital resources for teachers, formative and summative assessment, and equipment for lab investigations, *Essential Physics* forms a seamless learning system for mastering physics.

The interactive e-Book tools include:

31 videos

84 embedded interactive equations

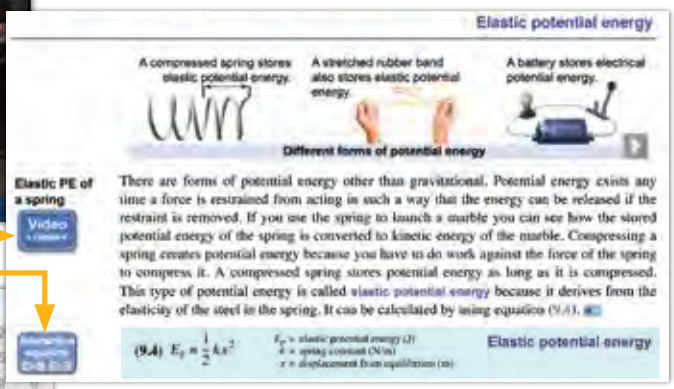
Full audio read

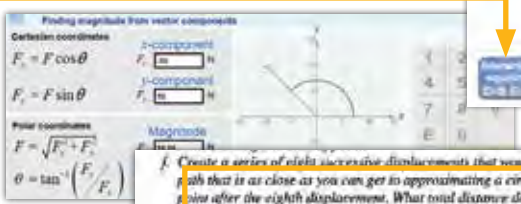
71 interactive simulations

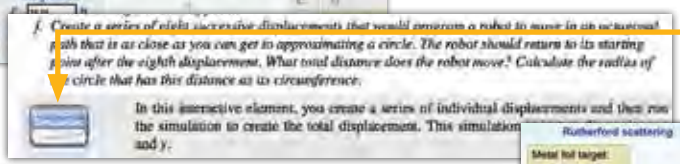
31 embedded animations

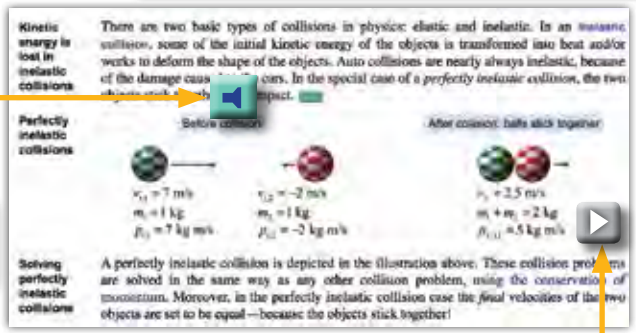
Summative assessment: The Infinite Test Bank

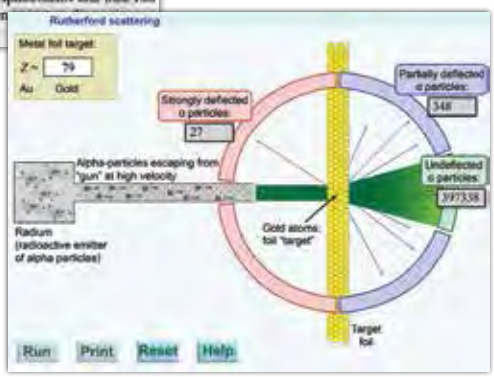
Formative assessment

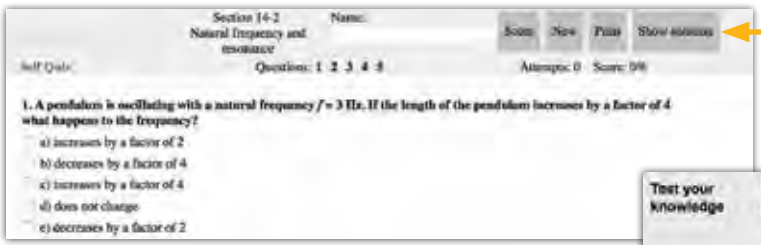


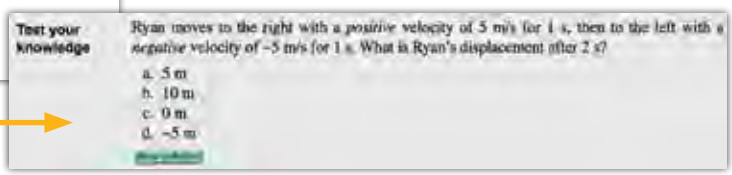






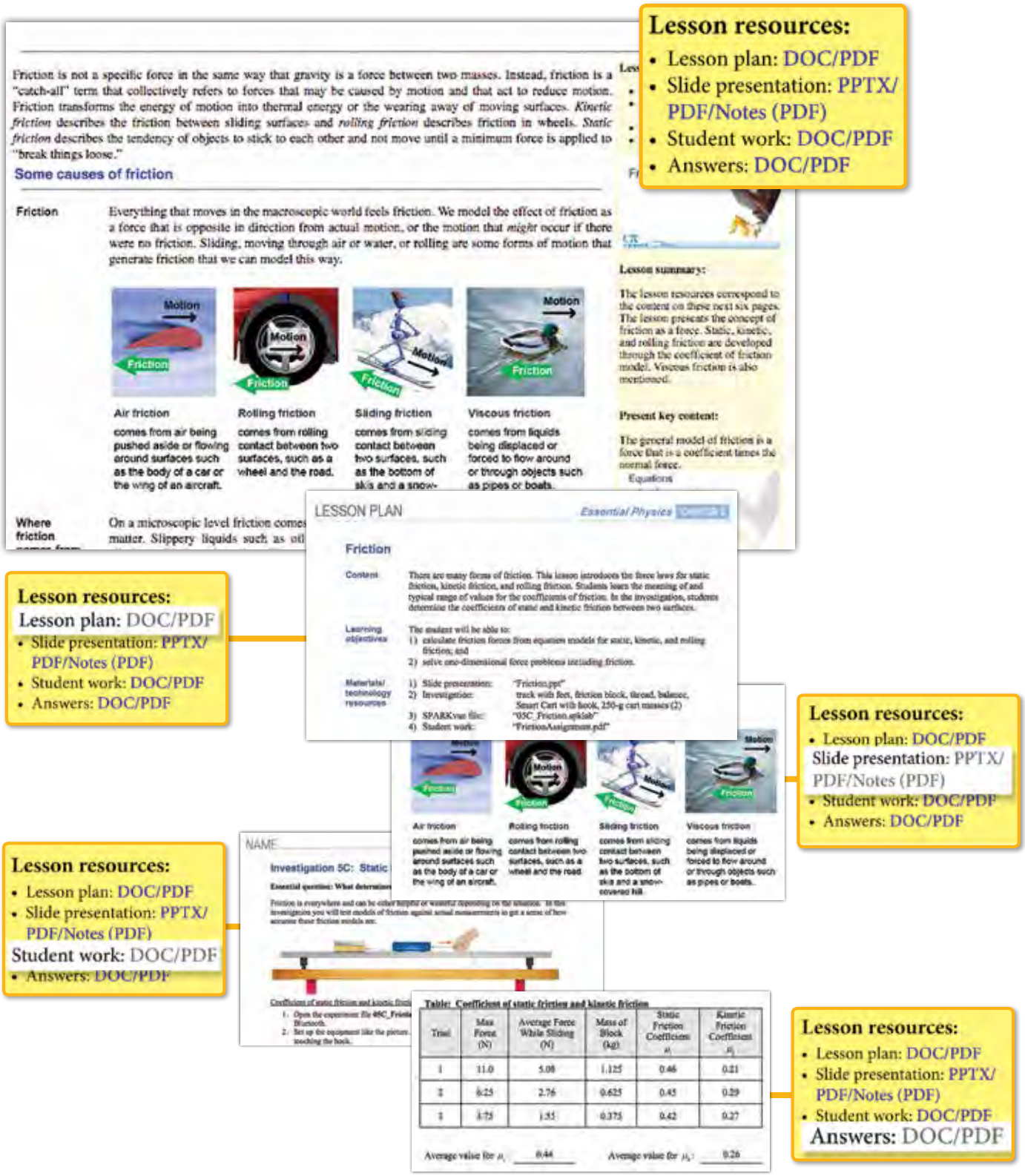






Essential Physics meets your state standards and supports STEM and NGSS!

The Digital Teacher Edition includes lesson plans, slide presentations, student work, and answer keys, all at point-of-use.



Get a textbook, e-Book, and equipment for the price of most textbooks!

Essential Physics 3rd Edition Student Textbook

EP-6323

- *Hardbound student textbook*

Essential Physics 3rd Edition Student e-Book only

EP-6323-EB1

EP-6323-EB5

Includes e-Book with 24/7 online/offline access

Equipment Kits

Comprehensive Equipment Kit *41 labs are designed to use this equipment set.*

EP-6490

- Forces & Machines Set*
- Simple Machines Set*
- Mini Launcher, Clamp, & Rod
- Oscillations, Waves & Sound Components Set*
- Wireless Light Source
- Optics Components Set*
- Tripod Stands (2) & Crossrail
- Tripod Track Bracket
- Forces Accessories
- Modular Circuits Set*

**Each set includes a Gratnells® Storage Tray.*

Assembly shown with Forces & Machines Components

Standard Equipment Kit *25 labs are designed to use this equipment set.*

EP-3567A

Includes 1 of each of the following:

- Smart Cart (Blue), ME-1241
- Friction Block, ME-9807
- PAScar Cart Mass (set of 2), ME-6757A
- Angle Indicator, ME-9495A
- Track End Stop (set of 2), ME-8971
- Super Pulley with Clamp, ME-9448B
- 1.2m Dynamics Track, ME-9493
- Track Feet (set of 2), ME-8972
- Weights
- Modular Circuits
- Wireless Current Module
- Wireless Voltage Sensor
- Gratnells® Storage Tray

For complete pricing information go to pasco.com/essentialphysics

Advanced Physics 1 Experiment Guide

PS-3812

This experiment guide covers the latest standards for College Board Advanced Placement Physics 1.

- Every lab is based on the College Board Learning Objectives.
- Data Analysis and Assessment Questions are designed to prepare students for the AP® Physics 1 exam.
- Every lab employs the same strategies found in free response questions on the AP® exam.
- Includes editable student handouts.

Prepare your students for inquiry investigations in the physics lab. Each lab is presented three ways:

- Structured
- Guided inquiry
- Student designed

You decide which level of inquiry is appropriate for each lab.

Each lab includes teacher resources:

- Pre-lab discussion and questions
- Procedural overview
- Teacher tips
- Sample data
- Assessment and synthesis questions
- Extended inquiry suggestions

ADV PHYSICS 1 EXPERIMENTS	EQUIPMENT		ALIGNMENT	
LAB	Perform these labs with the PS-3813 Equipment Kit	Add the PS-3814 Expansion Kit to perform all these labs	IB® Standards*	AP® 1 Standards**
1. Graphical Analysis: Motion	✔	✔	2.1	3.A.1.1, 2, 3
2. Newton's Second Law	✔	✔	2.2	3.B.1.1, 2, 3, 3.B.2.1
3. Atwood's Machine	✔	✔	2.2	3.B.1.1, 2
4. Coefficients of Friction	✔	✔	2.2	3.C.4.1,2
5. Two Dimensional Motion: Projectiles		✔	1.3, 2.1	3.E.1.3, 4
6. Conservation of Mechanical Energy	✔	✔	2.3	5.B.4.1,2
7. Work and Kinetic Energy	✔	✔	2.3	4.C.2.1, 2
8. Conservation of Momentum		✔	2.4	5.D.1.3,5.D.2.2, 4
9. Momentum and Impulse	✔	✔	2.4	3.D.2.3, 4
10. Rotational Dynamics		✔	B.1	3.F2.1, 2, 3.A.1.3
11. Rotational Statics		✔	B.1	3.F.1.1, 2, 3, 4, 5
12. Periodic Motion: Mass and Spring	✔	✔	4.1, 9.1	3.B.3.1, 2, 3, 4
13. Simple Pendulum	✔	✔	4.1, 9.1	3.B.3.1, 2, 3
14. Resonance and Standing Waves		✔	4.5, B.4	6.D.3.4, 6.D.4.1, 2
15. DC Circuits		✔	5.1, 5.2	1.B.1.2, 5.B.9.2, 3, 5.C.3.1

Each experiment guide includes video support!

How-to videos are included with the manual, on the PASCO web site and on YouTube, and can be installed on your own computers.

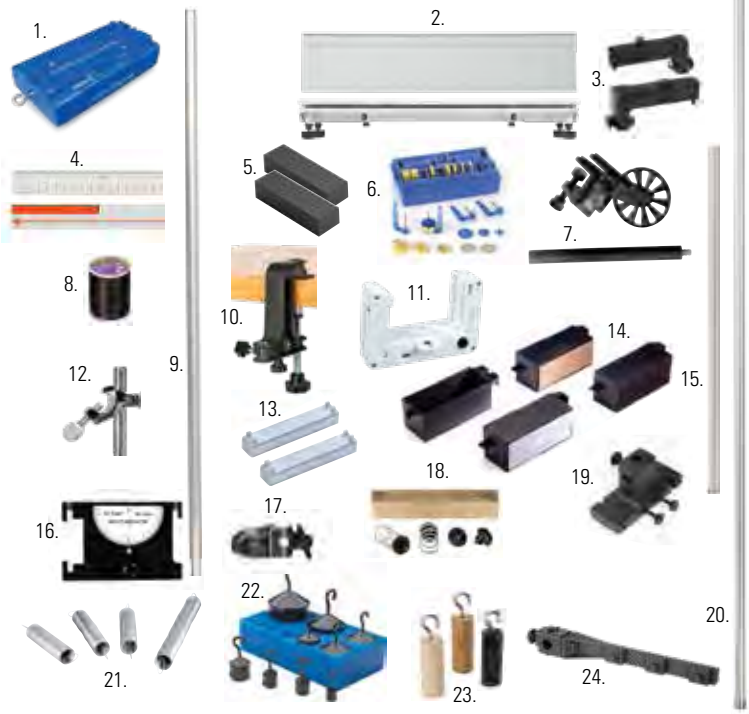
Try It!

* IB is a registered trademark of the International Baccalaureate Organization, which was not involved in the production of, and does not endorse, this product.
** AP is a trademark registered and/or owned by the College Board, which was not involved in the production of, and does not endorse, this product.

Advanced Physics 1 Equipment Kit

PS-3813

	Equipment	Part #	Qty
1.	Smart Cart (blue)	ME-1241	1
2.	PAStrack	ME-6960	1
3.	Dynamics Track End Stop (2 pack)	ME-8971	1
4.	Four Scale Meter Stick	SE-8695	1
5.	250-g Compact Cart Mass	ME-6755	2
6.	Mass & Hanger Set	ME-8979	1
7.	Super Pulley Kit	ME-9433	1
8.	Thread	ME-9875	1
9.	60-cm Stainless Steel Rod	ME-8977	1
10.	Aluminum Table Clamp	ME-8995	1
11.	Wireless Smart Gate	PS-3225	1
12.	Right Angle Clamp	SE-9444	1
13.	250-g Cart Mass	ME-6757A	3
14.	Discover Friction Accessory Tray	ME-8574	1
15.	45-cm Stainless Steel Rod	ME-8736	1
16.	Angle Indicator	ME-9495A	1
17.	Dynamics Track Rod Clamp	ME-9836	1
18.	Bumper Accessory Set	ME-9884	1
19.	Smart Cart Rod Stand Adapter	ME-1244	1
20.	90-cm Stainless Steel Rod	ME-8738	1
21.	Demonstration Spring Set	ME-9866	1
22.	Hooked Mass Set	SE-8759	1
23.	Photogate Pendulum Set	ME-8752	1
24.	Pendulum Clamp	ME-9506	1



Advanced Physics 1 Expansion Kit

PS-3814

	Equipment	Part #	Qty
1.	Smart Cart (red)	ME-1240	1
2.	Pendulum Accessory	ME-8969	1
3.	Aluminum Table Clamp	ME-8995	1
4.	Wireless Rotary Motion Sensor	PS-3220	1
5.	Stainless Steel Calipers	SF-8711	1
6.	Tension Protractor	ME-6855	2
7.	60-cm Stainless Steel Rod	ME-8977	1
8.	Aluminum Table Clamp	ME-8995	1
9.	Tuning Fork Set	SE-7342	1
10.	Resonance Air Column	WA-9606	1
11.	AC/DC Electronics Lab Kit	EM-8656	1
12	Wireless Voltage Sensor	PS-3211	1
13.	Wireless Current Sensor	PS-3212	1
14.	Photogate Mounting Bracket	ME-6821A	1
15.	Mini Launcher	ME-6825B	1
16.	Carbon Paper	SE-8693	1

Advanced Physics Sensor Bundle

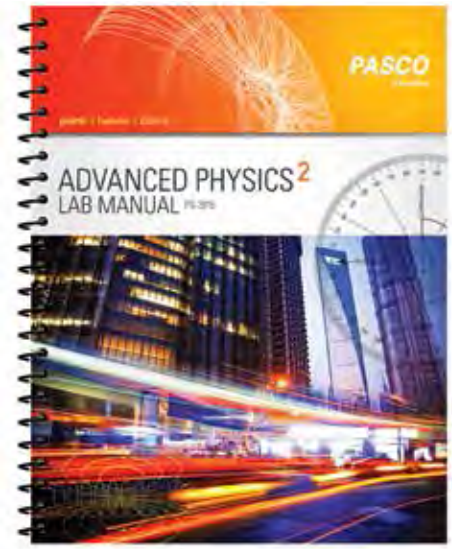
Just need sensors?

PS-3818

Equipment		Part #	Qty
1.	Smart Cart (red)	ME-1240	1
2.	Wireless Smart Gate	PS-3225	1
3.	Smart Cart (blue)	ME-1241	1
4.	Wireless Rotary Motion Sensor	PS-3220	1
5.	Wireless Voltage Sensor	PS-3211	1
6.	Wireless Current Sensor	PS-3212	1
7.	Wireless Pressure Sensor	PS-3203	1
8.	Wireless Magnetic Field Sensor	PS-3221	1

Advanced Physics 2 Experiment Guide

PS-3815



This experiment guide covers the latest standards for College Board Advanced Placement Physics 1.

- Every lab is based on the College Board Learning Objectives.
- Data Analysis and Assessment Questions are designed to prepare students for the AP® Physics 1 exam.
- Every lab employs the same strategies found in free response questions on the AP® exam.
- Includes editable student handouts.

Prepare your students for inquiry investigations in the physics lab. Each lab is presented three ways:

- Structured
- Guided inquiry
- Student designed

You decide which level of inquiry is appropriate for each lab.

Each lab includes teacher resources:

- Pre-lab discussion and questions
- Procedural overview
- Teacher tips
- Sample data
- Assessment and synthesis questions
- Extended inquiry suggestions

ADV PHYSICS 2 EXPERIMENTS	EQUIPMENT		ALIGNMENT	
LAB	Perform these labs with the PS-3816 Equipment Kit	Add the PS-3817 Expansion Kit to perform all these labs	IB® Standards*	AP® 2 Standards**
1. Hydrostatic Pressure	✔	✔	B.3	3.C.4.1, 3.C.4.2
2. Buoyant Force		✔	B.3	1.E.1.2, 3.A.3.1, 3.C.4.2
3. Fluid Dynamics	✔	✔	B.3	5.B.10.1, 5.B.10.3, 5.B.10.4
4. Boyle's Law	✔	✔	3.2	5.B.7.2, 7.A.3.2, 7.A.3.3
5. Spherical Mirror Reflection	✔	✔	C.1	6.E.4.1, 6.E.4.2
6. Snell's Law	✔	✔	4.4	6.E.3.2, 6.E.3.3
7. Focal Length of a Converging Lens	✔	✔	C.1	6.E.5.1, 6.E.5.2
8. Interference and Diffraction	✔	✔	4.4, 9.2, 9.3	6.C.3.1
9. Electric Field Mapping		✔	5.1, 10.1	2.E.2.1
10. Magnetic Fields		✔	5.4	2.D.2.1, 2.D.3.1, 2.D.4.1
11. Magnetic Field Strength		✔	5.4	2.D.2.1
12. Electromagnetic Induction	✔	✔	11.1	4.E.2.1
13. Capacitor Fundamentals		✔	11.3	4.E.4.2, 4.E.4.3
14. Series and Parallel Capacitors		✔	11.3	4.E.5.3, 5.B.9.5
15. RC Circuits		✔	11.3	4.E.5.1, 4.E.5.2, 4.E.5.3
16. Planck's Constant		✔	12.1	6.F.3.1, 6.F.4.1

Each experiment guide includes video support!

How-to videos are included with the manual, on the PASCO web site and on YouTube, and can be installed on your own computers.

Try It!

* IB is a registered trademark of the International Baccalaureate Organization, which was not involved in the production of, and does not endorse, this product.
** AP is a trademark registered and/or owned by the College Board, which was not involved in the production of, and does not endorse, this product.

Advanced Physics 2 Equipment Kit

PS-3816

	Equipment	Part #	Qty
1.	Water Reservoir	ME-8594	1
2.	Wireless Pressure Sensor	PS-3203	1
3.	Four-Scale Meter Stick	SE-8695	1
4.	Concave Mirror Accessory	OS-8457	1
5.	Basic Optics Light Source	OS-8470	1
6.	Optics Track, 1.2 m	OS-8508	1
7.	Basic Optics Ray Table	OS-8465	1
8.	Basic Optics Viewing Screen	OS-8460	1
9.	Converging Lens, 50-mm diam.	OS-8466A	1
10.	Adjustable Lens Holder	OS-8474	1
11.	Diffraction Plate	OS-8850	1
12.	Rod, 45-cm	ME-8736	2
13.	Aluminum Table Clamp	ME-8995	2
14.	Stainless Steel Calipers	SE-8710	1
15.	Three-finger Clamp	SE-9445	2
16.	Laser Pointer (with known wavelength)	SE-9716B/C	1
17.	Wireless Voltage Sensor	PS-3211	1
Not Pictured:	.539 ID Plastic Tube, 12"	640-014	1
	Magnet or Enameled Wire, 22-gauge	712-029	1

Advanced Physics 2 Expansion Kit

PS-3817

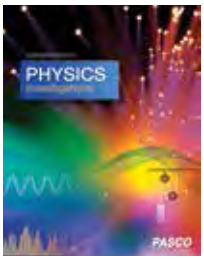
Equipment		Part #	Qty
1.	Smart Cart (red)	ME-1240	1
2.	Aluminum Table Clamp	ME-8995	1
3.	Thread	ME-9875	1
4.	Overflow Can	SE-8568	1
5.	Right Angle Clamp	SE-9444	1
6.	Field Mapper Kit	PK-9023	1
7.	Student Power Supply, 18 VDC, 3 A	SE-8828	1
8.	Digital Multimeter	SE-9786A	1
9.	Neodymium Magnets (solid)	EM-8648B	16
10.	AC/DC Electronics Lab Kit	EM-8656	1
11.	Magnaprobe™ Wand	SE-7390	1
12.	4-mm Banana Plug Patch Cord	SE-9750	2
13.	Wireless 3-Axis Magnetic Field Sensor	PS-3221	1
14.	Wireless Current Sensor	PS-3212	1
Not Pictured:	Aluminum Cylinder	648-04768	1
	Brass Cylinder	648-04770	1
	Magnet or Enameled Wire, 22-gauge	712-029	1
	Capacitor, 100-µF	222-039	5
	Blue LED (450–500 nm)	527-047	1
	Green LED (501–565 nm)	527-048	1
	Yellow/Amber LED (566–620 nm)	527-049	1
	Red LED (621–750 nm)	527-050	1

Advanced Physics Sensor Bundle

Just need sensors?

PS-3818

Equipment		Part #	Qty
1.	Smart Cart (red)	ME-1240	1
2.	Wireless Smart Gate	PS-3225	1
3.	Smart Cart (blue)	ME-1241	1
4.	Wireless Rotary Motion Sensor	PS-3220	1
5.	Wireless Voltage Sensor	PS-3211	1
6.	Wireless Current Sensor	PS-3212	1
7.	Wireless Pressure Sensor	PS-3203	1
8.	Wireless Magnetic Field Sensor	PS-3221	1



Comprehensive Physics Investigations Student Lab Manual

EP-6326

Are you looking for more hands-on physics labs? The Comprehensive Physics Investigations Student Lab Manual includes over 40 labs and activities. Best of all, digital access to these Online Teacher Resources is included with purchase of the lab manual

- A single teacher guide is all you need to outfit your class or lab.
- Complete with guided inquiry lab activities, suggested answers, and much more.
- Requires Simple Machines Engineering Kit

Investigations and activities in the student lab manual cover topics such as:

- Graphs of Motion
- Motion Graphs
- Acceleration
- A Model for Accelerated Motion
- Newton's Second Law
- Hooke's Law
- Static and Kinetic Friction
- Projectile Motion
- Acceleration on an Inclined Plane
- Static Equilibrium
- Work and the Force vs. Distance Graph
- Inclined Plane and the Conservation of
- Energy
- Work and Energy
- Springs and the Conservation of Energy
- Work Done by Friction
- Design a Crash Barrier
- Conservation of Momentum
- Inelastic Collisions
- Elastic Collisions
- Levers
- Pulleys
- Ramps and Inclined Planes
- Gear Ratios
- Designing Gear Machines
- Torque
- Mechanical Advantage of Gears
- Oscillators
- Resonance
- Waves
- Interference
- Resonance and Sound
- Design a Musical Instrument
- Electricity and Circuits
- Voltage and Batteries
- Design a Lemon Battery
- Resistors and Ohm's Law
- Series and Parallel Resistances
- Electrical Power
- Compound Circuits
- Magnification of Mirrors and Lenses
- Reflection in a Plane Mirror
- Refraction of Light
- Creating Real and Virtual Images with Lenses
- Image Formation for a
- Convex Lens
- Build a Microscope and Telescope
- Phosphorescence

All the Physics Equipment You Need...

Comprehensive Equipment Kit

EP-6490

This comprehensive kit includes:

- Forces and Motion Kit
- Oscillations, Waves, and Sound Kit
- Light, Color, and Optics Kit
- Simple Machines Engineering Kit
- Modular Circuits Kit

These kits require either SPARKvue or PASCO Capstone software, available at **pasco.com/downloads**

Choose the Kits You Need...

Forces & Motion Kit

EP-3576

Forces + Motion Labs

- Graphs of Motion
- Motion Graphs
- Acceleration
- A Model for Accelerated Motion
- Newton's Second Law
- Hooke's Law
- Static and Kinetic Friction
- Projectile Motion
- Acceleration on an Inclined Plane
- Work and the Force vs. Distance Graph
- Inclined Plane and the Conservation of Energy
- Work and Energy
- Springs and the Conservation of Energy
- Work Done by Friction
- Design a Crash Barrier
- Conservation of Momentum
- Inelastic Collisions
- Elastic Collisions
- Ramps and Inclined Planes

Go to **pasco.com** enter **EP-3576** for complete kit contents

Simple Machines Engineering Kit

EP-3577

Simple Machines Labs

- Static Equilibrium
- Levers
- Pulleys
- Gear Ratios
- Designing Gear Machines
- Torque
- Mechanical Advantage of Gears

Go to **pasco.com** enter **EP-3577** for complete kit contents

Modular Circuits Kit

EM-3536

Modular Circuits Labs

- Electricity and Circuits
- Voltage and Batteries
- Design a Lemon Battery
- Resistors and Ohm's Law
- Series and Parallel Resistances
- Electrical Power
- Compound Circuits

Go to **pasco.com** enter **EM-3536** for complete kit contents

Light, Color & Optics Kit

EP-3558

Light, Color & Optics Labs

- Magnification of Mirrors and Lenses
- Reflection in a Plane Mirror
- Refraction of Light
- Creating Real and Virtual Images with Lenses
- Image Formation for a Convex Lens
- Build a Microscope and Telescope
- Phosphorescence

Go to **pasco.com** enter **EP-3558** for complete kit contents

Oscillations, Waves & Sound Kit

EP-3578

Oscillations, Waves & Sound Labs

- Oscillators
- Resonance
- Waves
- Interference
- Resonance and Sound
- Design a Musical Instrument

Go to **pasco.com** enter **EP-3578** for complete kit contents

MatchGraph!™ FREE App

for Windows®, Mac®, iPad® and Android™

Now works with PASCO Motion Sensors and the Wireless Smart Cart!

FREE motion-graphing software

Engage your students with a student-centered experience as they study motion graphs. Give them a deeper understanding of interpreting motion graphs, while they see their own motion graphed in real time!

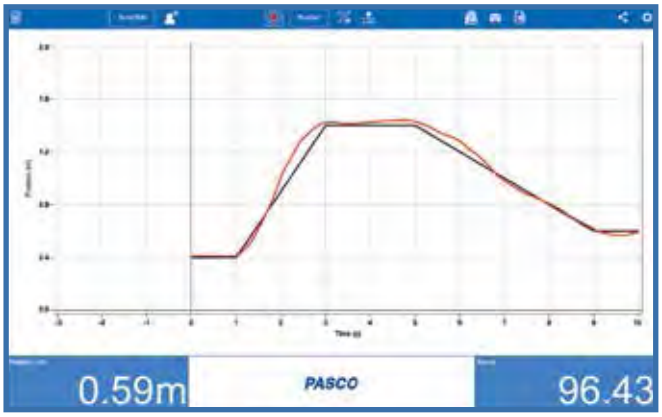
MatchGraph!™

MatchGraph features:

- **Students choose from position and velocity profiles** as they learn to relate motion to the graphs they make.
- **Their journals can capture images of matches**, which can be used in their lab reports.
- **Students can export their data** into SPARKvue® or PASCO Capstone™ for even more analysis.
- **Students can export images** of MatchGraph data into their lab reports.

This interactive game teaches students these motion-graphing basics:

- Position
- Velocity graph
- Acceleration
- Slope and rate of change
- Frame of reference



Wireless Motion Sensor

PS-3219

Includes rod clamp

NEW

Use with MatchGraph software to study position and velocity graphing in real time. Investigate ocean-floor mapping. Study objects in freefall. Measure dynamics carts to study kinematics, conservation of momentum, and kinetic energy.

Download the Free *MatchGraph!* App

for Mac®, Android™, and Windows® computers at **pasco.com/downloads.** Download the free iPad® or Android™ app on the App Store or Google Play.

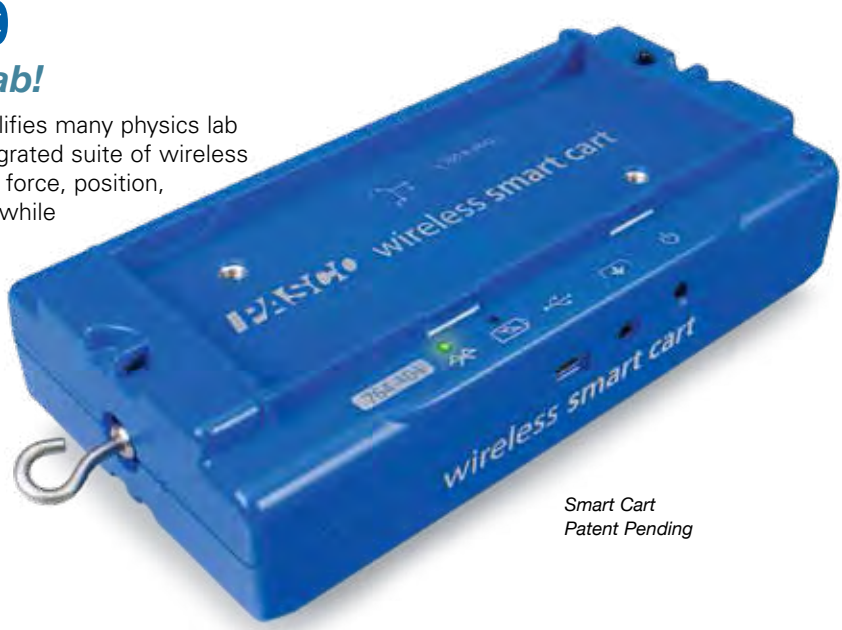
ANDROID APP ON Google play

Download on the App Store

Wireless Smart Cart

Game changer for the physics lab!

The patent-pending Wireless Smart Cart greatly simplifies many physics lab activities and opens up new possibilities with its integrated suite of wireless sensors! The Smart Cart can make measurements of force, position, velocity and acceleration, on or off a dynamics track, while transmitting data wirelessly over Bluetooth®.

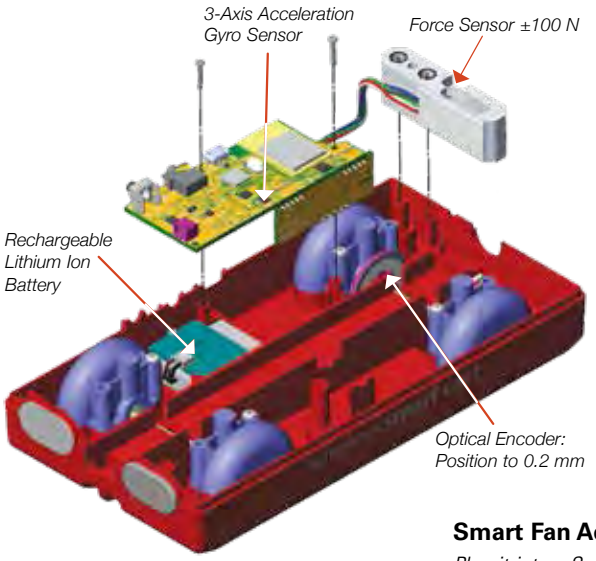


Smart Cart
Patent Pending

Smart Cart Features:

- Magnetic bumper
- **Sealed wheel encoder sensor**
- Force sensor hook and rubber bumper
- ±100 N force sensor
- 3-axis acceleration/gyro sensor
- 3-position plunger
- Mass tray
- Velcro® tabs
- Rechargeable battery
- Bluetooth connectivity
- Available in red and blue

What's Inside a Smart Cart?



Read the review from *The Physics Teacher*

The PASCO Wireless Smart Cart: A Game Changer in the Undergraduate Physics Laboratory

Asif Shakur and Ismor Gomez, Salisbury University, Salisbury, MD

With the introduction of the Wireless Smart Cart by PASCO scientific in April 2016, we expect a paradigm shift in undergraduate physics laboratory instruction. We have evaluated the feasibility of using the smart cart by carrying out experiments that are usually performed using traditional PASCO equipment. The simplicity, convenience, and cost-saving achieved by replacing a plethora of traditional laboratory sensors, wires, and equipment clutter with the smart cart are reported here.

Inelastic collision

We performed a simple inelastic collision experiment to ascertain the feasibility of using the wireless smart cart in an undergraduate laboratory setting. Two similar smart carts (red and blue) were placed on a 1-m PASCO aluminum track. The free PASCO app SPARKvue was installed on an iPhone. The app paired up with the blue cart via Bluetooth and recognized the unique identification sticker on the cart. We gave the blue cart a gentle push in the direction of the stationary red cart. The two carts collided and stuck together on the Velcro pads. The two carts moved together with a slower speed. Note that we only needed one iPhone to pair up with only one cart (blue) in order to draw meaningful conclusions. The velocity and time data (in addition to position, acceleration, and a raft of other data) were wirelessly transmitted by the smart cart to the iPhone as a CSV file (comma separated values). The data were tabulated in an Excel file, and a graph of velocity vs. time is depicted in Fig. 2.

Fig. 1. The PASCO Wireless Smart Cart.

Go to **pasco.com/smartcart**

Wireless Smart Cart Charging Garage

Charge up to five Smart Carts at once. Provides storage for the carts and accessory bumpers. Includes power adapter.

Smart Fan Accessory

Plug it into a Smart Cart. When the Fan Accessory it is connected to a Smart Cart, it allows for an unprecedented level of control, functionality and programmability. Also works in manual mode with all PASCO carts.

Smart Cart Charging Garage

ME-1243

Smart Fan Accessory

ME-1242

Use PASCO Capstone software to wirelessly control the Smart Fan.

Smart Cart

ME-1240 (red)

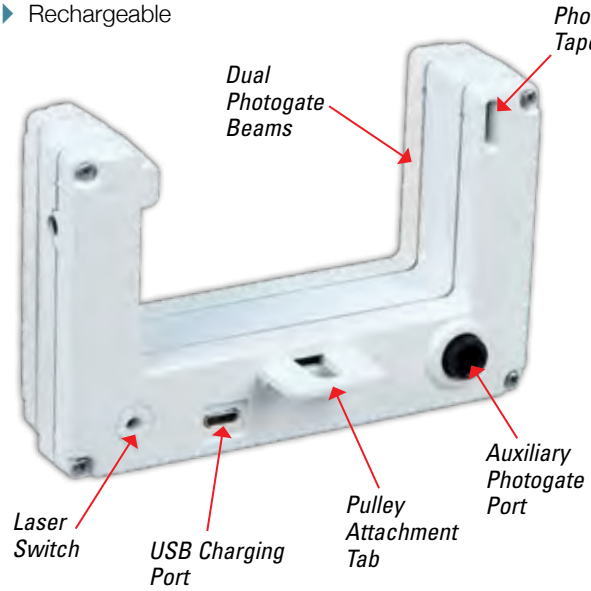
ME-1241 (blue)

Includes: Hook, Rubber bumper, Magnetic bumper, and USB cable for charging

Wireless Smart Gate

Features:

- Dual photogate beams
- Laser switch
- Photogate tape slot
- Auxiliary photogate/Time-of-Flight port
- USB and Bluetooth®
- Rechargeable



The Wireless Smart Gate has all the features of the wired Smart Gate. It has dual photogate beams spaced at 1.5 cm to accurately measure speed. The built-in laser switch (when used with any laser) allows you to time larger objects. Use Photogate Tape passing through the photogate tape slot to measure movement of irregular objects. The auxiliary port is for adding an additional photogate head or Time-of-Flight Accessory.

NOTE: When using two Wireless Smart Gates, be aware that the synching resolution between two gates can be as much as 2 ms.

Wireless Smart Gate

PS-3225

Specifications

- Logging: Yes
- Battery: Rechargeable Lithium-Polymer
- Connectivity: Direct USB or via Bluetooth 4.0

Projectile Launcher

ME-6800

Includes launcher base, projectile balls, loading rod, safety glasses, 2-D collision accessory and manual.

Specifications

- Ranges: 1.2, 3, 5 m
- Launch Angles: 0 to +90°
- Launcher Length: 21 cm

Mini Launcher

ME-6825B

Includes launcher base, projectile balls, loading rod, safety glasses, 2-d collision accessory, and manual.

Specifications

- Range: 0.5, 1, 2 m
- Launch Angle: 0 to +90° and 0 to -45°
- Launcher Length: 18 cm

Projectile Launcher Wireless Smart Gate System

ME-6796

Includes wireless smart gate with mounting bracket, launcher with mounting stand, steel balls (2) with loading rod, 2-d collision accessory, aluminum table clamp, and 45 cm stainless steel rod.

Choose this wireless option to eliminate cables between the computer and the projectile launcher.

The Wireless Smart Gate has all the features of the Smart Gate (PS-2180), but it connects to your computing device via Bluetooth® or USB; it does not require an interface.

Time-of-Flight Accessory

ME-6810A

Includes time-of-flight accessory, instruction manual, and experiment guide.

- For use with all PASCO launchers

Wireless Rotary Motion Sensor

Show that angular momentum is conserved: The Wireless Rotary Motion Sensor records the angular velocity as a ring is dropped on a spinning disk.

The Wireless Rotary Motion Sensor measures angle, angular velocity, and angular acceleration, as well as their linear equivalents. The included three-step pulley allows different torques to be applied, rotating a rigid system at different rates of acceleration. The included rod-mounting holes let you orient the sensor for different experiments. The Wireless Rotary Motion Sensor connects directly to your devices via Bluetooth® or USB.

Specifications

- Angle resolution: 0.18° (0.00314 radian)
- Linear resolution: 0.0157 mm (with 5 mm pulley radius)
- Three-step pulley: 10, 29, and 48 mm diameter
- Shaft diameter: 6.35 mm
- Maximum rotation rate: 30 revolutions per second
- Optical encoder: 2000 divisions/rev, bidirectional
- Rechargeable battery: Lithium-polymer
- Logging: Yes
- Connectivity: Direct USB or via Bluetooth® 4.0

Wireless Rotary Motion Sensor

PS-3220

Rotational Inertia Accessory

ME-3420

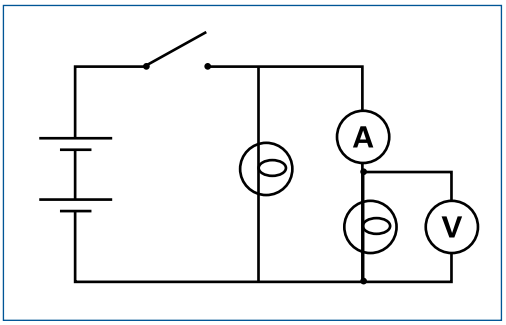
Includes disks (2): 8.9 cm diameter, 100 g; thin ring: 8.9 cm o.d., 7.9 cm i.d., 100 g; 38 cm pendulum rod (27 g); 75 g mass (2); clamp-on super pulley; alignment guides (3): 3.9 cm radius, 1.7 g

PASCO Modular Circuits

- Puts learning first
- Eliminates confusing wires
- Easy-to-connect modules

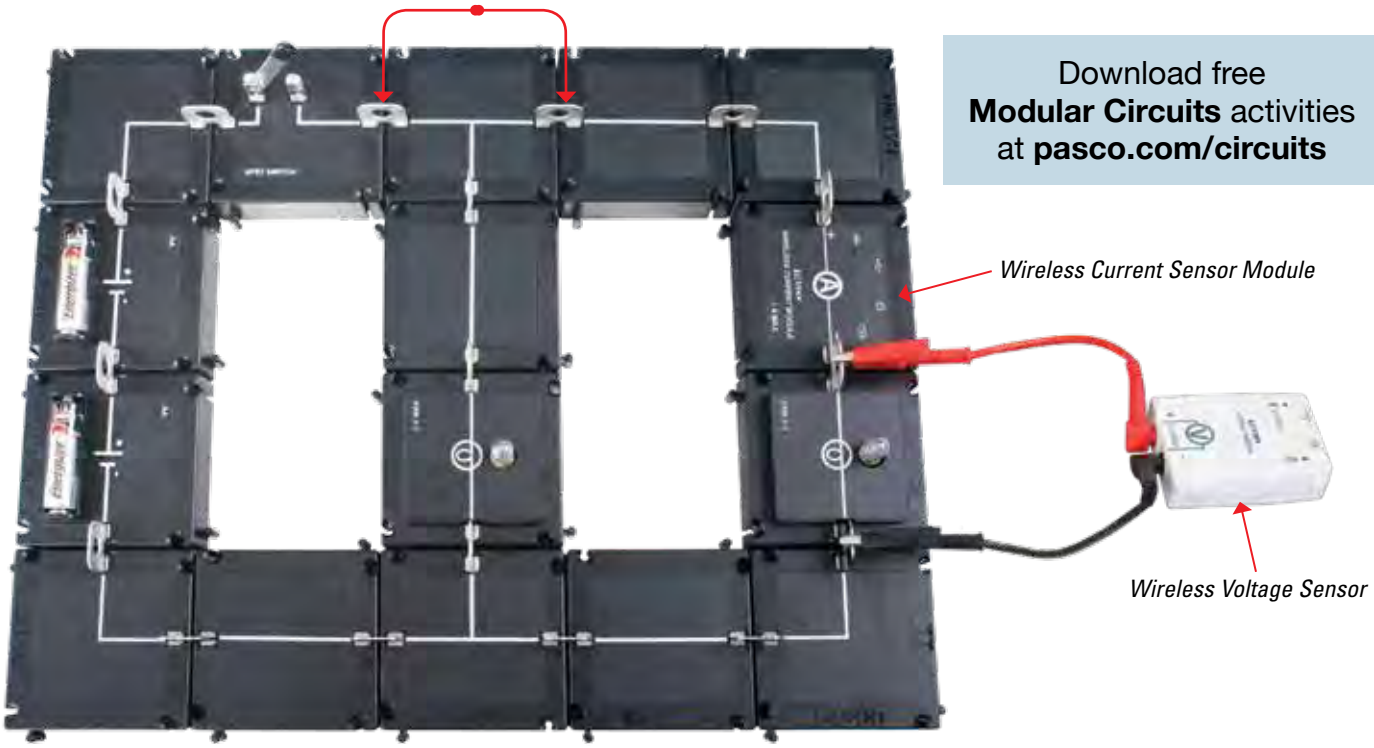
2017 AWARDS of EXCELLENCE TECH & LEARNING

These circuit modules are designed specifically for introductory circuits labs. For students who have never wired a circuit, this modular system makes it easy for them to see the layout because it ends up looking like a circuit diagram.



Circuit Diagram

Students insert metal tabs to make the electrical connection.



Download free **Modular Circuits** activities at **pasco.com/circuits**

Wireless Current Sensor Module makes it obvious that current goes through the component.

- Wireless Current Sensor Module EM-3534
- Wireless Voltage Sensor PS-3211

Since the Wireless Current Sensor is a module, it naturally fits in series with the circuit components.

The Wireless Current Sensor Module doesn't have extra wires going to an interface, so students see clearly where the current goes.

Two Modular Circuits Kits Are Available

The Basic Modular Circuits Kit includes the modules required to investigate basic circuits. It does not include sensors and activities can be performed either with the use of a multimeter or by adding sensors. The *Essential Physics* Modular Circuits Kit includes more modules, allowing for a greater variety of activities and includes the Wireless Voltage Sensor and the Wireless Current Sensor Module.

To make them visible, many of the components are mounted on top of the module or in a well for protection.

Each module connects mechanically to another by sliding the tabs into each other.

Modular Circuit Kits

***Essential Physics* Modular Circuits Kit** EM-3536

Basic Modular Circuits Kit EM-3535

Each kit comes in a Gratnell® case with trays that organize the modules. Also includes 2 AA batteries.

Required:

PASCO Capstone Software See page 123
or SPARKvue Software See page 122

Also available separately:

Battery Charger SE-3568
AA Rechargeable Batteries (4) SE-3569

Included in each kit

Module	Basic EM-3535	Essential EM-3536
Corner Wire Module	4	4
Straight WIre Module	4	5
Tee Module	2	2
Spring Module	1	1
Switch Module, SPDT	1	1
Switch Module, SPST	1	1
Resistor Module	2	3
Capacitor Module	1	1
Light Bulb Module	2	3
Potentiometer Module	0	1
Motor Module	0	1
LED Module	0	1
1000 Turn Coil Module	0	1
Battery Holder Module	2	2
Battery, AA	2	2
Jumper Clips	30	45
Diode	1	1
330 ohm Resistor	1	2
1000 ohm Resistor	1	2
100 microfarad Capacitor	1	1
330 microfarad Capacitor	1	1
Magnets (0.45" x 0.25")	0	8
Plotting Compass	0	1
Alligator Clip Jumper Wire	0	1
EM-3534 Current Sensor Module	0	1
PS-3211 Wireless Voltage Sensor	0	1
Gratnells® Storage Tray	1	1

Add the Expansion Kit ...

Modular Circuits Expansion Kit

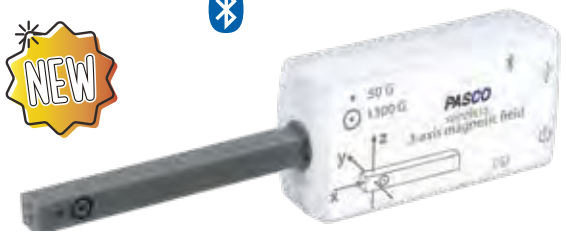
EM-3540

This expansion kit supplies extra modules found in both the Basic and Essential Physics Modular Circuits Kits (EM-3535 and EM-3536). It includes a Banana Jack Terminals module for powering your circuits with an external power supply or signal generator. It also includes a storage case with custom foam insert.

Includes
Spring Clips (1)
Straight (2)
Tee (2)
Corner (2)
Light Bulb (1)
Battery Holder (1) (battery not included)
Jumper Clips (15)
Banana Jack Terminals (1)
Gratnells® Storage Case

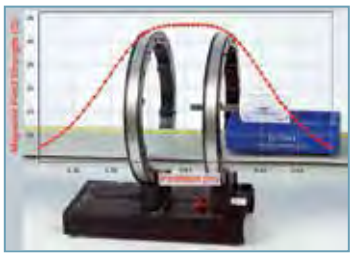
Wireless 3-Axis Magnetic Field Sensor

PS-3221



*Required:
Zero Gauss Chamber EM-8652

PASCO's new Wireless 3-Axis Magnetic Field Sensor is sensitive enough to measure Earth's magnetic field! It can also measure magnets and fields in a coil.



Typical Applications

- Measure magnetic field of permanent magnets.
- Measure Earth's magnetic field.*
- Measure field strength of Helmholtz coils.

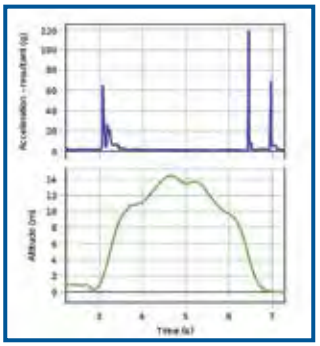
Wireless 3-Axis Acceleration/Altimeter

PS-3223

The Wireless 3-Axis Acceleration/Altimeter can remotely log acceleration in three dimensions and altitude, making it ideal for recording roller coaster rides.

Typical Applications

- 3-axis accelerometer
- Four ranges: ±16 g, ±100 g, ±200 g, ±400 g
- 3-axis gyroscope on ±16 g range
- Altimeter



Award-Winning Wireless Spectrometry
for iOS®, Android™, Chrome*, PC, and Mac®

2016 winner! AWARDS EXCELLENCE TECH&LEARNING

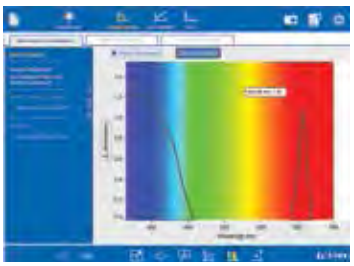
//CODiE// 2017 SIIA CODiE WINNER

bett AWARDS 2017 FINALIST

Wirelessly measure intensity, absorbance, transmittance, and fluorescence. The Bluetooth® and USB connectivity enable use with your tablets and computers, which makes this a powerful and intuitive tool for your spectrometry needs.

Perform these labs with the PASCO Spectrometer:

- Photosynthesis with DPIP
- Absorption spectra of plant pigments
- Concentration of proteins in solution
- Rate of an enzyme-catalyzed reaction
- Growth of a cell culture



Absorbance spectrum of chlorophyll

Wireless Spectrometer

PS-2600

Includes Wireless Spectrometer, 10 cuvettes, and Spectrometry software.

Also available:

Optional Fiber Optic Cable
PS-2601

Cuvettes & Caps
SE-8739

Cuvette Rack
EC-3590

*Go to **pasco.com/compatibility** to see our ever-expanding list of supported Chromebooks™.

Wireless Temperature Sensor

PS-3201

Includes 1 coin cell battery.

Wireless Force Acceleration Sensor

PS-3202

Includes 1 eye bolt, 1 thumb screw, 1 bumper, a lithium-ion battery, and a USB connector.

Wireless Current Sensor

PS-3212

Includes rechargeable battery and banana-clip cables.

Wireless Voltage Sensor

PS-3211

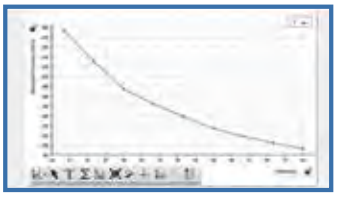
Includes 1 coin cell battery.

Wireless Pressure Sensor

PS-3203

Includes 2 feet of polyurethane plastic tubing, 1 tube connector, 2 male barb connectors, 1 female barb connector, 1 60cc syringe, a lithium-ion battery, and a USB connector.

Make accurate and consistent measurements of gas pressure, regardless of ambient conditions. Study the Empirical Gas Laws.

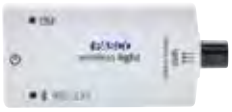


The ideal sensor to study gas laws!

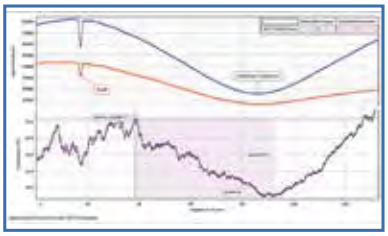
Wireless Light Sensor

PS-3213

Includes 1 coin cell battery.



Students can explore the electromagnetic spectrum, model planetary motion, and relate photosynthesis to light color and intensity.



This eclipse data was collected at PASCO in Roseville, CA, on August 21, 2017.

Wireless Sensor Charging Station

PS-3599

Includes Wireless Sensor Charging Station (13 cm x 35 cm), power adapter, 10 USB charging cables, 9 removable partitions.

Typical Applications

- Charge all types of PASCO wireless sensors.
- Remove partitions to resize sensor bays.

This versatile charging station can be configured to fit any size wireless sensor by adding or removing partitions.

Interface Comparison

Compare the features and capabilities and see which interface works best in your lab.





	SPARK LX PS-3601	SPARK LXi PS-3600	AirLink PS-3200	SPARKlink Air PS-2011	550 Universal Interface UI-5001
PASPORT Ports	0	2	1	2	2
Analog Inputs			0	0	2 (±10 V, optional gain voltage 10x, 100x)
Digital Inputs	5	5	0	0	2
Connects via USB	Yes	Yes	Yes	Yes	Yes
Connects via Bluetooth	Yes	Yes	Yes	Yes	Yes
Rechargeable battery (for cordless operation only)	Yes	Yes	Yes	Yes	No (AC adapter)
Works with PASCO Capstone Software	No	No	Yes	Yes	Yes
Works with SPARKvue Software	Yes	Yes	Yes	Yes	Yes
Accepts PASPORT Sensors	No	Yes	Yes	Yes	Yes
Accepts ScienceWorkshop Sensors	No	No	No*	No*	Yes
Maximum Sampling Rate			Sensor dependent <1000 Hz	Sensor dependent <1000 Hz	Up to 2 MHz on one channel
Signal Generator	N/A	N/A	N/A	N/A	±8 V, at 400 mA, DC to 100 kHz
Included Items	Ruggedized case, hands-free stand, Lab Manager, SPARKvue, MatchGraph!, Spectrometry	Ruggedized case, hands-free stand, Lab Manager, SPARKvue, MatchGraph!, Spectrometry	USB Cable	AC adapter, USB cable, fast response temperature and voltage probe	USB cable, Power supply
Expansion Port			No	No	No

* The AirLink and SPARKlink Air can accept most ScienceWorkshop sensors with the proper adapter although they won't have the same high maximum sample rates. One exception is the Sound Sensor (CI-6504), which is not recommended for use with an adapter.

AirLink

PS-3200

Includes one PASPORT sensor port, USB and Bluetooth connectivity, and USB cable.

SPARKlink Air

PS-2011

Includes 2 PASPORT sensor ports, as well as voltage and temperature ports, USB and Bluetooth connectivity, USB cable, and voltage probe and fast response temperature probe.

SPARK LX & LXi

NEW

PASCO's NEXT GEN SCIENCE DATALOGGERS for indoor and outdoor use

SPARK LX
PS-3601

SPARK LXi
PS-3600

These innovative science handhelds blend PASCO probeware with SPARKvue data collection and analysis software plus our new lab management application: Lab Manager. They are durable, splash-proof, and work seamlessly with our PASPORT and wireless sensors.

Lab Manager software allows teachers to:

- Monitor student screens (or lock student screens to get students' attention).
- Broadcast teacher or student screens to class.
- Control student devices for guidance.
- Quiz students and view responses in real time.
- Message all student devices.
- Easily send and collect any file to and from student devices.

Choose from Two Models	SPARK LX PS-3601	SPARK LXi PS-3600
Ruggedized case for indoor/outdoor and wet/dry lab use	✔	✔
9.6" full-color touchscreen	✔	✔
Lab Manager application	✔	✔
Simultaneously connects up to 5 wireless sensors	✔	✔
Includes 2 PASPORT ports		✔
Includes Voltage Probe and port		✔
Includes Temp Probe and port		✔
Can connect more PASPORT sensors with the AirLink, SPARKlink Air, and 550 Universal Interface	✔	✔
Installed software		
PASCO SPARKvue, MatchGraph!, and Spectrometry	✔	✔
Microsoft Office Suite	✔	✔
Google Suite	✔	✔
Hands-free stand	✔	✔

SPARK LX

PS-3601

Use with PASCO Wireless sensors (or for use with PASPORT sensors + an AirLink, SPARKlink® Air, or 550 Universal Interface). The SPARK LX can simultaneously connect up to five wireless sensors.

Also available:
SPARK LX Charging Station
PS-3603

SPARK LXi

PS-3600

Use with wired and wireless sensors, the SPARK LXi can simultaneously accommodate up to five wireless sensors. It also includes two ports for blue PASPORT sensors, plus two ports for the included Fast Response Temp Probe and the Voltage Probe.

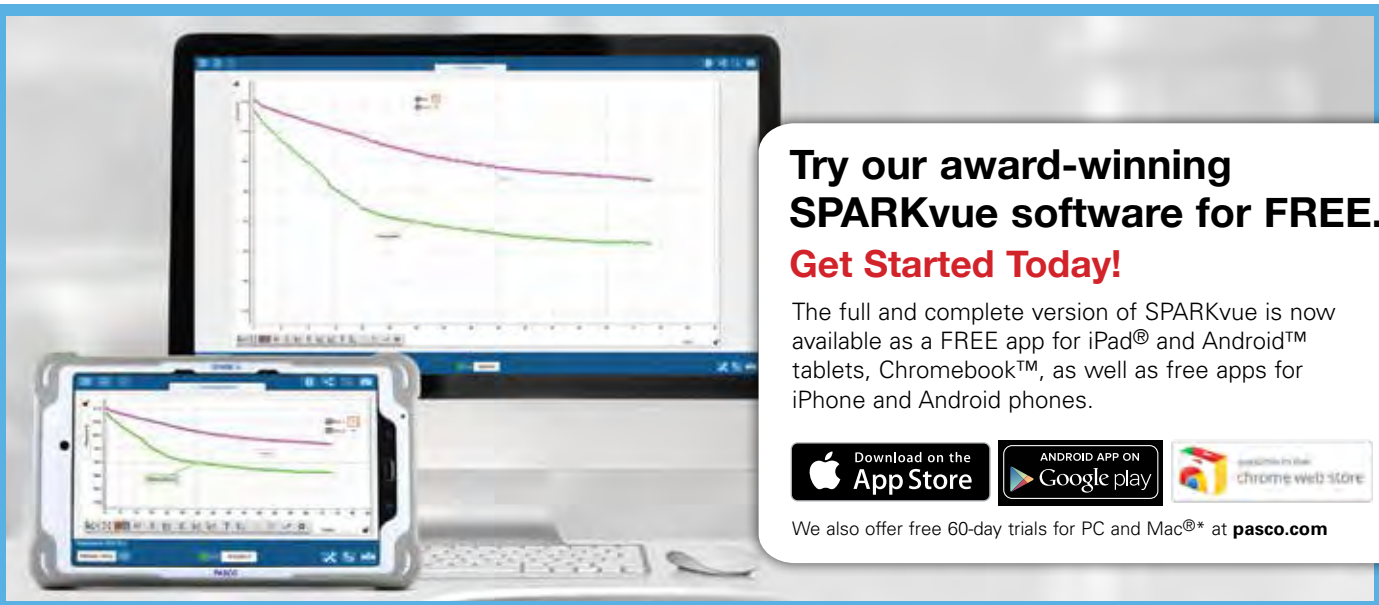
Also available:
SPARK LXi Charging Station
PS-3602

NEW SPARKvue 4.0

you choose

reimagined
remarkably easy
redesigned

- New Welcome screen allows you to start a new activity or open an experiment, with one click.
- Jump right into most common labs using Templates and Quick Start labs.
- Monitor sensor data without recording using the new Live Data Bar.
- Configure, calibrate, and edit sensor properties with Hardware Setup button.
- Share experiment files directly to Cloud services such as Google Drive.



Try our award-winning SPARKvue software for FREE.

Get Started Today!

The full and complete version of SPARKvue is now available as a FREE app for iPad® and Android™ tablets, Chromebook™, as well as free apps for iPhone and Android phones.

Download on the App Store | ANDROID APP ON Google play | chrome web store

We also offer free 60-day trials for PC and Mac®* at **pasco.com**

Smart Phones

Android phone

iPhone

Tablets

SPARK LX & LXi

Android tablet

iPad

Windows tablet

Laptops/Desktops

Chromebook

PC

Mac

SPARKvue (single user license)

PS-2401

sparkvue

SPARKvue (site license)

PS-2400

sparkvue

SPARKvue App

Download:

Download on the App Store | chrome web store

ANDROID APP ON Google play

Upgrade to the new SPARKvue® 4.0 version

- SPARKvue 4.0 is even more intuitive.
- New entry screen makes getting started easier.

Choose from three entry paths:

1. Manual Entry

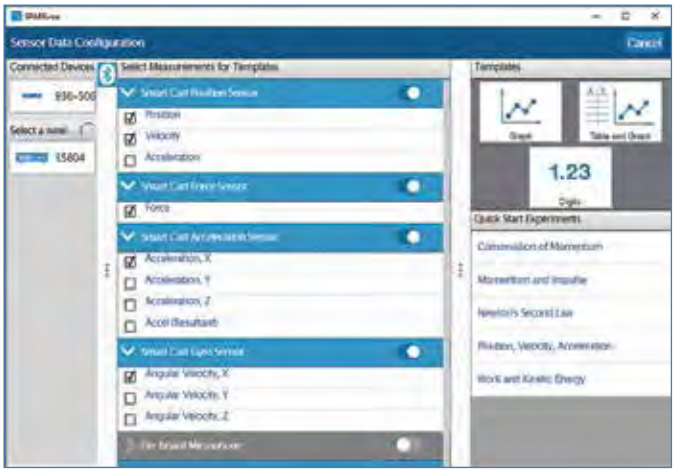
Select manual entry and simply start typing in your data in the table. The graph is already set up to start tracing your data.

2. Sensor Data

Select Sensor Data to connect to sensors and record data.

3. Remote Logging

Select Remote Logging to either set up a sensor to log data remotely or to download logged data from a sensor.



The PASCO 550 Universal Interface…

This powerful wireless sensor interface for Physics works with SPARKvue and Capstone.

This is the interface with the measurement capability for any physics experiment your physics lab needs. It features:

- 2 MHz sampling rate
- 2 high-speed analog inputs
- 2 digital inputs for photogates and other timing sensors
- 2 PASCO PASPORT sensor inputs
- Signal generator with built-in Voltage and Current sensors.
- Use with other PASPORT interfaces
- Connect to computers via USB
- Bluetooth® connectivity

With the 550, your Physics lab is equipped with high-speed data collection, signal generation and power supply, oscilloscope and FFT displays, timers, and more.

550 Universal Interface Specifications:

2 high-speed analog inputs

Measurement Range: ±10 V differential input
Input Impedance: 1 MΩ
Input Protection: ±250 V continuous
Selectable Voltage Gain: X1, X10, X100
Resolution: 14-bit, 0.12 mV

2 Digital Inputs

Digital sensors such as Photogates and Time-of-Flight plug directly into the 550 Interface.

- Compatible with all ScienceWorkshop digital sensors
- Sensor Connect Detection
- 0-5 V TTL
- Bi-directional

2 PASPORT Inputs

Compatible with PASCO's complete line of more than 80 PASPORT sensors.

- Sample rates depend on sensors

Signal Generator

Waveforms: sine, triangle, square wave, positive and negative ramps, DC

Frequency Range: 0.001 Hz to 100 kHz; 1 mHz resolution
Amplitude Range: ±8 V; **Resolution:** 1.33 mV, 12-bit DAC.
Max Output Current: 400 mA at 8 V, over-current detection
Selectable Voltage Limit
Selectable DC Offset
Frequency Sweep Function
Measure Output Current, Voltage

550 Universal Interface

UI-5001

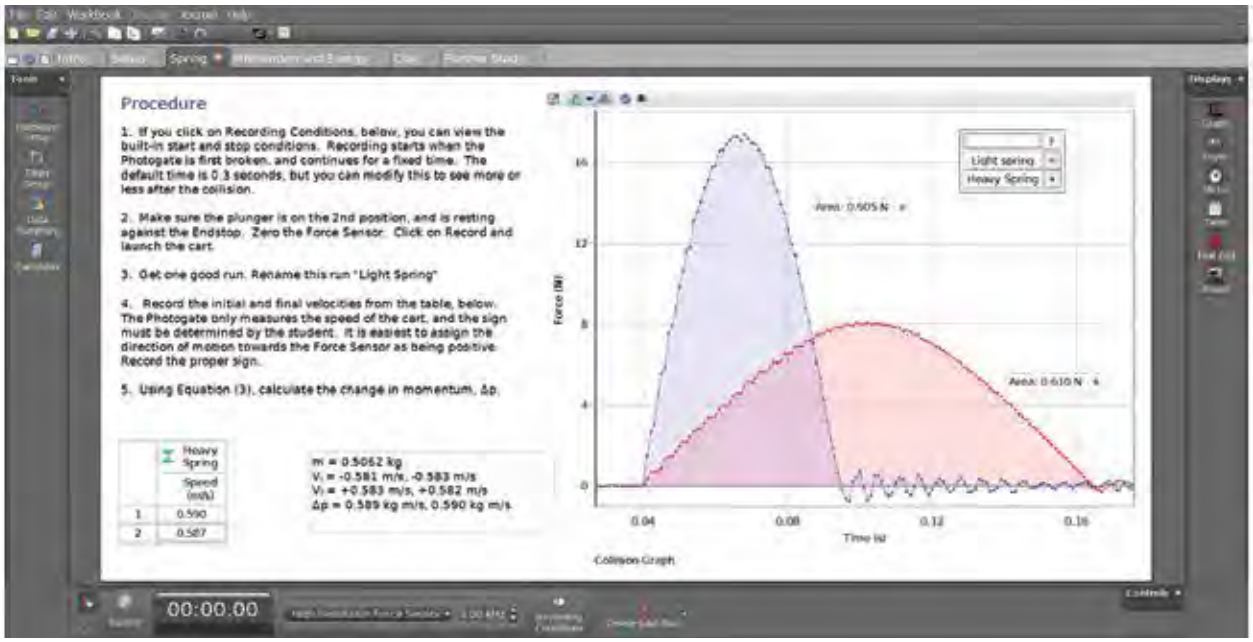
Requires:

PASCO Capstone Software
See opposite page.
OR
SPARKvue Software
See pages 94-95.

PASCO capstone™ Software

Designed specifically to collect, display, and analyze data in physics and engineering labs

- Site license includes student home use
- For MAC® and Windows™



Sensors

PASCO Capstone Basic Features

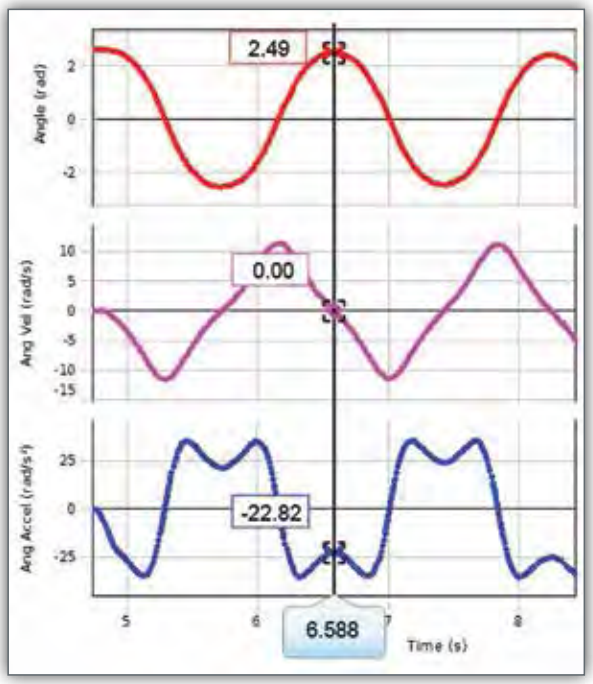
- Auto-ID sensors are recognized when they are plugged in (or identified through Bluetooth®)
- Works with PASPORT, ScienceWorkshop, and new Wireless sensors
- In-app pairing of wireless sensors makes it easy to pick wireless sensors by proximity
- Pre-configured photogate timers

Workbook Format

- Basic displays include graph, table, digits, meter, oscilloscope, text box, picture.
- Make multiple pages with instructions and embedded live graphs.
- Collect data and display it in real time.
- Play back data in real time or slow or high speed.
- Enter data manually – Easy setup in a table
- Lay out displays with smart guidelines.
- Create a Journal by taking snapshots of pages or displays.
- Copy and paste displays into documents.
- Made a mistake? Just hit the Undo button.

Graphs

- Draw predictions on graphs before taking data.
- Multiple y-axes and/or multiple plot areas
- Perform Quick-Calcs on the graph axis to linearize data.
- Curve-fits report the uncertainties in the parameters.
- Multi-coordinate tool gives y-values wherever it intersects data.



Multi-Coordinate Tool

This tool finds the values of all the measurements all at once. It's great for showing how the position, velocity, and acceleration are related in oscillations.

PASCO Capstone Software
Single User License UI-5401 Site License UI-5400

Building Better Bridges Kit

Teach engineering concepts with this complete STEM bridge-building kit.

Now is the perfect time for your students to learn about bridge-building and how bridges really work. This complete STEM kit allows students to learn and apply engineering design concepts. They can use the I-Beams to build bridges and structures that behave like the real thing! And with the included new Wireless Load Cell, students can measure forces under tension or compression anywhere on their structures.

Students can perform the following lab investigations using PASCO's Building Better Bridges Kit.

- Measuring Forces
- Equilibrium of Forces
- Equilibrium of Rotation
- Forces in Trusses
- Forces in Bridges

Kit is compatible with PASCO Structures System.

Building Better Bridges Kit

ME-3581

Includes Lab Activities, Wireless Load Cell (with Bluetooth® 4.0 connectivity), I-Beams (various sizes), Connectors, Truss Screws, Weight Set, a Gratnells® Case and more

Want another Load Cell?

Wireless Load Cell PS-3216

STEM

Programming and Robotics with the ErgoBot

This unique module offers 23 lessons and projects covering introductory and intermediate programming, robotics, sensors, code development, variables, loops, logic structures, autonomous operation, design, engineering, optimization, and performance testing.

- 23 lessons and projects
- 7 interactive simulations
- Interactive IDE
- 23 slide presentations
- 23 student assignments

The ErgoBot

The ErgoBoard

Teacher Resources

- Everything works right out of the box – nothing to solder or assemble.
- Designed for the classroom – use the same ErgoBot every period, all day.
- Projects 1-8 require no installed software. Students write easy code that gets the ErgoBot moving in less than 20 minutes.
- All three sensors are included and need only a few jumpers to connect.
- Build up to C-level programming language using logic and sensors.
- The teacher's guide includes 23 projects with lessons, slides, and a wealth of instructional material.
- The Arduino-compatible ErgoBoard is available separately to upgrade your existing ErgoBot.

Hardware and software work together to make the easiest most engaging programming course ever created.

- No assembly required
- 23 projects start from novice level
- Works with Windows® and Mac® OS X
- Wireless Bluetooth® communication
- Practical for every classroom

ErgoBot

EP-6471

ErgoBoard with Sensors

EP-6472

ErgoBot with ErgoBoard Robotics

EP-6473

Includes ErgoBot, ErgoBoard and sensors

ErgoBot Programming and Robotics Teacher Resources

EP-6485

Sensor Index

PASCO's 5-Year Educational Warranty

To withstand the rigors of student use, PASCO products are made of the highest quality materials. They are designed and manufactured by our team of education researchers and engineers in Roseville, California. And we back up our products with a 5-year warranty, so you can be completely confident about buying PASCO solutions.

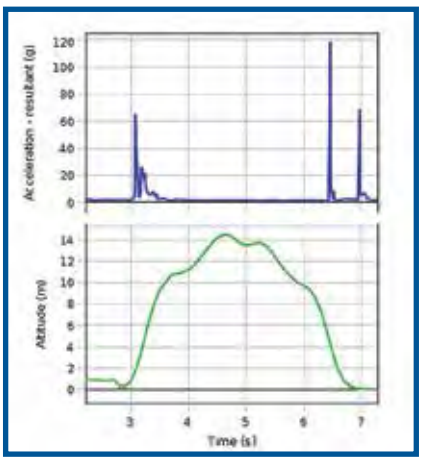
Wireless 3-Axis Acceleration/ Altimeter

PS-3223

The Wireless 3-Axis Acceleration/ Altimeter can remotely log acceleration in three dimensions and altitude, making it ideal for recording roller coaster rides.

Typical Applications

- 3-axis accelerometer
- Four ranges: ±16 g, ±100 g, ±200 g, ±400 g
- 3-axis gyroscope on ±16 g range
- Altimeter

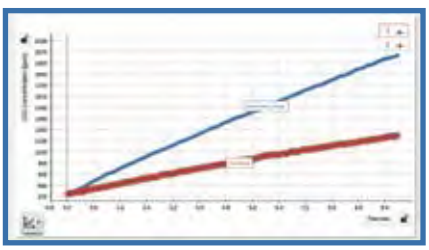


Wireless CO_2 Sensor

PS-3208

Includes 250-ml sampling bottle and USB charging cable.

Use this wireless sensor to measure the concentration of CO_2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile probe. CO_2 data can be logged directly on the device for long-term life science and environmental science studies.



Directly compare separate controlled environments.

Wireless Colorimeter and Turbidity

PS-3215

Includes 10 cuvettes, 1 turbidity calibration standard (100 NTU), 2 cuvette racks and USB charging cable.

Also available:

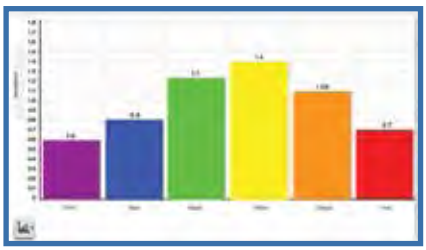
Spectrometer/Colorimeter Cuvettes SE-8739

Determine the concentration of a solution with ease. Study absorbance vs. concentration to explore Beer's Law, and measure chemical rates of reaction.

The Teaching Advantage

- Simultaneous data collection in six wavelengths (colors) of light increases accuracy of results and reduces frustration caused by missing data
- Sensor calibrates in all wavelengths automatically in one step
- Rates of reaction experiments can be conducted easily.

Set up in seconds and collect individual measurements with ease.



Determine the relationship between absorbance and concentration.

WARNING! This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Wireless Conductivity Sensor

PS-3210

Includes 1 coin cell battery.

Use the Wireless Conductivity Sensor to measure the electrical conductivity of a water solution. With this wireless sensor you can investigate the properties of solutions, as well as model and measure water quality.

Measure the conductivity of water and water-based solutions.

Features

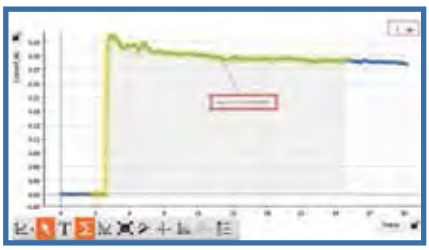
- Measure both conductivity and total dissolved solids
- Automatic temperature compensation
- Dust- and sand-proof and water-resistant (1 meter for 30 minutes)
- Battery life >1 year
- Remote logging

Wireless Current Sensor

PS-3212

Includes rechargeable battery and banana-clip cables.

This sensor's wide current range allows for introductory and advanced explorations of the fundamental concepts of electricity and basic circuits.



Features

- Range ±1A
- Bluetooth® sampling rate of 1 kHz
- High-speed sampling via USB; 100 kHz burst mode
- Includes remote logging on your device

Wireless Force Acceleration Sensor

PS-3202

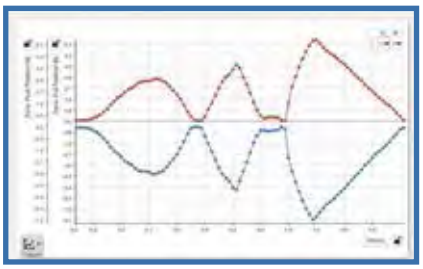
Includes 1 eye bolt, 1 thumb screw, 1 bumper, a lithium-ion battery, and a USB connector.

Capable of measuring force, acceleration, and rotation, this sensor is ideal for experiments involving rotating platforms, moving carts, spring oscillations, collisions, and impulse. The wireless design offers improved measurements without a cable affecting experiment outcome. Finger-holes support handheld applications, or mount it onto a cart or rod.

The Teaching Advantage

- Simultaneously measures force and acceleration. Measures acceleration in x, y, and z axes and resultant acceleration. Built-in gyroscope measures rotation.
- Features convenient Bluetooth® wireless connectivity and long-lasting rechargeable battery.
- Probe can be quickly zeroed through software for accurate taring.
- Logs force and acceleration data directly onto the sensor for long-term experiments.

When students are the force, Newton's Third Law is no longer a leap of faith.



Directly compare action and reaction of forces.

Wireless Light Sensor

PS-3213

Includes 1 coin cell battery.

This wireless sensor is a great tool for explorations in Earth, Life, and Physical sciences. With its ambient light detector for illuminance and UV, and its directional detector for colors, your students can explore the electromagnetic spectrum, model planetary motion, and relate photosynthesis to light color and intensity.

Features

All these measurements in one!

- Illuminance (lux), PAR, and irradiance
- UVA, UVB, and UV Index
- RGB color detection
- Battery life >1 year
- Includes remote logging on your device

Wireless 3-Axis Magnetic Field Sensor

NEW

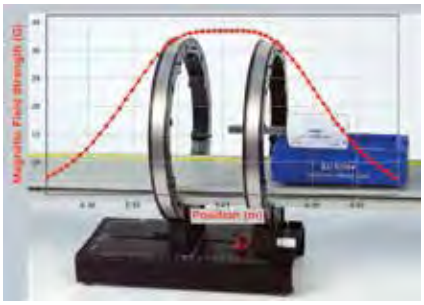
PS-3221

Includes 3-Axis Magnetic Field Sensor, Sensor Mounting Rod, USB Charging Cable

This 3-Axis Magnetic Field Sensor can sense the Earth's magnetic field and fields from coils and bar magnets. There are two ranges: ±50 gauss and ±1300 gauss. This sensor is primarily for static fields.

The Teaching Advantage

- Simultaneous measurements on three axes
- Dual range: ±50 G and ±1300 G
- Sensitive enough to measure the Earth's magnetic field
- Measure fields from bar magnets and coils



A graph of Magnetic Field Strength vs. Position (from PASCO Capstone) is superimposed on a picture of a 3-Axis Magnetic Field Sensor riding on a Smart Cart through Helmholtz coils.

Features

- Ranges: ±50 G and ±1300 G
- Resolution: ±0.01 G (50 G range); ±2 G (1300 G range)
- Maximum Sample Rate: 100 Hz
- Measurements: Magnetic Field Strength (3 axes and resultant)
- Logging: Yes
- Battery: Rechargeable Lithium-Polymer
- Connectivity: Direct USB or via Bluetooth 4.0

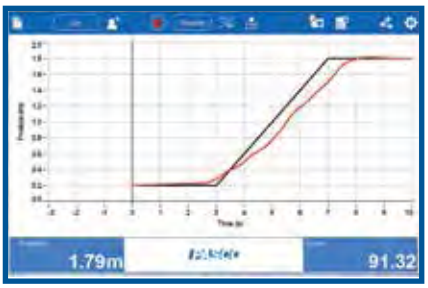
Wireless Motion Sensor

NEW

PS-3219

Recommended:
MatchGraph! Software *See page 66*

The Wireless Motion Sensor measures position, velocity, and acceleration of objects using ultrasound. Students can measure themselves and watch their motion graphed in real time. The Wireless Motion Sensor can detect objects within a range of 15 cm to 4 m away. The fact that the sensor is wireless means no cables to get in the way, which is key for handheld or ceiling-mounted applications. The Wireless Motion Sensor connects directly to your devices via Bluetooth® or USB.



The Wireless Motion Sensor works with our free MatchGraph! software (see page 76). It is an ideal way to teach the concepts of motion graphing, interpreting graphs, and rate of change or slope.

Features

- Range: 0.15 to 4 m
- Resolution: 1 mm
- Maximum sample rate: 50 Hz
- Transducer rotation range: 180°
- Rechargeable battery: Lithium-polymer
- Logging: Yes
- Connectivity: Direct USB or via Bluetooth® (Bluetooth 4.0)

Wireless Oxygen Gas Sensor

PS-3217

Includes USB charging cable, 250-mL sampling bottle

The Wireless Oxygen Gas Sensor is accurate and easy to use, which makes it the perfect sensor to study photosynthesis, respiration, and oxygen cycling in the environment. With remote logging, simultaneous measurement of humidity and temperature experiments can go beyond the lab period and easily give students hours or days of data for analysis.

Features

- Bluetooth® and USB connectivity
- 0-100% Oxygen Gas Concentration
- ±1 % Oxygen at constant temperature and pressure
- Also reports ambient temperature and humidity
- 2-3yr operating life with replaceable sensing element

(See pasco.com for full specifications.)

PASCO's 5-Year Educational Warranty

To withstand the rigors of student use, PASCO products are made of the highest quality materials. They are designed and manufactured by our team of education researchers and engineers in Roseville, California. And we back up our products with a 5-year warranty, so you can be completely confident about buying PASCO solutions.

Wireless pH Sensor

PS-3204

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

This sensor measures the pH of a solution as discrete measurements or as a continuous reading. Use the probe to study water quality, test household solutions, or perform high-resolution acid-base titrations.

The Teaching Advantage

- High resolution with low noise allows even subtle pH changes to be observed.
- Factory calibration lets students get right to data collection, with optional user calibration supported.
- Uses durable, accurate gel-filled Ag-Ag Cl electrode.
- Features convenient Bluetooth® wireless connectivity and long-lasting coin cell battery.
- Logs pH data directly onto the sensor for long-term experiments.

The versatile Wireless pH Sensor works as well in the field as in the lab.

Easily measure and compare the pH of common acids and bases.

Wireless Pressure Sensor

PS-3203

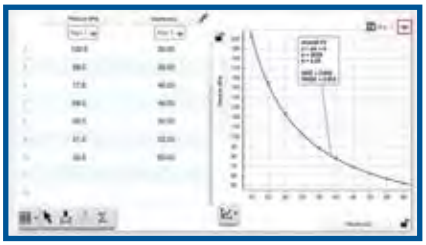
Includes 2 feet of polyurethane plastic tubing, 1 tube connector, 2 male barbed luer locks, 1 female barbed luer lock, 1 60cc syringe, a lithium-ion battery, and a USB connector.

With the new Wireless Pressure Sensor you can make accurate and consistent measurements of gas pressure, regardless of ambient conditions, and explore gas laws and how chemical reactions affect gas pressure.

The Teaching Advantage

- Measures pressure relative to an internal sealed reference vacuum, which allows the collection of reliable data even when the pressure within the system drops below ambient pressure.
- Supports common units (kPa, atm, psi, mmHg, or N/m2) for many applications.
- Features Bluetooth® wireless connectivity and long-lasting rechargeable battery.

A test tube, piece of steel wool, and a Wireless Pressure Sensor are all you need to have your students calculate the amount of oxygen in the air.



With the included syringe, your students can easily quantify the relationship between pressure and volume.

Wireless Rotary Motion Sensor

PS-3220

The Wireless Rotary Motion Sensor measures angle, angular velocity, and angular acceleration, as well as their linear equivalents. The included three-step pulley allows different torques to be applied, rotating a rigid system at different rates of acceleration. The included rod-mounting holes let you orient the sensor for different experiments. The Wireless Rotary Motion Sensor connects directly to your devices via Bluetooth® or USB.

Show that angular momentum is conserved: The Wireless Rotary Motion Sensor records the angular velocity as a ring is dropped on a spinning disk.

Features:

- Angle resolution: 0.18° (0.00314 radian)
- Linear resolution: 0.0157 mm (with 5 mm pulley radius)
- Three-step pulley: 10, 29, and 48 mm diameter
- Shaft diameter: 6.35 mm
- Maximum rotation rate: 30 revolutions per second
- Optical encoder: 2000 divisions/rev, bidirectional
- Rechargeable battery: Lithium-polymer
- Logging: Yes
- Connectivity: Direct USB or via Bluetooth® 4.0

Smart Cart

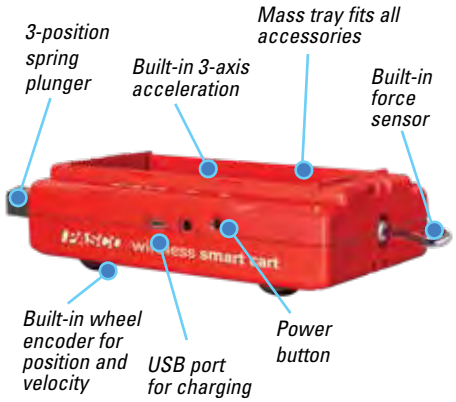
ME-1240 (red)
ME-1241 (blue)

Patent Pending

It is the ultimate tool for your physics lab with built-in sensors that measure force, position, velocity, and acceleration. The Smart Cart can make these measurements on or off a dynamics track and transmit the data wirelessly over Bluetooth®.

Features:

- Built-in ±100N force sensor
- 3-axis accelerometer
- Built-in wheel encoder
- Bluetooth connectivity
- Magnetic bumper for force sensor
- 3-position plunger
- Mass tray
- Velcro® tabs
- Rechargeable battery
- Force sensor hook and rubber bumper
- Available in red and blue



Wireless Smart Gate

PS-3225

The Wireless Smart Gate has all the features of the wired Smart Gate. It has dual photogate beams spaced at 1.5 cm to accurately measure speed. The built-in laser switch (when used with any laser) allows you to time objects too large to fit through the standard photogate. Use Photogate Tape passing through the photogate slot to measure movement of objects. The auxiliary port is for adding an additional photogate head or Time-of-Flight Accessory.

NOTE: When using two Wireless Smart Gates, be aware that the synching resolution between two gates can be as much as 2 ms.

Features:

- Dual photogate beams
- Laser switch
- Photogate tape slot
- Auxiliary photogate/Time-of-Flight port

Specifications:

- Logging: Yes
- Battery: Rechargeable Lithium-Polymer
- Connectivity: Direct USB or via Bluetooth 4.0

Wireless Temperature Sensor

PS-3201

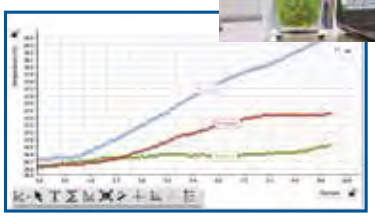
Includes 1 coin cell battery.

Welcome to the modern thermometer. Students can access instant temperature readings but also continuously monitor, log, and plot temperature data in SPARKvue on nearly any connected device. When class-time ends but the experiment continues, students can set the sensor to log data autonomously for days or weeks and then download the data for analysis.

Specifications

Range: -40°C to 125°C
Resolution: 0.05°C
Accuracy: 0.5°C
Battery: Coin cell (>500,000 samples)
Logging: Yes
Bluetooth: BT 4.0

The versatile Wireless Temperature Sensor works well, both in the lab and out of doors.



Easily compare the temperature in different environments.

Wireless Voltage Sensor

PS-3211

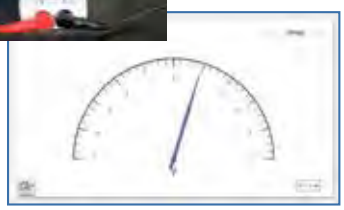
Includes 1 red and 1 black shrouded, banana-to-alligator-clip test leads.

Explore energy and energy transformations with this sensor. Use it to:

- Measure the voltage of student-constructed batteries and see how chemical energy can turn into electrical energy.
- Look at renewable energy by connecting to a wind turbine.
- Track the flow of energy by creating simple circuits.

Features

- Range ±15 V
- Bluetooth® sampling rate of 1 kHz
- High-speed sampling via USB; 100 kHz burst mode
- Includes remote logging on your device.



Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable

(Please see pasco.com for detailed specifications.)

The Wireless Weather Sensor is an all-in-one instrument for monitoring environmental conditions. By incorporating several sensing elements into a single unit, the sensor provides up to **19 different measurements!** Use the sensor in logging mode with the Weather Vane Accessory for long-term monitoring, or use it as a hand-held instrument to study microclimates and record ambient conditions relevant to many biological and environmental phenomena.

Weather Vane Accessory

PS-3553

Includes tripod, tripod adapter, and weather vane.

Equip your Wireless Weather Sensor for extended environmental monitoring with the Weather Vane Accessory. Once deployed the sensor will freely rotate to capture wind speed and direction, whether you are monitoring data in real time or using the sensor in logging mode to capture hours (or days!) of data for later analysis.

The Wireless Temperature Link enables wireless connection for any PASCO temperature probe with a 3.5 mm connection. The link comes with a Fast Response Temperature Probe, but it can also connect to the Stainless Steel Temperature Probe, Skin/Surface Temperature Probe, the Absolute Zero Sphere, and the Ideal Gas Law Apparatus.

NEW

Specifications

Compatible Temperature Probes: Skin/Surface (PS-2131); Fast Response (PS-2135); Stainless Steel (PS-2153)
Range with included probe: -30°C to 105°C
Jack: 3.5 mm stereo
Logging: Yes
Battery: Coin cell
Connectivity: Bluetooth 4.0

Wireless Temperature Link

PS-3222

Includes Fast Response Temperature Probe

Wireless Spectrometer

PS-2600

Includes Spectrometer and 10 cuvettes.

Also available:

Optional Fiber Optic Cable PS-2601
Cuvettes & Caps SE-8739
Cuvette Rack EC-3590

Award-Winning Wireless Spectrometry for iOS®, Android™, Computers, and Chrome*

Measure intensity, absorbance, transmittance, and fluorescence.

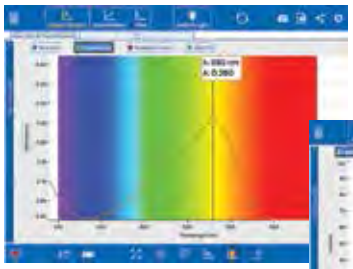
Now PASCO offers Bluetooth® spectrometry for your iPad and Android tablets! This new spectrometer from PASCO is specifically designed for introductory spectrometry experiments. The Bluetooth and USB connectivity enable use with your computers and tablets, making this a powerful and intuitive tool for your spectrometry needs. With this one apparatus you can measure intensity, absorbance, transmittance, and fluorescence.

You can perform these labs with the Wireless Spectrometer:

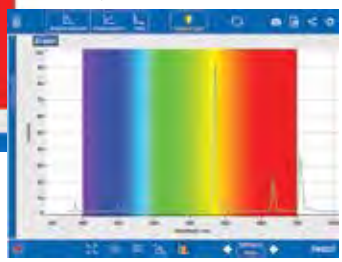
- Emission Spectra of Light
- Absorbance Spectra
- Beer's Law
- Kinetics
- Fluorescence

Specifications

- Bluetooth and USB connectivity
- 2–3 nm FWHM resolution
- 380–950 nm range
- 2 fluorescence excitation wavelengths at 405 nm and 500 nm
- LED-boosted tungsten light source



Full visible spectrum analysis of solutions



Create Beer's Law plots to relate absorbance and concentration.

The Wireless Spectrometer is compatible with **PASCO's spectrometry software.**

- PC and Mac versions included with purchase.
- FREE for iOS, Android, and Chrome* tablets.
- Designed specifically for introductory spectrometry experiments.

**Go to pasco.com and see our ever-expanding list of compatible Chromebooks.*

Polarimeter

PS-2235

Includes 1 Sample Cell

Also available:

Polarimetry Sample Cell Replacement PS-2234

PASCO Polarimeter for your Chromebook™, iPad®, Tablets, and Computers

Measure the optical rotation of chiral compounds.

PASCO's new Polarimeter has both Bluetooth® and USB connectivity, so it works on your iPad®, Chromebook™, tablets, and computers. It is ideal for introductory Organic and Biochemistry experiments with chiral compounds.

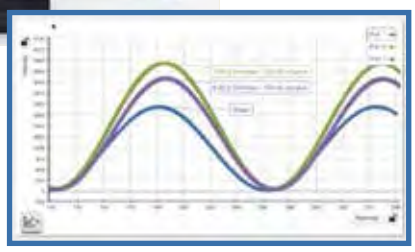
In this new device, plane polarized light is passed through a sample, which contains a chiral compound, to an analyzer and a detector. The degree of optical rotation of the plane polarized light is based on the type and amount of sample present.

Determine the concentration of a sugar solution based on the optical rotation of plane polarized light.

Specifications

- Bluetooth® and USB connectivity
- 589 nm LED light source
- Accuracy = ± 0.09° optical rotation
- SPARKvue- and Capstone-compatible
- Industry-standard, horizontal polarimeter sample cell (100 mm)

Determine the concentration of a sugar solution based on the optical rotation of plane polarized light.



Optical rotation of sucrose

3-Axis Acceleration/Altimeter

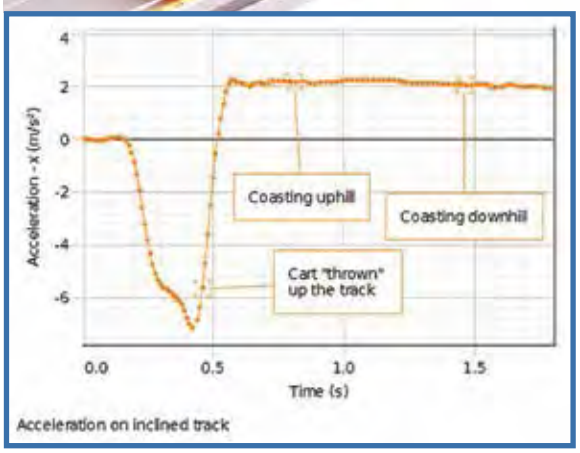
PS-2136A

Includes cart mounting bracket, thumb screws, and Sensor Extension Cable.

Simultaneously measure changes in altitude and acceleration.

- Measures X, Y, and Z components of acceleration
- Automatically calculates magnitude of the resultant
- Choose units of m/s2 or g's
- Can measure altitude changes as small as 10 cm
- Measure 16 g with .002 g resolution accelerations
- Sample acceleration measurements up to 500 Hz
- Sample acceleration and altitude up to 100 Hz
- Altitude max sample rate 20 Hz

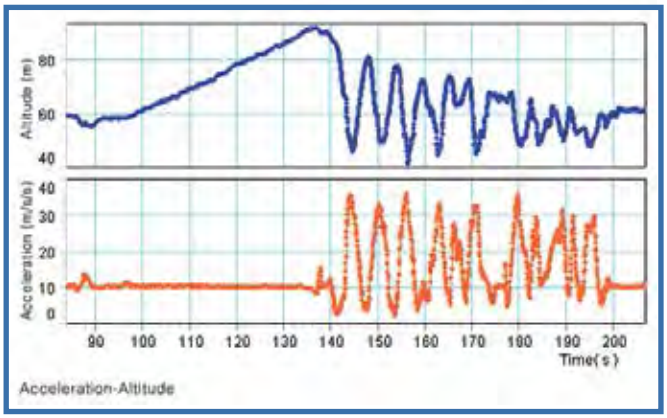
Mount to dynamics cart to help students understand how acceleration changes with track angle.



The cart acceleration parallel to the track is measured as the cart is "thrown" up the incline and allowed to coast up and back down the track.

The Teaching Advantage

- Easily mounted to PASCO carts for studying Newton's Laws
- 3-axis icon on the sensor indicates the location of the accelerometer



Acceleration and altitude data from a roller coaster.

See our Wireless 3-Axis Acceleration/ Altimeter on page 101.

Visual Accelerometer

PS-2128

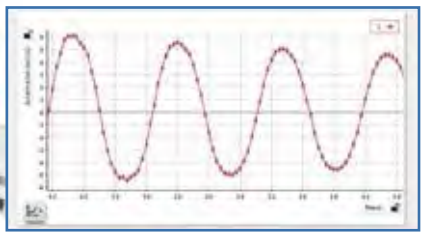
Includes plastic screws for attaching to a PASCO cart, Sensor Extension Cable, and 3 AA batteries.

What can be hard to explain can be easy to show with the Visual Accelerometer. Introduce linear acceleration, centripetal acceleration and forces, and learn about simple harmonic motion. Measure the acceleration while riding an elevator.

The Teaching Advantage

- Three selectable ranges, so both gentle and sudden accelerations can be analyzed.
- Auto-scale setting for maximum sensitivity.
- Sensor can retain its peak value for accelerations that occur too quickly for the eye to see.
- Tare (zero) button compensates for the orientation of the sensor and makes sure only actual accelerations are measured.
- Students can clearly see direction of acceleration in relation to the cart's motion.

Mounts directly to PASCO dynamics carts.



Clear data combined with the built-in visual cues to reinforce student understanding.

See and measure the lateral acceleration involved in simple harmonic motion.

PASCO's 5-Year Warranty

To withstand the rigors of student use, PASCO products are made of the highest quality materials. They are designed and manufactured by our team of education researchers and engineers in Roseville, California. And we back up our products with a 5-year warranty, so you can be completely confident about buying PASCO solutions.

PASCO 5 YEAR WARRANTY

Wireless Solutions

for iOS, Android™, Chrome™, Mac® and PC devices

Have devices for your science program and just need to connect sensors?

No problem. We have the simple answer. It's the same solution, whatever device you use. Select our AirLink or SPARKlink Air and connect any PASPORT sensor to your existing tablets. Then download SPARKvue for iOS and Android devices.

AirLink PS-3200

The new AirLink connects any PASPORT sensor directly to your devices via Bluetooth®. Now, when you use this AirLink, you can perform experiments that were difficult or impossible before and transmit the data directly to your mobile devices. And using the AirLink will simplify your lab setup by removing the clutter of cables.

SPARKlink® Air PS-2011

Two sensor ports for connecting sensors to your computer and mobile devices via USB or Bluetooth® make the SPARKlink Air ideal for schools with computers, tablets, or a mixture of both.

SPARKvue®

Download on the App Store

ANDROID APP ON Google play

Download SPARKvue for free! It brings real-time sensor data collection, visualization and analysis for inquiry-based science to your iPad, Chromebook, or Android tablet.

See page 5 for more information.

Wireless Blood Pressure Sensor

PS-3218

Includes Blood Pressure Sensor, standard-size arm cuff, bladder and pressure release valve.

PASCO's new Wireless Blood Pressure Sensor has all the features of our PASPORT Blood Pressure Sensor, with the added convenience of collecting data wirelessly. Students can easily measure both systolic and diastolic arterial blood pressure (mmHg) as well as heart rate (pulse in bpm).

Typical Applications

- Determine the effects of exercise on blood pressure and heart rate
- Compare the blood pressure and heart rate of different students in the class
- Explore the effects of body position on blood pressure and heart rate

Students determine blood pressure using familiar methods.

A clear and easy way to observe heart rate plus systolic and diastolic blood pressure.

Breath Rate Sensor

PS-2187

Includes Masks (10) and Clips (10).

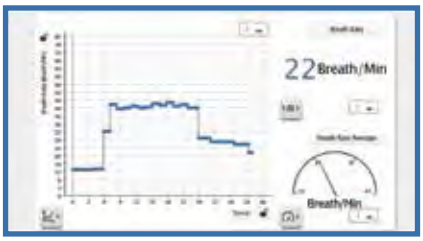
Also available:
Replacement Masks (10 Pack) PS-2567
Replacement Clips (10 Pack) PS-2568

Measuring breath rate is as easy as breathing. Study physical fitness by measuring breath rate before, during, and after exercise. Add our Hand-Grip Heart Rate Sensor and Blood Pressure Sensor for a more complete study of exercise physiology.

The Teaching Advantage

- Clip the end of the sensing tube to a common dust mask worn by test subject for easy use
- Sensor provides stable output even during exercise for ease of analysis

Determine breath rate while exercising.



A graph showing a student's breath rate before, during, and after exercise.

Charge Sensor

PS-2132

Includes 0.9 m shield cable with alligator clips.

Measure the amount and the polarity of electric charge present. Demonstrate and measure charging by induction, use as a replacement for an electroscope, or explore the distribution of charge across a surface.

The Teaching Advantage

- No guessing – the polarity of the charge is shown automatically
- Built-in push-button tare
- High input impedance means repeatable results

Immediately see the polarity and the quantity of charge present on an object.

Wireless CO_2 Sensor

PS-3208

Includes 250-ml sampling bottle and USB charging cable.

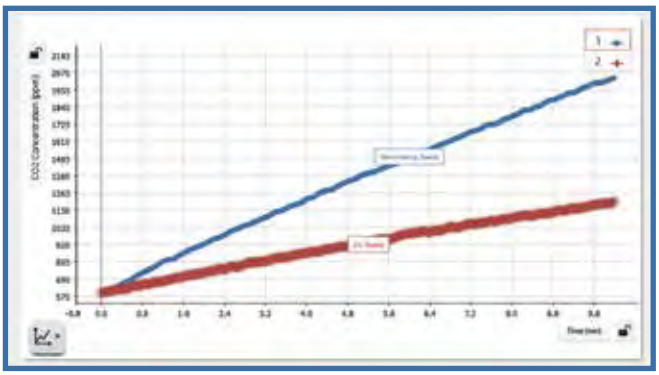
Also available:

Dissolved CO_2 Waterproof Sleeve PS-3545

Use this wireless sensor to measure the concentration of CO_2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile probe. CO_2 data can be logged directly on the device for long-term life science and environmental science studies.

Features

- Includes remote logging on your device.



Directly compare separate controlled environments.

Wireless Colorimeter and Turbidity

PS-3215

Includes 10 cuvettes, 1 turbidity calibration standard (100 NTU), 2 cuvette racks and USB charging cable.

WARNING! This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Also available:

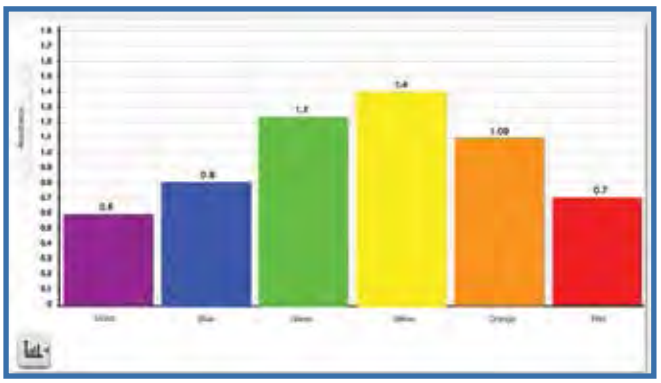
Spectrometer/Colorimeter Cuvettes SE-8739

Determine the concentration of a solution with ease. Study absorbance vs. concentration to explore Beer's Law, and measure chemical rates of reaction.

The Teaching Advantage

- Simultaneous data collection in six wavelengths (colors) of light increases accuracy of results and reduces frustration caused by missing data
- Sensor calibrates in all wavelengths automatically in one step
- Rates of reaction experiments can be conducted easily.

Set up in seconds and collect individual measurements with ease.



Determine the relationship between absorbance and concentration.

Wireless Conductivity Sensor

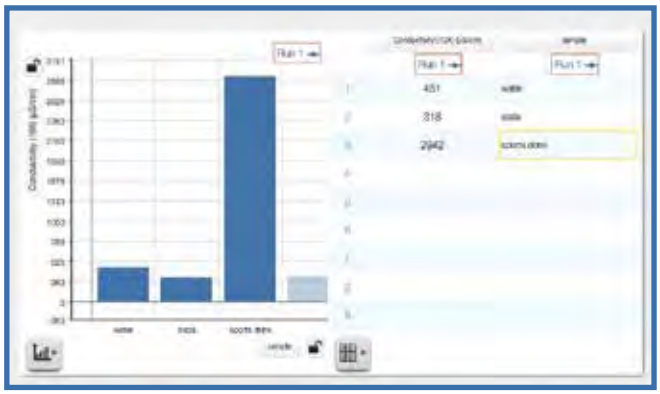
PS-3210

Includes 1 coin cell battery.

Use the Wireless Conductivity Sensor to measure the electrical conductivity of a water solution. With this wireless sensor you can investigate the properties of solutions, as well as model and measure water quality.

Features

- Measure both conductivity and total dissolved solids
- Automatic temperature compensation
- Dust- and sand-proof and water-resistant (1 meter for 30 minutes)
- Battery life >1 year
- Remote logging

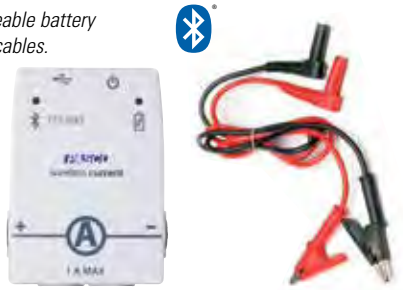


Measure the conductivity of water and water-based solutions.

Wireless Current Sensor

PS-3212

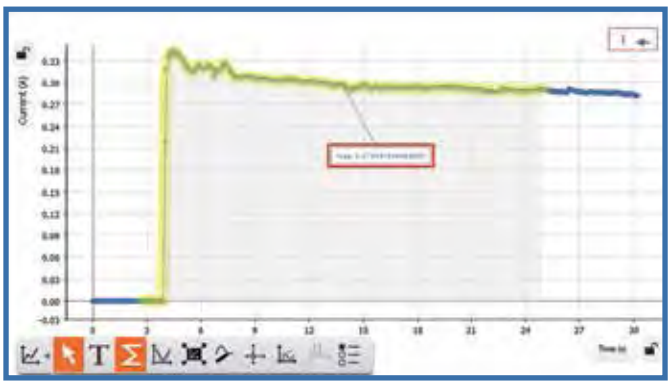
Includes rechargeable battery and banana-clip cables.



This sensor's wide current range allows for introductory and advanced explorations of the fundamental concepts of electricity and basic circuits.

Features

- Range ±1A
- Bluetooth® sampling rate of 1 kHz
- High-speed sampling via USB; 100 kHz burst mode
- Includes remote logging on your device



Wireless Optical Dissolved Oxygen Sensor

PS-3224

Includes USB charging cable

Also available:
ODO Metal Guard PS-3604
ODO Sensor Cap PS-3605

The Wireless Optical Dissolved Oxygen (DO) Sensor is the perfect solution to monitor DO in the lab or the field. Optical technology is accurate, fast, and does not require flow or calibration. With built-in memory, you can log data for hours or days to capture day/night nutrient cycles and changes in metabolic processes. With the included cover, the sensor has a fully waterproof design and is submersible to 10 m.

Perform these labs with the sensor:

- Photosynthesis, respiration, and fermentation
- Monitor water quality
- Measure net primary productivity
- Model ecosystems

Specifications:

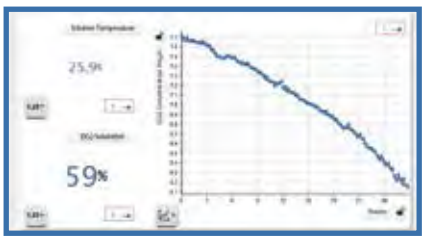
Bluetooth® and USB connectivity

Response Time: 90% in 25 sec

Operating Temperature: 0–50°C

Range: 0–20 mg/L or 0–300% saturation
Reports solution temperature and ambient pressure

Accuracy: ±0.2 mg/L or 1% (whichever is greater) with user calibration; ±0.5 mg/L or 3% (whichever is greater without user calibration; >200% saturation ±10%



Wireless Drop Counter

PS-3214

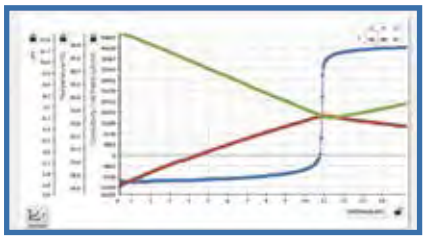
Includes Drop Dispenser and Micro Stir Bar plus a stainless steel sensor rod for easy attachment to a ring stand.

Add the new Wireless Drop Counter for more efficient and accurate titration data. Conducting a titration has never been easier!

The Teaching Advantage

- IR filter assures accurate counts because room lighting cannot affect results
- Sensor unit can suspend up to three other probes in solution, simplifying many experiments
- Wider drop window (18x13mm) means better drop detection and easier alignment with burettes

Integrated probe-management makes titration setup a snap.



Perform simultaneous pH, conductivity, and temperature titrations using the Wireless pH Sensor and the Drop Counter.

Heater-Stirrer

PS-3401

Includes support rod.

This compact heater-stirrer is an essential for any lab! The white ceramic top is ideal for heating and for seeing color changes when mixing solutions. It has been designed to withstand spills. Its safety features include warning labels and indicator LEDs. The included rod makes it easy to support sensors.

Micro Stir Bar (5-Pack)

PS-2565

The Micro Stir Bar maintains a constant flow of solution over the end of an electrode, such as the pH and Conductivity probes. For use with a standard magnetic stir plate and cylindrical probes of about 13 mm diameter.

The Teaching Advantage

- Magnet is completely sealed to prevent damage from chemicals
- Allows study of solutions in micro-quantities

EKG Sensor

PS-2111

Includes 100 self-adhesive electrode patches.

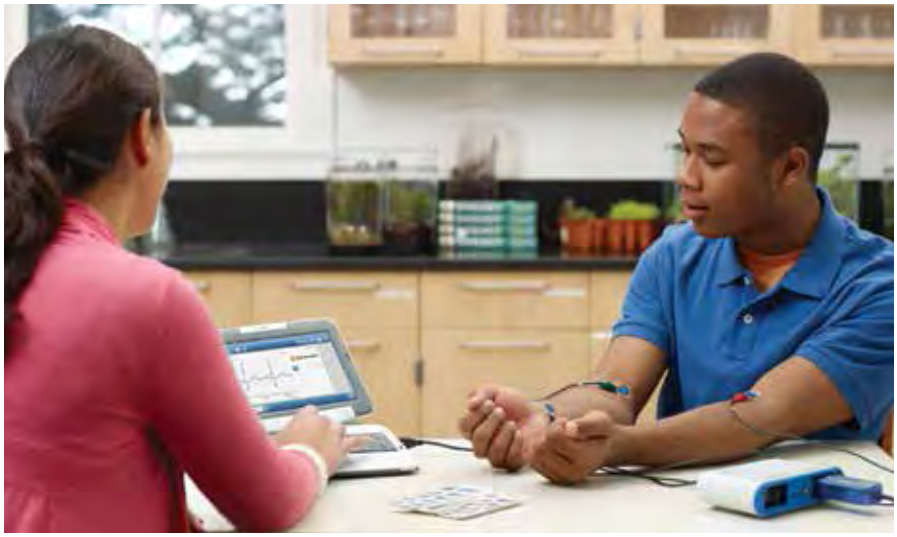
Also available:

EKG Sensor Electrode Patches (100-pack; one-year shelf life) CI-6620

Take the mystery out of that old medical show staple by letting students measure and record the electrical signals produced by the heart. Students can use it to measure their own heart rate, and then explore the effects mild exercise has on heart rate.

The Teaching Advantage

- Three-electrode design is easy to use.
- Electrodes are contained in disposable stick-on pads, eliminating the need for messy gels.

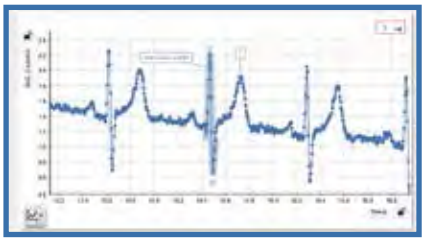


Easy setup and quick data collection make it possible for every student to see their heartbeat in a class period.

EXPLORE BLOOD PRESSURE

Round out your exploration of the circulatory system with our Blood Pressure Sensor.

For more information, see pages 24 and 142.



Clear data helps students better understand the electrical signals of the heart.

Ethanol Sensor

PS-2194

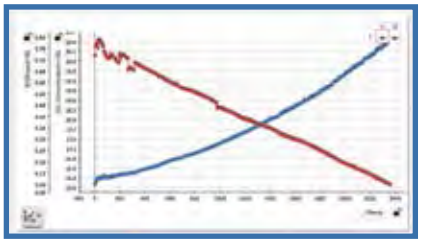
Includes probe and PTFE tape.

This sensor measures the concentration of ethanol in a gas, up to 3%. Explore the effects of temperature on ethanol production during yeast fermentation using a PASCO EcoChamber, or study combustion and its byproducts.

The Teaching Advantage

- Easy to calibrate

Directly measure the products of fermentation.



Compare ethanol production to oxygen uptake over time.

Flow Rate/Temperature Sensor

PS-2130

Measure the temperature and flow rate of streams, rivers, and other flowing bodies of water. Explore how geographic features can affect water flow, determine sediment transport rate, or map out flow rates and temperatures at different locations and depths in a stream.

The Teaching Advantage

- Telescoping handle allows taking data at greater depths.
- Rugged construction reduces chance of losing pieces during field use.

Collect data safely from the shore with the telescoping handle.

The built-in temperature sensor is located next to the impeller to better correlate temperature and flow rate data.

Force Platform

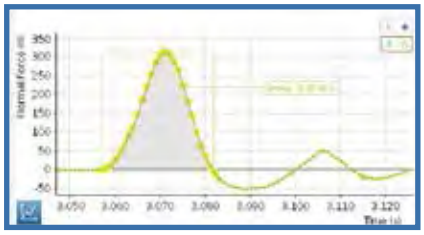
PS-2141

Measure large forces applied over a wide area. Explore the physics of jumping and hang time or study the impulse imparted by a bouncing ball. Examine the forces acting on a person riding an elevator, or use two to verify Newton's Third Law.

The Teaching Advantage

- Large surface for jumping and landing.
- High data rate provides a smooth data set to ease analysis.

Fast response, wide range, and durability make a variety of experiments possible.



Use the area under the curve to determine the impulse of the initial impact.

2-Axis Force Platform

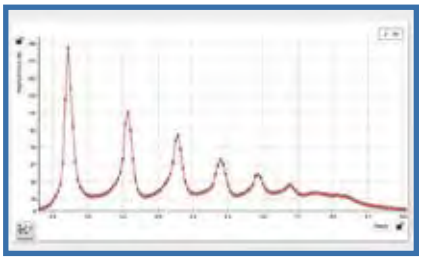
PS-2142

Go beyond models and simulation and get force data from the real world. Study friction by dragging objects across the surface and measure normal and friction forces. Explore the physics of a broad jump, and introduce vectors and force components. Use one platform on the floor and another on the wall and study the static equilibrium of a ladder leaning on a wall.

The Teaching Advantage

- 2-axis measures both normal and parallel forces
- Perfect for measuring forces on the human body

Add a new dimension to study more complex motion.



Get the complete picture by viewing the normal force and parallel force together.

Wireless Force Acceleration Sensor

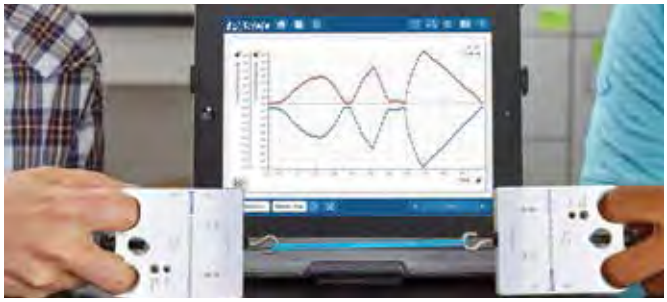
PS-3202

Includes 1 eye bolt, 1 thumb screw, 1 bumper, a lithium-ion battery, and a USB connector.

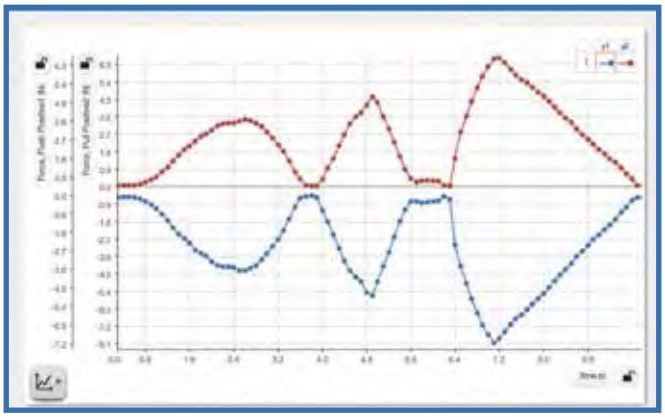
Capable of measuring force, acceleration, and rotation, this sensor is ideal for experiments involving rotating platforms, moving carts, spring oscillations, collisions, and impulse. The wireless design offers improved measurements without a cable affecting experiment outcome. Finger-holes support handheld applications, or mount it onto a cart or rod.

The Teaching Advantage

- Simultaneously measures force and acceleration. Measures acceleration in x, y, and z axes and resultant acceleration. Built-in gyroscope measures rotation.
- Features convenient Bluetooth® wireless connectivity and long-lasting rechargeable battery.
- Probe can be quickly zeroed through software for accurate taring.
- Logs force and acceleration data directly onto the sensor for long-term experiments.



When students are the force, Newton's Third Law is no longer a leap of faith.



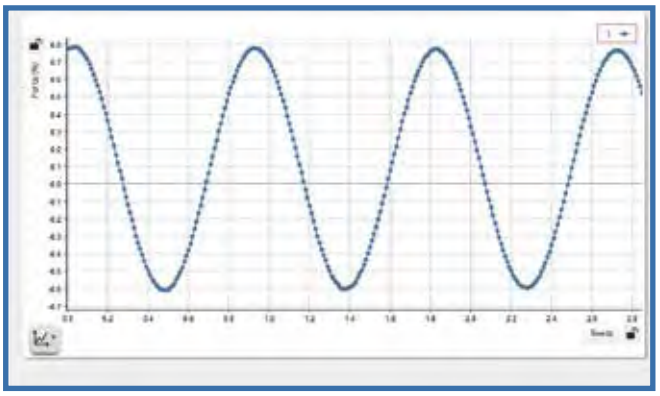
Directly compare action and reaction of forces.

High Resolution Force Sensor

PS-2189

This force sensor allows the student to measure smaller changes in force, such as forces exerted by an oscillating mass, the force of a swinging pendulum, or use it as a pan balance for long-term experiments with evaporating liquids.

Study simple harmonic motion.

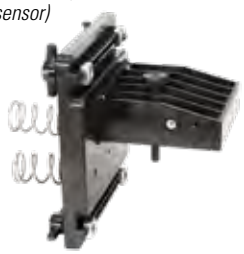


High resolution means even the smallest oscillations in force are captured with high fidelity.

Force Bracket

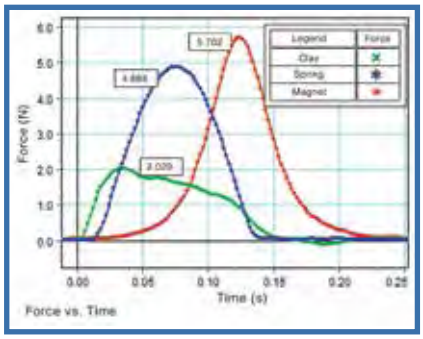
ME-6622

Includes spring bumpers (2) (different spring constants), magnetic bumper (1), rubber bumper (1), clay cup for inelastic collisions (1) (clay included), #0 Phillips head screwdriver (to attach to force sensor)



The Force Bracket with bumpers mounts the PASCO Force Sensor directly to a dynamics track. It includes 5 collision attachments for the Force Sensor and conveniently stores each attachment on the bracket itself.

Using any of these attachments, the bracket serves as an excellent support or target for collision studies using the Force Sensor.



Force vs. time data for a clay, spring and magnet.

Force Sensor Balance Stand

CI-6460

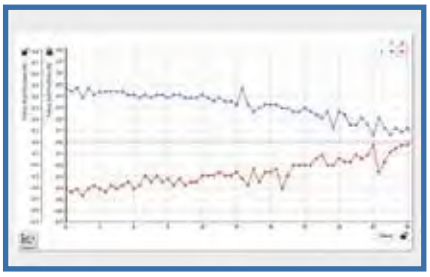
Includes Force Sensor stand and balance pan. Force Sensor sold separately.

Connect a Force Sensor to this stand and students have a convenient electronic balance for a wide variety of physics experiments. Connect an Acceleration Sensor for studies of angle vs. normal force. Use it as a pan balance or to measure buoyant force.

The Teaching Advantage

- Mounting screws and balance pan can be stored on the pan when not in use.

The Force Sensor Balance Stand lets you observe buoyant force from the perspective of the fluid.



The buoyant force exerted on the object is equal to the additional force experienced by the beaker.

Rocket Engine Test Bracket

ME-6617

Rocket Engine not included.

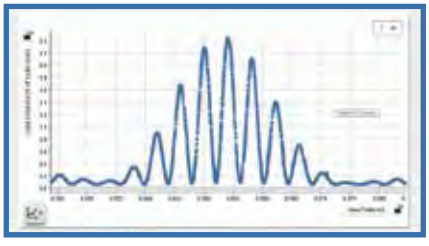
For outdoor use only!

With the Rocket Engine Test Bracket securely attached to a Force Sensor, students can measure, and graphically display, the impulse of Estes™ and other model rocket engines. A perfect supplement for rocketry studies.

The Teaching Advantage

- Accommodates rocket engine sizes A, B, C, and D.
- Finds both the impulse and the maximum force exerted by rocket engines.

Yes, this really is rocket science!



Measure the force vs. time profile of a rocket engine.

Galvanometer

PS-2160

Includes BNC to banana plug cable and jack adapter, and 2 resistors (0.1 ohm and 10 ohm).

Measure extremely small voltages with high resolution. Study sensitive circuits involving low voltages and currents, and even measure the voltage drop along a simple length of wire. This sensor is perfect for resistivity experiments.

The Teaching Advantage

- Measures with 0.1 V resolution for precise results.
- Designed to reduce measurement noise and deliver clean data.

Find out if that really is a 1% resistor with the precision of the Galvanometer.

Rock-solid performance lets you measure the smallest changes in voltage and current with confidence.

Goniometer Sensor

PS-2137

Includes an Angle Sensor and 1 Goniometer Probe with Velcro® connection kit.

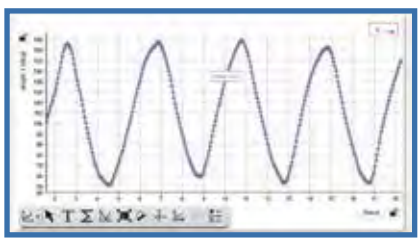
Measure two joints simultaneously. Just add an additional probe:
Goniometer Probe PS-2138
Includes probe and Velcro® connection kit.

Measure how far and how fast human limbs bend. Study how arms and legs move, and compare normal motion to that of moderate exercise and athletic activity. Use with a Force Sensor to analyze energy expenditure when lifting weights or climbing stairs.

Sensor simply straps on with Velcro®, making it easy to put on and take off. It allows the motion of several people to be compared in a short time. Can be used without calibration with good accuracy. However, calibration can reduce uncertainty to less than 1% of measured values.

See every flex and extension as your students become part of the experiment.

Study the motion of the knee while walking with the Velcro® straps included with the sensor.



Measure the extent of movement and changes in velocity during normal actions.

WE CAN HELP

We offer support, training, and customer service by email or phone and through self-directed online tutorials, live webcam feeds, or in-person training in your school.

Visit PASCO.com for details

Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable

The Wireless Weather Sensor is an all-in-one instrument for monitoring environmental conditions. By incorporating several sensing elements into a single unit, the sensor provides up to **17 different measurements!** Use the sensor in logging mode with the Weather Vane Accessory for long-term monitoring, or use it as a hand-held instrument to study microclimates and record ambient conditions relevant to many biological and environmental phenomena.

Specifications:

Battery: Rechargeable
Water-resistance: IP-64 splash-proof
(Please see pasco.com for detailed specifications.)

Equip your Wireless Weather Sensor for extended environmental monitoring with the Weather Vane Accessory. Once deployed the sensor will freely rotate to capture wind speed and direction, whether you are monitoring data in real time or using the sensor in logging mode to capture hours (or days!) of data for later analysis.

Weather Vane Accessory

PS-3553

Includes tripod, tripod adapter, and weather vane.

General Science Sensor

PS-2168

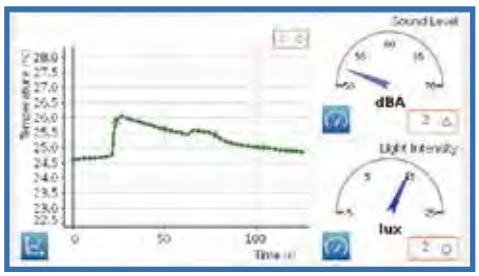
Includes built-in Light and Sound Sensors, Stainless Steel Temperature Probe and Voltage Probe.

Simultaneously measure temperature, light, sound level, and voltage — all with this one sensor. Measure the change in temperature of a cooling liquid, monitor noise levels in the classroom or in the field, or study the electrical discharge of capacitors.

The Teaching Advantage

- Easy-to-use design requires no calibration
- Versatile combination of sensors makes this a good overall solution for a General Science lab

Sensor has three selectable ranges for low, indoor, and outdoor measurements.



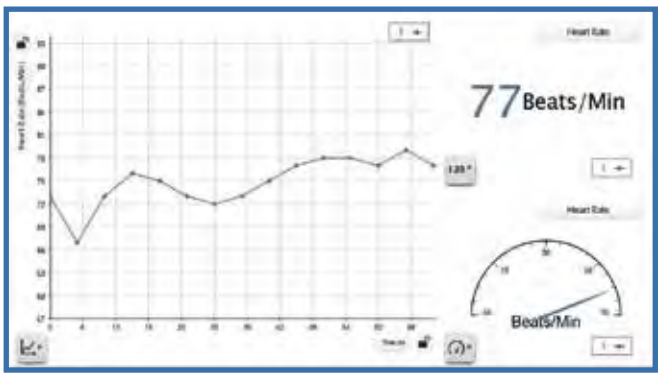
Collect and view different measurements at the same time.

Wireless Hand-Grip Heart Rate Sensor

PS-3206

Includes hand-grips and Bluetooth® Heart Rate Module with one coin-cell battery.

Using the new wireless Hand-Grip Heart Rate Sensor, it's easier than ever before to conduct physiology labs on the cardiovascular system or homeostasis. Use this sensor for a quick and easy way to acquire wireless measurement for either continuous monitoring or initial vs. final data points.



Compare your heartbeat during a variety of activities.

Wireless Exercise Heart Rate Sensor

PS-3207

Includes Bluetooth® Heart Rate Module with one coin-cell battery and chest strap (M-XXL).

The Wireless Exercise Heart Rate Sensor has a chest strap and will transmit data wirelessly up to 10 m away!

A single data set shows heart rate before, during, and after exertion.

Wireless pH Sensor

PS-3204

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

This sensor measures the pH of a solution as discrete measurements or as a continuous reading. Use the probe to study water quality, test household solutions, or perform high-resolution acid-base titrations.

The Teaching Advantage

- High resolution with low noise allows even subtle pH changes to be observed.
- Factory calibration lets students get right to data collection, with optional user calibration supported.
- Uses durable, accurate gel-filled Ag-Ag Cl electrode.
- Features convenient Bluetooth® wireless connectivity and long-lasting coin cell battery.
- Logs pH data directly onto the sensor for long-term experiments.

The versatile Wireless pH Sensor works as well in the field as in the lab.

Easily measure and compare the pH of common acids and bases.

Ion Selective Electrodes

Ammonium
PS-3516

Carbon Dioxide
PS-3517

Calcium
PS-3518

Chloride
PS-3519

Potassium
PS-3520

Nitrate
PS-3521

Each Ion Selective Electrode (ISE) includes a 2m cable.

Requires one of these:
Wireless pH Sensor PS-3204
Or
a PASPORT pH Amplifier

Also available:
Electrode Support PS-3505

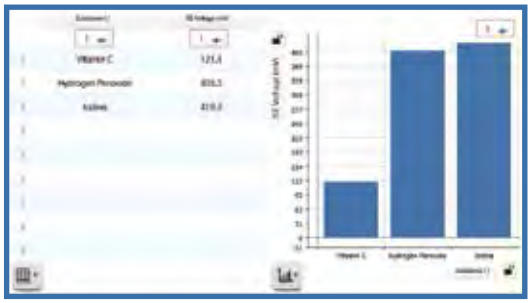
Oxidation Reduction Potential Probe

PS-3515

Requires one of these:
Wireless pH Sensor PS-3204
Or
a PASPORT pH Amplifier

Also available:
Electrode Support PS-3505

Use this probe to monitor solutions during oxidation-reduction titrations, perform water quality studies, and study the effects of water chlorination. This probe is not a standalone sensor. It connects to and requires an amplifier.



Quickly determine the overall tendency of a solution to gain or lose electrons.

Wireless Light Sensor

PS-3213

Includes 1 coin cell battery.

This wireless sensor is a great tool for explorations in Earth, Life, and Physical sciences. With its ambient light detector for illuminance and UV, and its directional detector for colors, your students can explore the electromagnetic spectrum, model planetary motion, and relate photosynthesis to light color and intensity.

Features

All these measurements in one!

- Illuminance (lux)
- UVA, UVB, and UV Index
- RGB color detection
- Battery life >1 year

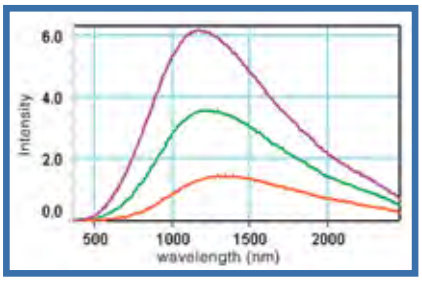
Broad Spectrum Light Sensor

PS-2150

Measure light intensity from the far infrared to the far ultraviolet. This sensor is design specifically for use with our OS-8539 Educational Spectrophotometer System and OS-8543 Prism Spectrophotometer Accessory for Black Body experiments. The Broad Spectrum Light Sensor uses a thermopile and window combination that respond to both the near infrared and visible light necessary for the Black Body Experiment.

The Teaching Advantage

- Ideal for the Black Body Spectrum
- For use with Spectrophotometer



Classic textbook diagram of the intensity versus wavelength blackbody curves.

Temperature/Sound Level/ Light Sensor

PS-2140

Includes Ambient Temperature, Light, and Sound Level Sensors.

Here are three popular sensors in one. Simultaneously measure temperature, sound, and light levels. Study how light, heat, and sound relate to energy, and compare environmental conditions among various species of plants.

The Teaching Advantage

- Use with our GPS Position Sensor to map data and correlate with locations
- Measure each quantity individually or any combination of the three

Designed for introductory level explorations of the physical environment.

Display shows how the sensor reads your world.

High Sensitivity Light Sensor

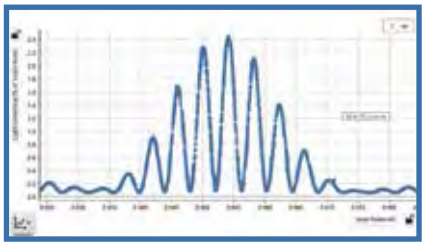
PS-2176

Measure small changes in light intensity in low intensity conditions. Conduct spectrophotometric studies on glowing gases, analyze interference and diffraction patterns. Use with our Rotary Motion Sensor to collect precise position data for more accurate results.

The Teaching Advantage

- Sensor works in three ranges from very low intensity candle light to overcast daylight
- Change ranges at the push of a button
- Detect changes in brightness as low as 0.0005 lux for finely detailed analysis

The light sensor combines with the rotary motion sensor for the diffraction of light experiment.



High sensitivity makes it possible to see the second order of the diffraction pattern.

Infrared Light Sensor

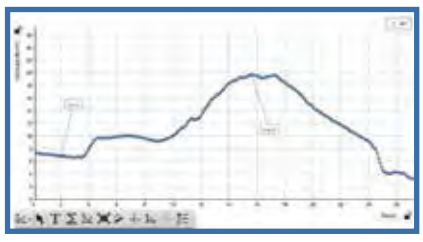
PS-2148

You can't see it, but now, you can measure it: infrared radiation. Introduce and explore blackbody radiation, estimate surface temperatures without contact, study energy received from the sun as heat, and explore radiation emitted as heat from common objects.

The Teaching Advantage

- Probe is sensitive over a vast range of wavelengths, allowing a comprehensive study of the topic at hand
- Contains a built-in thermistor to measure temperature on the "cold" side of the thermopile
- Sense wavelengths from 580 nm to 40,000 nm

Capture light beyond the visible spectrum.



Clearly see the infrared light radiating from your own hand.

Wireless Load Cell Accelerometer

NEW

PS-3216

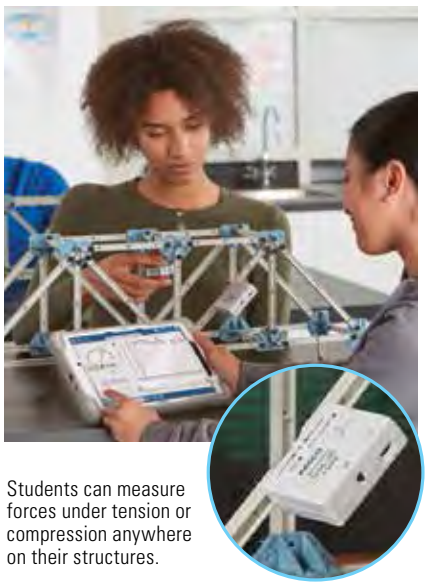
Recommended:
Building Better Bridges Kit ME-3581

The Wireless Load Cell and Accelerometer is designed for use with all PASCO Structures Systems, and is included in the Building Better Bridges Kit.

While it does not have the high resolution of the wired load cells, the Wireless Load Cell can be used for most structures related activities. It's wireless nature and the added accelerometer also make it ideal for studying the oscillations of structures.

The Teaching Advantage

- Low cost
- Built in accelerometer measures accelerations in three dimensions plus the resultant
- No wires, make it easier than ever to integrate into structures beams



Students can measure forces under tension or compression anywhere on their structures.

Load Cell & Dual Amplifier Set

PS-2206

(Includes 4 100N Load Cells and 6-Port amplifier)

Also available:
Load Cell and Amplifier Set PS-2199

These load cells are designed to be inserted directly into our Structures Systems to provide compression and tension measurement points in a student's design. The Dual Amplifier can measure the forces of one or two load cells, such as at the top and bottom of a roller-coaster loop, or on one cell moving to different parts of a bridge. Expand this set by adding another load cell.

The Teaching Advantage

- Perfect for applications requiring only one or two load cells
- Expand this set with an additional load of a 5 N or 100 N Load Cell

Measure the stress and strain experienced by a structure in-line with the load cell amplifier.

100N Load Cell

PS-2200

Displacement Sensor

PS-2204

Includes digital indicator, pivot rod clamp, Phillips screw driver, and storage box.

Measure small displacement with amazing accuracy using this sensor – even the smallest deflection from a load applied to a truss, bridge, or other PASCO Structure System construction. Use the Digital Indicator as a stand-alone device to measure displacements and read them on the LCD display.

The Teaching Advantage

- Use the sensor and your PASCO interface to input and analyze collected data

- Easily mounts to a support rod with included pivot rod clamp

Detect even the smallest flex when your structure is put under load.

Wireless 3-Axis Magnetic Field Sensor

NEW

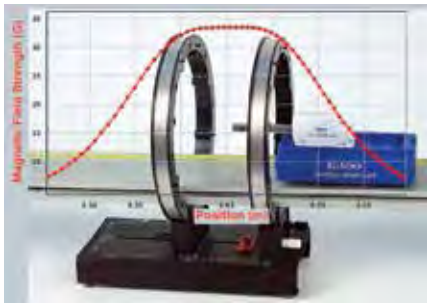
PS-3221

*Required:
Zero Gauss Chamber EM-8652

PASCO's new Wireless 3-Axis Magnetic Field Sensor is sensitive enough to measure Earth's magnetic field! It can also measure magnets and fields in a coil.

Typical Applications

- Measure magnetic field of permanent magnets.
- Measure Earth's magnetic field.*
- Measure field strength of Helmholtz coils.



Features:

- X, Y, Z magnetic field components
- Resultant magnetic field
- USB and Bluetooth®
- Two ranges: 50 G and 1300 G
- Rechargeable

Zero Gauss Chamber

EM-8652

This double-walled, high permeability metal chamber produces a zero-gauss field within the chamber. By placing the Magnetic Field Sensor probe into the chamber and pushing the "Tare" button, the sensor may be zeroed. Highly recommended for measurement of the Earth's magnetic field.

Magnetic Field Sensor

PS-2112

Make a magnetic field "visible". Use this sensor to map the magnetic field around a bar magnet, explore how the strength of a magnetic field is related to the distance from the source magnet, and explore magnetic fields formed by coils and loops.

The Teaching Advantage

- Single-range sensitivity: ±1000 gauss
- Align sensor with magnetic field along length of probe until highest field strength displays

Measure the magnetic field generated by a current passing through a coil.

2-Axis Magnetic Field Sensor

PS-2162

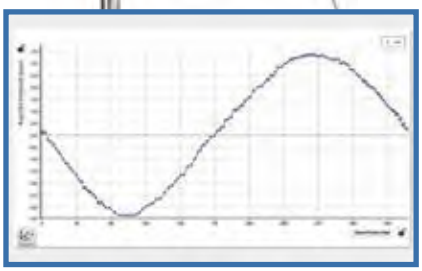
Includes Sensor Extension Cable.

Recommended:
Zero Gauss Chamber EM-8652

Simultaneously measure radial and axial field strengths. Map magnitude and direction from a bar magnet or a coil, explore magnetic fields generated by alternating current, and measure the Earth's magnetic field. Combine with a Rotary Motion Sensor to collect precise position data at the same time for more accurate field maps.

The Teaching Advantage

- Designed to reduce noise at low sampling rates
- Simple tare button to zero (uses Zero Gauss Chamber)
- 0.01 gauss resolution @ 10 Hz

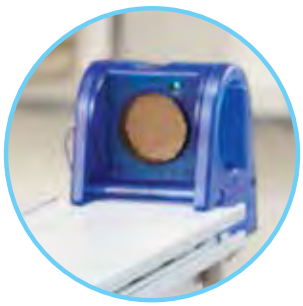


Reveal the naturally occurring magnetic field of the Earth.

Motion Sensor

PS-2103A

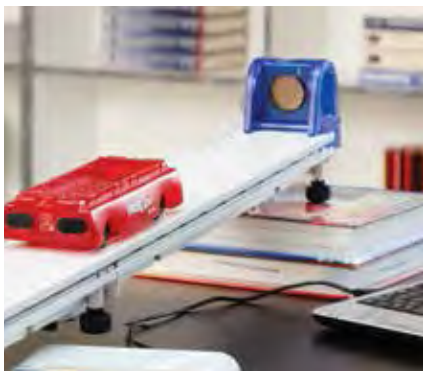
Also see the new Wireless Motion Sensor on page 103.



Locked onto the end of our dynamics track

Standing flat on a table top

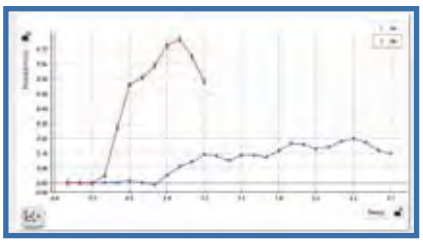
Mounted on a rod stand



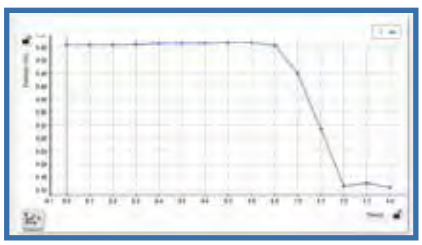
Integration of sensor and equipment makes changing the angle of incline a breeze.

Motion Sensor Guard

SE-7256



Comparing the acceleration of a cart down a track at different angles takes no time at all.



Use a Motion Sensor Guard to see the motion of an object falling toward the Motion Sensor.

Motion Sensor

Need to know distance, velocity or acceleration? Explore linear motion in detail with this sensor. Students can study the back-and-forth motion of a cart on a track or the movement of their own bodies in the classroom. Even acceleration of a falling object due to gravity can be studied with relative ease.

The Teaching Advantage

- Tight beam allows collection of data over a greater range of distance
- Probe detects and filters out false target readings, eliminating spikes and misreadings
- Automatic determination of distance, velocity, and acceleration allows students to focus on the motion and not on tedious calculations

Magnetic Motion Sensor Bracket

PS-2546

Combine with the Force Sensor to explore simple harmonic motion or Newton's Second Law.

Rotary Motion Sensor

Put a new spin on many common experiments with this highly versatile sensor. Use it to study not only rotary motion, pendulum motion, and angular momentum, but a surprising variety of other topics as well. With the right accessories it can be used to determine the acceleration of gravity, to study linear velocity and acceleration, and it can be used in an optics lab to study interference and diffraction patterns.

The Teaching Advantage

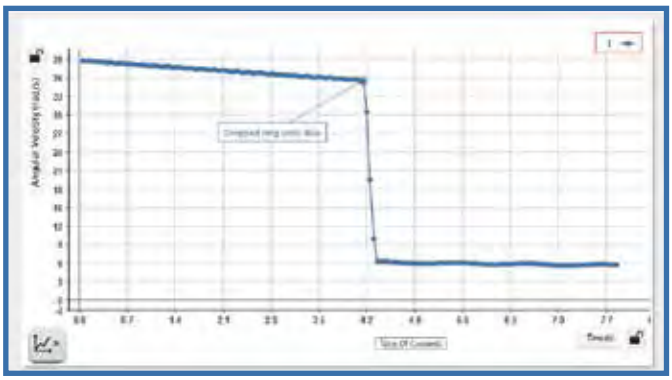
- Sensor's 0.09 degree resolution (about 4,000 points per revolution) allows highly precise angular measurements
- Sensor measures reliably up to 30 revolutions per second (which translates to a maximum linear speed of about 4.5 m/s)
- Attached rod clamp allows sensor to be mounted in almost any orientation

Rotary Motion Sensor

PS-2120A

Recommended:

Linear Motion Accessory CI-6688A
Mini Rotational Accessory CI-6691
See applications below.

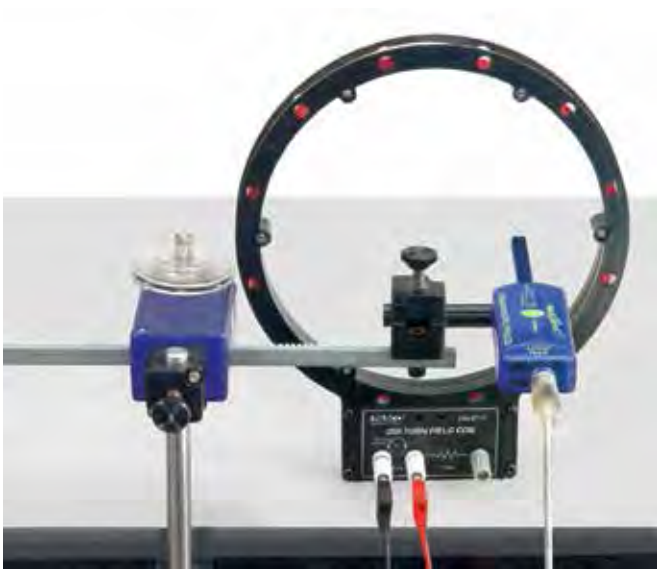


The graph captures angular velocity before and after the collision. Knowing the mass and dimensions of the ring and disk, students will find that angular momentum is conserved.

Also see the new Wireless Rotary Motion Sensor on page 104.

Investigate what happens to angular momentum when a ring is dropped on a spinning disk.

Combined with the Linear Translator from the Sensor-based Diffraction Kit, the Rotary Motion Sensor controls and measures linear position during optics labs.



Add the Linear Motion Accessory to your Rotary Motion Sensor for precise distance measurements.

Flat pH Probe

PS-3514

Connects to and requires a pH Sensor. Includes soaker bottle.

This pH probe gives you the freedom to measure what you want, where you want. Study pH levels in different kinds of foods, investigate the pH of common skin and hair care products, and easily collect pH data when doing soil analysis.

Whether your flat surface is a Petri dish or a slice of cheese, find the pH with a minimum of fuss.

The Flat pH Probe (above) requires one of the following:

Wireless pH Sensor PS-3204
Or
PASPORT pH Amplifier

Wireless Optical Dissolved Oxygen Sensor

NEW

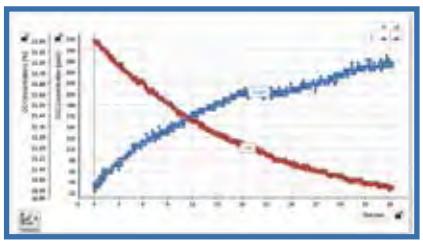
PS-3224

Includes USB charging cable.

Use this sensor for any experiment requiring the measurement of oxygen levels, such as the study of photosynthesis, animal and insect respiration, and gas production during chemical reactions. Combine with our CO_2 Sensor to also monitor conditions within a terrarium or perform simple physiological studies.

The Teaching Advantage

- Automatically compensates for temperature
- Calibrates in one step with the touch of a button



Analyze oxygen gas consumption and carbon dioxide gas production of the pea seeds.

Wireless Oxygen Gas Sensor

NEW

PS-3217

Includes USB charging cable, 250-mL sampling bottle.

The Wireless Oxygen Gas Sensor is accurate and easy to use, which makes it the perfect sensor to study photosynthesis, respiration, and oxygen cycling in the environment. With remote logging, simultaneous measurement of humidity and temperature experiments can go beyond the lab period and easily give students hours or days of data for analysis.

Wireless pH Sensor

PS-3204

Includes 1 coin cell battery and a direct-connect pH probe with storage bottle.

This sensor measures the pH of a solution as discrete measurements or as a continuous reading. Use the probe to study water quality, test household solutions, or perform high-resolution acid-base titrations.

The Teaching Advantage

- High resolution with low noise allows even subtle pH changes to be observed.
- Factory calibration lets students get right to data collection, with optional user calibration supported.
- Uses durable, accurate gel-filled Ag-Ag Cl electrode.
- Features convenient Bluetooth® wireless connectivity and long-lasting coin cell battery.
- Logs pH data directly onto the sensor for long-term experiments.

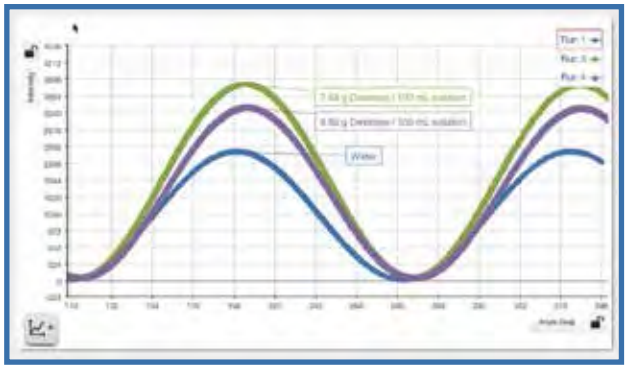
Polarimeter

PS-2235

Includes 1 Sample Cell

Also available:
Polarimetry Sample Cell Replacement
PS-2234

Determine the concentration of a sugar solution based on the optical rotation of plane polarized light.



Optical rotation of sucrose

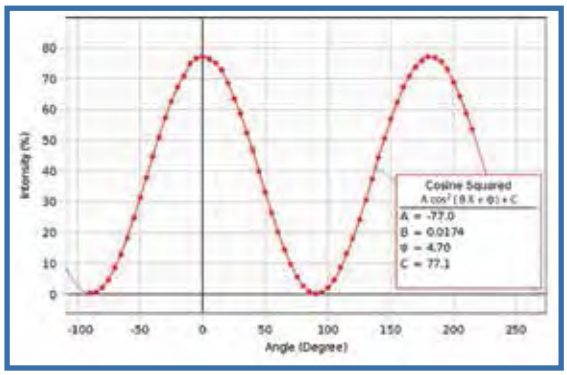
Polarizer Demonstrator

OS-9477A

Includes two round polarizer discs with stands.

Also available:
Polarizer Demonstrator Accessory OS-8172
Linear Polarizer (2-pack) OS-8549

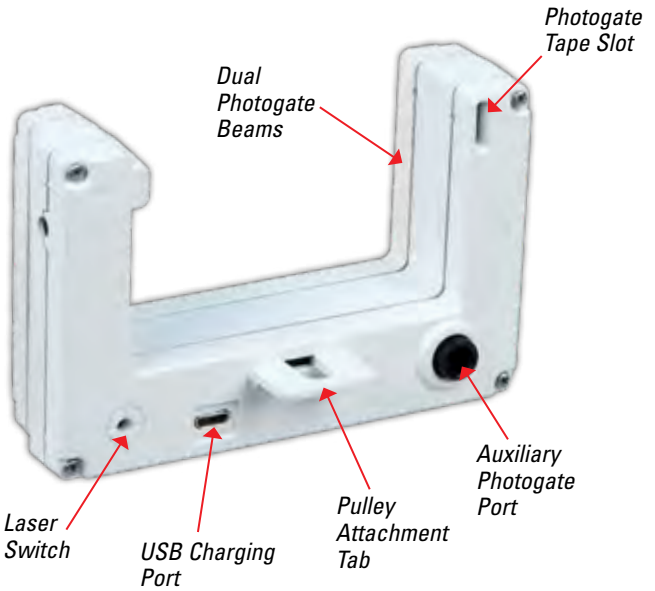
Introduce the concept of polarization with this colorful and meaningful demonstration.



As the polarizer is rotated, the intensity of the light varies as the square of the cosine of the angle between the two polarizers.

Wireless Smart Gate

- Dual photogate beams
- Laser switch
- Photogate tape slot
- Auxiliary photogate/Time-of-Flight port



The Wireless Smart Gate has all the features of the wired Smart Gate. It has dual photogate beams spaced at 1.5 cm to accurately measure speed. The built-in laser switch (when used with any laser) allows you to time objects too large to fit through the standard photogate. Use Photogate Tape passing through the photogate slot to measure movement of objects. The auxiliary port is for adding an additional photogate head or Time-of-Flight Accessory.

NOTE: When using two Wireless Smart Gates, be aware that the synching resolution between two gates can be as much as 2 ms.

Wireless Smart Gate

PS-3225

Specifications

- Logging: Yes
- Battery: Rechargeable Lithium-Polymer
- Connectivity: Direct USB or via Bluetooth 4.0

Smart Gate

PS-2180

Includes Smart Gate Cord

The Smart Gate has dual Photogate beams spaced at 1.5 cm to accurately measure speed. Built-in laser switch (when used with any laser) allows you to time objects too large to fit through the standard Photogate. Other features include a slot for Photogate Tape, and an auxiliary port for an additional Photogate or the Time of Flight Accessory.

Recommended:

High Resolution Photogate Tape ME-6666

Smart Gate System

PS-3701

Needs only one PASPORT connection. Photogate daisy-chains to Smart Gate.

Includes Smart Gate: PS-2180
Photogate Head: ME-9498A

Smart Gate Pulley System

PS-3702

The Super Pulley attaches directly to the Smart Gate, providing a simple, low-friction system to measure position, velocity and acceleration. Additionally, with the pulley removed, the photogate can be used to perform standard photogate experiments.

Includes Smart Gate (1) PS-2180, Super Pulley (1) ME-9450A Super Pulley Rod (1) ME-8736

Projectile Launcher Wireless Smart Gate System

ME-6796

Includes wireless smart gate with mounting bracket, launcher with mounting stand, steel balls (2) with loading rod, 2-d collision accessory, aluminum table clamp, and 45 cm stainless steel rod.

Choose this wireless option to eliminate cables between the computer and the projectile launcher.

The Wireless Smart Gate has all the features of the Smart Gate (PS-2180), but it connects to your computing device via Bluetooth® or USB; it does not require an interface.

Photogate Head

ME-9498A

Required:
Digital Adapter PS-2159
To Attach to Track:
Photogate Brackets (set of 2) ME-9806

Start and stop digital timers with high precision. Get reliable data when studying linear motion, conservation of momentum, or anything requiring highly accurate time data. Requires Digital Adapter PS-2159 for use with SPARK or SPARKvue or any other PASPORT systems.

The Teaching Advantage

- Can measure times as short as 0.1 ms and resolve distances just under 1 mm
- Can be mounted in any orientation for a variety of uses
- Connects to Smart Gate

Use the Photogate with the PAScars using the specially designed picket fence "flag".

When studying motion, timing is everything. Help your students understand the root concept of velocity, and acceleration.

Time-of-Flight Accessory

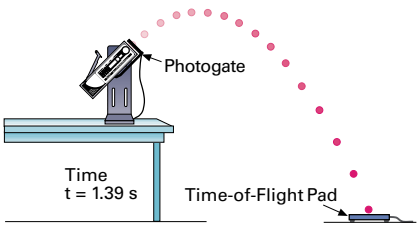
ME-6810A

Required:
Digital Adapter PS-2159
Recommended:
Phone Jack Extender Cord (6m) PI-8117

Designed primarily for freefall or projectile experiments. Measure the time a projectile or a free-falling object is in the air. Study projectile motion and the acceleration of gravity. Requires Digital Adapter (PS-2159) for use with PASPORT systems.

The Teaching Advantage

- Large surface area is easy to hit
- Automatic timing provides more reliable data leading to more accurate results
- Connects to Smart Gate



Timing begins when the photogate beam is broken and ends when the projectile hits the pad and the signal is sent to the interface.

Photogate Tape, High Resolution

ME-6666

Includes
High Resolution
Photogate Tape (30m).

Required:
Smart Gate PS-2180

Large Picket Fence

ME-9377A

An easy and highly accurate way to determine the acceleration due to gravity (g) experimentally. Conduct free-fall experiments by dropping this Picket Fence through the PASCO Photogate. As it falls, the black bars block the photogate beam. Knowing the distance between them and the time it takes them to fall through, the acceleration can be found.

Cart Picket Fences

ME-9804
(Set of 2)

Wireless Pressure Sensor

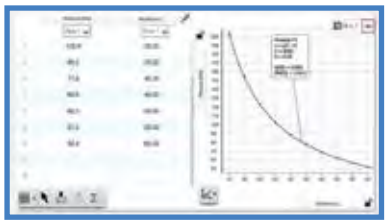
PS-3203

Includes 2 feet of polyurethane plastic tubing, 1 tube connector, 2 male barbed luer locks, 1 female barbed luer lock, 1 60cc syringe, a lithium-ion battery, and a USB connector.

With the new Wireless Pressure Sensor you can make accurate and consistent measurements of gas pressure, regardless of ambient conditions, and explore how chemical reactions affect gas pressure. In combination with a Temperature Probe, you can study the Ideal Empirical Gas Laws.

The Teaching Advantage

- Measures pressure relative to an internal sealed reference vacuum, which allows the collection of reliable data even when the pressure within the system drops below ambient pressure.
- Supports common units (kPa, atm, psi, mmHg, or N/m2) for many applications.
- Features Bluetooth® wireless connectivity and long-lasting rechargeable battery.



With the included syringe, your students can easily quantify the relationship between pressure and volume.

A test tube, piece of steel wool, and a Wireless Pressure Sensor are all you need to have your students calculate the amount of oxygen in the air.

Dual Pressure Sensor

PS-2181

Includes 60cc syringe, tubing and quick-release connectors.

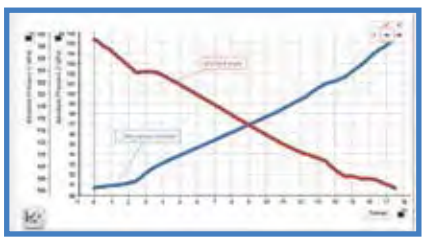
Also available:
Quad Pressure Sensor PS-2164

This sensor measures the difference in gas pressure between two inputs. Compare absolute pressures to a vacuum or ambient air pressure. Observe pressure changes in a heat engine, study air pressure on and under an airplane wing, or collect data to determine respiration rates.

The Teaching Advantage

- Relative heat-engine pressure records below zero
- Selection of units reduces the need to calculate conversions
- High-sensitivity, smooth data with little noise is easier to analyze

The Dual Pressure Sensor is perfect for use with the Diffusion/Osmosis Apparatus.



Simultaneously measure the pressure on both sides of the membrane.

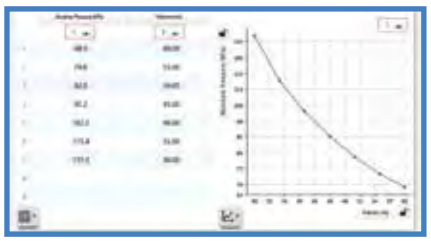
Absolute Pressure/ Temperature Sensor

PS-2146

Includes Fast Response Temperature Probe, 60cc syringe, tubing and quick-release connectors.

Get accurate temperature and absolute gas-pressure measurements when studying the gas laws. This sensor can be used to estimate absolute zero in common ˚C and ˚F scales.

Ideal for studying gas laws such as Boyle's Law.



Plot pressure versus volume to better understand their relationship.

Alpha Beta Gamma Radiation Sensor

PS-2166

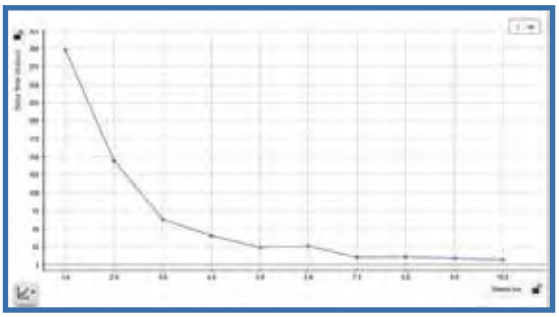
Includes Digital Adapter

Measure alpha, beta, and gamma radiation levels. Discover the relationship between radiation intensity and distance from the source. Use the Alpha Beta Gamma Radiation Sensor in conjunction with our Radiation Sources, Isotope Generator Kit and/or Absorbers.

The Teaching Advantage

- Produces clear audible beep when a count is registered
- Designed for easy mounting

Determine how activity changes with distance from a radioactive source.



Students can compare their individual data to mathematical models.

Radiation Sources*

SN-8110

Includes three sources: alpha (Po-210), beta (Sr-90), gamma (Co-60). The sources are USNRC License Exempt (US only).

***Note:** Purchased Sources are "Non-Cancellable" and "Non-Returnable".
See Radioactive Source Disclaimer below.

Isotope Generator Kit* (BA-137m)

SN-7995A

Includes generator, syringe, tube, 250 ml. solution and storage case.

Safely study properties of radioactive decay with the short-lived BA-137m isotope generated with this kit (half-life of just 2.6 min). Contains one USNRC License Exempt (US only) quantity of CS-137.

***Note:** Purchased Sources are "Non-Cancellable" and "Non-Returnable".
See Radioactive Source Disclaimer below.

PASCO Radioactive Source Disclaimer –

Before purchasing PASCO radioactive sources:
Local, national, and international regulations may restrict the purchase, storage, transport, use or disposal of radioactive sources. Please consult your local regulations to ensure your compliance before you purchase radioactive sources.

PASCO advertised sources are direct shipped to customers from Spectrum Techniques (http://spectrumtechniques.com). Please review their "Terms and Conditions" page before purchasing. Once shipped, purchased sources are "Non-Cancellable" and "Non-Returnable". Radioactive sources cannot be returned under any circumstances including "End of Life" disposal.

Other/Misc: PASCO generally advertised sources are USNRC License Exempt (US only). International exempt sources (per the International Atomic Energy Agency) are available for international customers or by request.

Absorbers (Set of 20)

SN-8111A

Includes 20 calibrated absorbers: 4 epoxy-coated lead, 2 plastic, 10 aluminum sheets, 2 polyethylene and 2 aluminum foil absorbers.

Salinity Sensor

PS-2195

The Salinity Sensor measures salinity, conductivity and temperature, and determines salinity based on electrical conductivity. Great for exploring the salinity of local water sources or measuring the change in salinity of saltwater as it evaporates.

The Teaching Advantage

- Built-in calculation to compensate for the change in conductivity due to temperature change

Compare fresh and brackish samples quickly and easily.

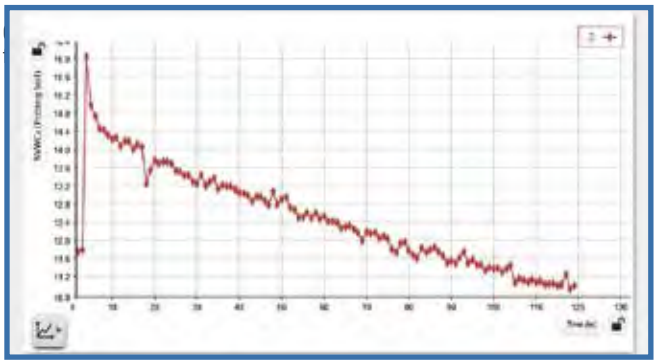
Soil Moisture Sensor

PS-2163

Just how dry is that soil sample and how does it affect your vegetation? Measure the water content of soil in percent. Measure changes in soil moisture around plants over time, study evaporation, and determine optimum moisture conditions for different species of plants.

The Teaching Advantage

- Pre-calibrated for common soil types
- Ideal for environmental science, agricultural science or biology



Soil moisture data over time shows evaporation.

Sound Level Sensor

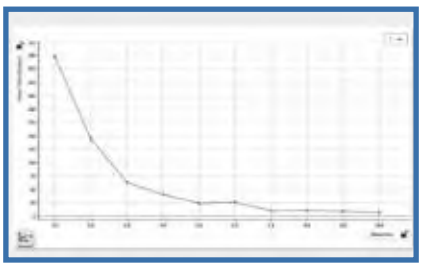
PS-2109

How loud is too loud? Study noise pollution, explore the difference between loudness and intensity, and determine how distance from a sound source affects loudness.

The Teaching Advantage

- Three ranges allow data collection from quiet whispering to the loudness of a jet aircraft
- Measures sound in dB, with the dBA scale for quieter sounds and the dBC scale for louder sounds
- Measures both level (loudness in dB) and intensity (energy over a given area in microwatts per square meter)

Use a musical instrument to distinguish between sound level and pitch.



A graph of sound level shows minimal change even though the pitch slides up and down the scale.

Award-Winning Wireless Spectrometry for iPad®, Android™ Tablets, Chromebooks* and Computers

Measure intensity, absorbance, transmittance, and fluorescence.

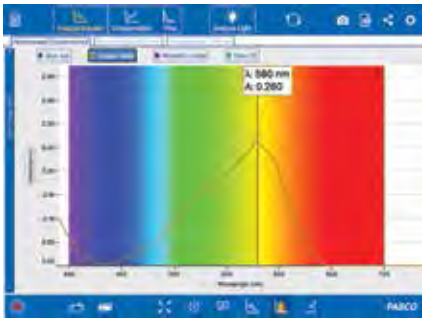
Now PASCO offers Bluetooth® spectrometry for your iPad, and Android and Chrome tablets! This new spectrometer from PASCO is specifically designed for introductory spectrometry experiments. The Bluetooth and USB connectivity enable use with your computers and tablets, making this a powerful and intuitive tool for your spectrometry needs. With this one apparatus you can measure intensity, absorbance, transmittance, and fluorescence.

You can perform these labs with the Wireless Spectrometer:

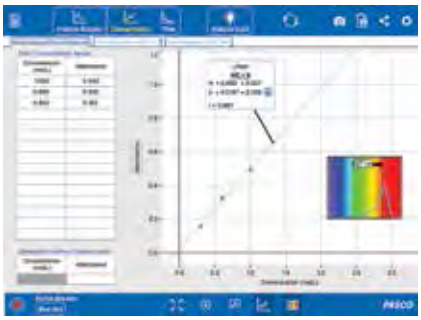
- Emission Spectra of Light
- Absorbance Spectra
- Beer's Law
- Kinetics
- Fluorescence

Wireless Spectrometer Specifications:

- Bluetooth and USB connectivity
- 2–3 nm FWHM resolution
- 380–950 nm range
- 2 fluorescence excitation wavelengths at 405 nm and 500 nm
- LED-boosted tungsten light source



Full visible spectrum analysis of solutions with a large digits display helps set the wavelength and see the absorbance.



Create Beer's Law plots to relate absorbance and concentration.

Wireless Spectrometer

PS-2600

Includes Wireless Spectrometer, 10 cuvettes, and Spectrometry software.

Also available:

Optional Fiber Optic Cable

PS-2601

The Wireless Spectrometer is compatible with **PASCO's spectrometry software.**

- PC and Mac versions included with purchase.
- FREE for iOS®, Android™ and Chrome™ tablets.
- Designed specifically for introductory spectrometry experiments.

winner! 2015 AWARDS of EXCELLENCE TECH & LEARNING

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bett AWARDS 2016 FINALIST

Spirometer

PS-2152

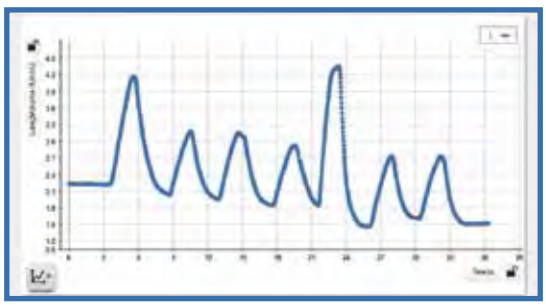
Also available:

Replacement Mouth Pieces (10)
PS-2522

Measure volume of airflow during breathing. Compare breathing patterns before and after exercise, measure lung capacity, and compare the breathing characteristics of athletes and non-athletes.

The Teaching Advantage

- Simple, easy-to-use one-piece sensor
- Disposable mouthpieces increase student safety and encourage participation.
- Designed to minimize resistance to airflow for more accurate results.



Capture breath rate and volume at the same time.

Wireless Temperature Sensor

PS-3201

Includes 1 coin cell battery.

winner! 2016 AWARDS EXCELLENCE TECH & LEARNING

Students can access instant temperature readings and continuously monitor, log, and plot temperature data in SPARKvue on nearly any connected device. When class-time ends students can set the sensor to log data autonomously for days or weeks and then download the data for analysis.

The Teaching Advantage

- Simplicity: just pair and go
- Variable sampling rate
- Logs temperature data directly onto the sensor for long-term experiments.

The versatile Wireless Temperature Sensor works well, both in the lab and out of doors.

Wireless Temperature Link

PS-3222

Includes Fast Response Temperature Probe

NEW

The Wireless Temperature Link enables wireless connection for any PASCO temperature probe with a 3.5 mm connection. The link comes with a Fast Response Temperature Probe, but it can also connect to the Stainless Steel Temperature Probe, Skin/Surface Temperature Probe, the Absolute Zero Sphere, and the Ideal Gas Law Apparatus.

Non-Contact Temperature Sensor

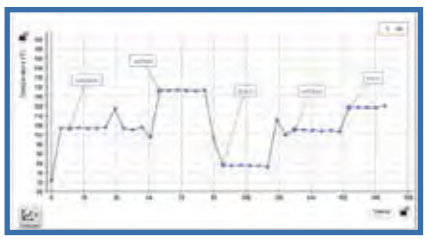
PS-2197

This sensor detects infrared light and records the temperature of objects without having to touch them. Compare different surfaces and compare the temperature results based on composition and amount of direct sunlight, even record the temperature as ice warms and melts.

The Teaching Advantage

- Quick-response time speeds data collection
- Wide temperature range and 0.5°C resolution allows a wide variety of surfaces to be studied

Students can create a temperature profile of a surface or building with the Non-Contact Temperature Sensor.



Temperature profile provides a great foundation for discussion of insulation, energy conservation, and more.

Skin/Surface Temperature Probe

PS-2131

Requires one of the following:

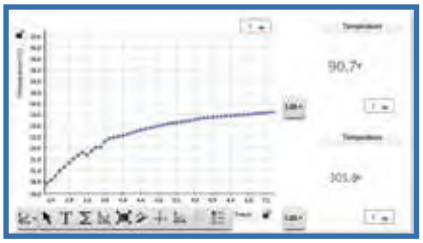
Temperature Sensor
PS-2125
Temperature/Sound Level/Light
PS-2140

Use this sensor when you need to know just how warm "warm to the touch" is. Compare skin temperature before and after exercise, map out temperature variations across the skin's surface, or perform heating and cooling experiments with solids.

The Teaching Advantage

- Wide temperature range allows a variety of surfaces and situations to be studied.
- Flat surface area assures good contact and accurate readings.

Just press the probe against a surface to get an accurate reading of the surface, not the surrounding air.



Report surface temperatures using degrees Celsius and Fahrenheit simultaneously.

Temperature/Sound Level/Light Sensor

PS-2140

Includes built-in ambient temperature, light and sound level sensors.

Recommended:

Stainless Steel Temperature Probe
PS-2153

Simultaneously measure temperature, sound levels, and light levels. Determine the light level on a sunny vs. a cloudy day, or compare sound levels of students whispering, singing, or applauding. Students can build a comprehensive data map of the physical characteristics of their surrounding environment.

The Teaching Advantage

- Use with our GPS Position Sensor to map data and correlate measurements with locations
- Add an optional Stainless Steel Temperature Probe for water studies and more

Find the sound level generated by common activities.

Measure the sound level of discrete events and even find the frequency of those events.

Stainless Steel Temperature Probe

PS-2153

Requires one of the following:

Temperature Sensor
PS-2125
Temperature/Sound Level/Light
PS-2140

Investigate melting and freezing points or measure rapid temperature changes found in endothermic or exothermic reactions. Connects to PASPORT temperature sensors, and the built-in temperature ports on the SPARK or SPARKlink.

The Teaching Advantage

- Teflon® covers to protect the probe from aggressive chemicals are available (CI-6549).
- A range of -35 to +135°C covers most classroom needs

Measure temperature in the water or in the ground.

Compare temperature at the soil surface to temperature below the surface

Fast Response Temperature Probes

PS-2135 (3-pack)

Includes 10 adhesive patches.

Requires one of the following:

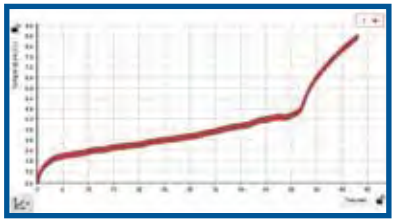
Temperature Sensor
PS-2125
Temperature/Sound Level/Light
PS-2140

Use with a Temperature Sensor to measure temperature in sensitive and fast-changing conditions, or study air convection, evaporative cooling, or endothermic and exothermic reactions. Temperature data displays immediately.

The Teaching Advantage

- Does not require calibration – plug it in and go.
- Probe has a 1-meter-long lead, allowing use with long-necked flasks and tall graduated cylinders.

The Fast Response Temperature Probe is ideal for small, hard to reach spaces – here frozen in ice.



Investigate phase change (melting point of water).

Thermocline Sensor

PS-2151

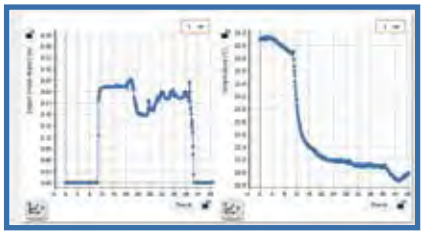
Includes Thermocline Sensor head.

Measure temperature as a function of depth in local streams and lakes while both data points are recorded automatically. Create temperature profiles for different bodies of water, compare temperature variations of freshwater vs. saltwater environments, and study ocean tides.

The Teaching Advantage

- Automatically recorded temperature and depth eliminates the need for manually marking a line, resulting in greatly increased accuracy of results
- Weighted base keeps sensor lead stable
- Works up to 10.5 m with a 0.03 m resolution

Study temperature vs. depth profiles of bodies of water – measure up to 10.5 m deep.



Show how temperature changes with depth even for small, relatively shallow bodies of water.

These sensors are still available at pasco.com

- **Temperature (PS-2125)**
- **Quad Temperature (PS-2143)**
- **Type K Temperature (PS-2134)**
- **Voltage/Current (PS-2115)**

Wireless Colorimeter and Turbidity

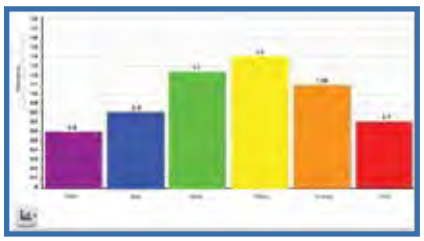
PS-3215

Includes 9 cuvettes, 1 turbidity standard calibration (100 NTU), 2 cuvette racks and USB charging cable.

The Wireless Colorimeter can measure absorbance and transmittance at six different wavelengths. Each wavelength represents a region of the ROYGBV color wheel. Measure the colors of a solution to introduce the principles of spectroscopy, relate absorbance to concentration, and study reaction rates. The colorimeter also functions as a turbidimeter for water quality analysis by measuring the scattering effect of suspended particles.

Compare turbidity of water samples from local water sources.

WARNING! This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.



The simple built-in calibration – just 15 seconds – means your data is as accurate in the classroom as in the field.

Wireless Voltage Sensor

Explore energy and energy transformations with this Wireless Voltage Sensor. Use the sensor to:

- Measure the voltage of student constructed batteries and see how chemical energy can turn into electrical energy.
- Look at renewable energy by connecting to a wind turbine
- Track the flow of energy by creating simple circuits.

Use the Voltage Sensor to see how tilt angle is related to solar cell effectiveness.

Wireless Voltage Sensor

PS-3211

ezSample™ Snap Vial Kits

Ammonia EZ-2334
Chlorine EZ-2339A
Iron EZ-2331
Nitrate EZ-2333B*
Phosphate EZ-2337

* **WARNING!** This product can expose you to chemicals including ethylene glycol, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Required:
Water Quality Colorimeter PS-2179

Chemical Water Quality Test Kits

Conduct colorimetric tests in the field and avoid the mess and tedium of mixing chemicals. These ezSample Snap Vials contain a pre-formulated reagent to test a variety of water-quality parameters. No more guessing at color variations – simply drop the vial into the Water Quality Colorimeter and read the concentration.

Snap the tip of the vial.

The sample instantly flows into tube, mixing with the reagent.

Place the vial in your Water Quality Colorimeter and read the results.

Titration in the field

PASCO also simplifies measurements that require a titration method. The ezSample Field Titrator Kits contain a vacuum-sealed quantity of titrant. The entire process requires only a minute or two, is completely portable, and avoids all the setup and cleanup associated with ordinary titrations.

Begin titrating by gently squeezing the lever to draw in your sample.

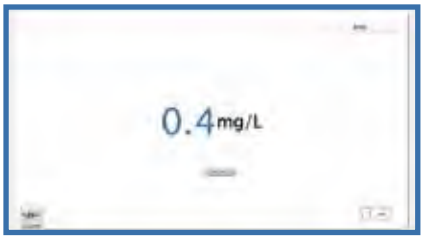
In this titration for Alkalinity, color initially changes to pink.

On final color change, turn titrator over and measure concentration using the built-in scale. That's it!

Water Quality Colorimeter

PS-2179

Designed specifically to support chemical analysis of water samples using the ezSample Snap Vial Water Quality Test Kits. Test kits include built-in calibration curves. Reports concentration value.



Iron concentration using ezSample Snap Vial and Water Quality Colorimeter

ezSample™ Field Titrator Kits

Alkalinity EZ-2340
Carbon Dioxide EZ-2341*
Total Hardness EZ-2338

* **WARNING!** This product can expose you to chemicals including phenolphthalein, which is known to the State of California to cause cancer, and methanol, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Required:
Water Quality Colorimeter PS-2179

Wireless Weather Sensor with GPS

PS-3209

Includes USB charging cable

Weather Vane Accessory

PS-3553

Includes tripod, tripod adapter, and weather vane.

The Wireless Weather Sensor is an all-in-one instrument for monitoring environmental conditions. By incorporating several sensing elements into a single unit, the sensor provides up to **19 different measurements!** Use the sensor in logging mode with the Weather Vane Accessory for long-term monitoring, or use it as a hand-held instrument to study microclimates and record ambient conditions relevant to many biological and environmental phenomena.

Specifications:

Battery: Rechargeable
Water-resistant
(Please see pasco.com for detailed specifications.)

Use the Wireless Weather Sensor with GPS to find your position and your local weather conditions.

The Wireless Weather Sensor can take 19 different measurements simultaneously.

Digital Adapter

PS-2159

Connect ScienceWorkshop "digital" sensors and other PASCO counting/timing devices (such as Photogates) to SPARK Science Learning System, SPARKlink or other PASPORT interfaces. The PASPORT Digital Adapter has two ports, connecting any two PASCO sensors or timing/counting devices with ¼" stereo phone plugs to any PASPORT interface, including SPARK Science Learning System and SPARKlink.

- Connect ScienceWorkshop Sensors: Motion Sensor II (CI-6742A), Rotary Motion Sensor (CI-6538), Flow Rate (CI-6730A), Drop Counter (CI-6499)
- Connect Timing/Counting Devices: Photogates, Photogate/Pulley System, Time-of-Flight Accessory

For a complete list of sensors that connect with the Digital Adapter, see pasco.com

Analog Adapter

PS-2158

Now connect most ScienceWorkshop sensors to our PASPORT interfaces, including the SPARK Science Learning System and SPARKlink.

The Analog Adapter works with any ScienceWorkshop Sensor with a 5-pin or 8-pin DIN connector. Please note that some ScienceWorkshop Sensors (Motion Sensor II, Rotary Motion Sensor, Flow Rate, and Drop Counter), plus our timing/counting devices such as Photogates and Time-of-Flight Accessory, require the Digital Adapter PS-2159 (shown at left).

For a complete list of sensors that connect with the Analog Adapter, see pasco.com

Sensor Extension Cable

PS-2500

2 meters in length, this cable is useful in the field, when an experiment involves liquids or chemicals, or any time you need a bit more length.

Replacement Items

Advanced Water Quality
Optical Dissolved Oxygen Sensor Cap PS-2587

Breath Rate
Replacement Masks (10 pack) PS-2567
Replacement Clips (10 pack) PS-2568

Colorimeter
Cuvettes and Caps (set of 6) PS-2509

Conductivity
Conductivity Probe, 10x PS-2571

Optical Dissolved Oxygen
Metal Guard PS-2588
Sensor Cap PS-2587

EKG
Electrode Patches (100 pack) CI-6620

Exercise Heart Rate
Transmitter and Belt PS-2512A

High Accuracy Drop Counter
Drop Dispenser PS-6935

Oxygen Gas
Oxygen Gas Probe PS-6524

pH
pH Electrode PS-2573

Photogate Tape
High Resolution Tape (30m) ME-6666

Polarimeter
Sample Cell Replacement PS-2234

Spirometer
Mouth Pieces (10 pack) PS-2522

Fast Response Temperature
Fast Response Probes (3 pack) PS-2135
Adhesive Patches (100 pack) PS-2525

Turbidity
Cuvettes and Caps (set of 6) PS-2509

Voltage
Voltage Probe PS-2165

SPARK LX & LXi

NEW

PASCO's NEXT GEN SCIENCE DATALOGGERS for indoor and outdoor use

These innovative science handhelds blend PASCO probeware with SPARKvue data collection and analysis software plus our new lab management application: Lab Manager. They are durable, splash-proof, and work seamlessly with our PASPORT and wireless sensors.

Choose from Two Models	SPARK LX PS-3601	SPARK LXi PS-3600
Ruggedized case for indoor/outdoor and wet/dry lab use	✔	✔
9.6" full-color touchscreen	✔	✔
Lab Manager application	✔	✔
Simultaneously connects up to 5 wireless sensors	✔	✔
Includes 2 PASPORT ports		✔
Includes Voltage Probe and port		✔
Includes Temp Probe and port		✔
Can connect more PASPORT sensors with the AirLink, SPARKlink Air, and 550 Universal Interface	✔	✔
Installed software		
PASCO SPARKvue, MatchGraph!, and Spectrometry	✔	✔
Microsoft Office Suite	✔	✔
Google Suite	✔	✔
Hands-free stand	✔	✔

Lab Manager software allows teachers to:

- Monitor student screens (or lock student screens to get students' attention).
- Broadcast teacher or student screens to class.
- Control student devices for guidance.
- Quiz students and view responses in real time.
- Message all student devices.
- Easily send and collect any file to and from student devices.

SPARK LX

PS-3601

Use with PASCO Wireless sensors (or for use with PASPORT sensors + an AirLink, SPARKlink® Air, or 550 Universal Interface). The SPARK LX can simultaneously connect up to five wireless sensors.

Also available:
SPARK LX Charging Station
PS-3603

SPARK LXi

PS-3600

Use with wired and wireless sensors, the SPARK LXi can simultaneously accommodate up to five wireless sensors. It also includes two ports for blue PASPORT sensors, plus two ports for the included Fast Response Temp Probe and the Voltage Probe.

Also available:
SPARK LXi Charging Station
PS-3602

Wireless CO_2 Sensor

PS-3208

Use this wireless sensor to measure the concentration of CO2 gas in a closed system or open environment. Study core topics (including photosynthesis, respiration, and carbon cycling) with this versatile probe. CO2 data can be logged directly on the device for long-term life science and environmental science studies.

Looking for more teacher resources?

Our collection of Middle School Life Science Teacher Resources is fully electronic and ready for download. It includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more. And the student version is FREE!

Middle School Life Science Teacher Resources

PS-3850

The electronic content includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more.

What Life Science topics would you like to measure?

Topic	Sensor or Kit	Pages
Biomes and Ecosystems		
Biomes	Weather with GPS	3, 7, 27
*Ecosystems**	*Weather with GPS, pH, CO_2, O_2, EcoZone*	*3, 7, 27, 19, 17, 23, 24*
Body Systems		
*Body Temperature**	*Temperature*	*4, 6, 27*
Digestion	Conductivity, Colorimeter & Turbidity	17-18
*Heart Rate**	*Heart Rate*	*5, 19, 21*
Kidney Function	Conductivity, Colorimeter & Turbidity	4, 6, 27
*Lungs**	*Pressure*	*25*
*Muscles**	*Pressure*	*25*
Reflexes	Motion	22-23
Venous Blood Flow*	Heart Rate, Blood Pressure	15, 19, 21, 16
Cell Structure and Function		
Cells and Cell Components	Digital Microscope	21
Diffusion	Colorimeter	17
*Fermentation**	*Temperature, Pressure, CO_2*	*4, 6, 17, 25, 27*
Microorganisms	Digital Microscope	21
*Photosynthesis**	*Light, Pressure, pH, CO_2, O_2, Photosynthesis Tank*	*6, 22, 24, 17, 23, 25*
Respiration	pH	24
Tissues	Digital Microscope	21
Diversity of Life		
Bacteria	Digital Microscope	21
*Effects of Acid Rain**	*pH*	*24*
Fungi	Digital Microscope	21
Plants	Digital Microscope	21
Protists	Digital Microscope	21
*Transpiration**	*Weather with GPS*	*3, 7, 27*
Human Health		
*Effects of Acid on Teeth**	*pH*	*24*
Exercise	Heart Rate, Breath Rate	15, 19, 21, 16
Interaction of Living Things		
Adaptations	Temperature	4, 6, 27
Matter & Energy in the Environment		
Abiotic Factors	Weather with GPS, Colorimeter & Turbidity	3, 7, 27, 17
Carbon Cycle	CO_2	17
Composting	Temperature, CO_2	4, 6, 17, 27
*Condensation and Evaporation**	*Weather with GPS*	*3, 7, 27*
Water Quality	pH, CO_2, O_2, Conductivity, Flow Rate, Colorimeter & Turbidity	17, 18, 20, 24

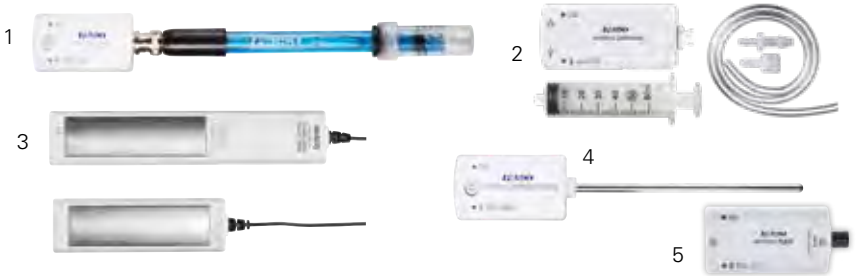
The topics with an asterisk (*), at left, are FREE labs available in the PASCO Digital Library.

For more information go to pasco.com

Wireless Life Science Starter Bundle *(Use to perform 11 of the digital labs on opposite page.)*

PS-3304A

1. Wireless pH PS-3204
2. Wireless Pressure PS-3203
3. Wireless Hand Grip Heart Rate PS-3206
4. Wireless Temperature PS-3201
5. Wireless Light PS-3213




GPS
PASCO
wireless
weather

What Earth Science topics would you like to measure?

Topic	Sensor or Kit	Page
Atmosphere		
*Atmosphere**	*Weather with GPS, CO_2, O_2*	*3, 7, 17, 27*
Convection	Temperature, Density Circulation Model	4, 6, 18, 27
Dynamic Earth		
*Seismic Waves**	*Light, Density Circulation Model*	*6, 18, 22*
Earth–Moon–Sun System		
*Night and Day**	*Light*	*6, 22*
Seasons*	Light, Temperature	4, 6, 18, 22, 27
Earth's Structure		
*Soil**	*pH, Conductivity*	*18, 24*
Human Impact on the Environment		
Water Quality	pH, CO_2, O_2, Conductivity, Flow Rate, Colorimeter & Turbidity	17, 18, 20, 24
Rocks and Minerals		
*Effects of Acid Rain**	*pH*	*24*
Water and Oceans		
*Condensation and Evaporation**	*Weather with GPS*	*3, 7, 27*
*Mapping the Ocean Floor**	*Light*	*6, 22*
Salinity	Conductivity	18
Weather and Climate		
*Climate**	*Temperature*	*4, 6, 27*
*Cloud Conditions**	*Weather with GPS*	*3, 7, 27*
Greenhouse	Temperature, EcoZone	4, 6, 19, 27
Landforms	Temperature	4, 6, 27
*Weather Conditions**	*Weather with GPS*	*3, 7, 27*

The topics with an asterisk (*), at left, are FREE labs available in the PASCO Digital Library.

For more information go to pasco.com

Wireless Earth Science Starter Bundle *(Use to perform 11 of the digital labs on opposite page.)*

PS-3305B

1. Wireless pH PS-3204
2. Wireless Motion Sensor PS-3219
3. Wireless Light PS-3213
4. Wireless Weather Sensor with GPS PS-3209
5. Wireless Temperature PS-3201

Looking for more teacher resources?

Our collection of Middle School Earth Science Teacher Resources is fully electronic and ready for download. It includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more. And the student version is FREE!

Middle School Earth Science Teacher Resources

PS-3851

The electronic content includes lab preparation information, teacher tips, assessment, an editable Word® version of student handouts, answer key, and much more.

What Physical Science topics would you like to measure?

Topic	Sensor or Kit	Page
Chemistry		
*Boyle's Law**	*Pressure*	*25*
*Reaction Rates**	*Temperature, Pressure*	*4, 6, 25, 27*
Electricity and Magnetism		
Batteries	Voltage	27
Circuits	Circuit Kit	22
Conductors and Insulators	Voltage, Circuit Kit	22, 27
Current	Voltage, Circuit Kit	22, 27
Electromagnetism	Voltage	27
Magnets	Force	20
Static Electricity	Voltage	27
*Voltage**	*Voltage, Circuit Kit*	*22, 27*
Energy		
Conservation of Energy	Motion	23
*Convection**	*Temperature, Density Circulation Model*	*6, 18, 22*
*Endothermic Reactions**	*Temperature, Pressure*	*4, 6, 25, 27*
*Evaporative Cooling**	*Temperature*	*4, 6, 27*
*Exothermic Reactions**	*Temperature, Pressure*	*4, 6, 25, 27*
*Heat Transfer**	*Temperature*	*4, 6, 27*
*Light Intensity**	*Light*	*6, 22*
*Radiation**	*Temperature*	*4, 6, 27*
*Solar Energy**	*Light, Temperature*	*4, 6, 22, 27*
*Temperature**	*Temperature*	*4, 6, 27*
*Thermal Conductivity**	*Temperature*	*4, 6, 27*
Light		
Electromagnetic Spectrum	Light	6, 22
*Light Intensity**	*Light*	*6, 22*
Light Refraction	Light	6, 22
Light Scattering	Light	6, 22
Vision	Human Eye Model	21

Topic	Sensor or Kit	Page
Matter		
Chemical Changes	Temperature, Pressure	4, 6, 25, 27
*Conservation of Matter**	*Temperature, Pressure*	*4, 6, 25, 27*
*Freezing Point Depression**	*Temperature*	*4, 6, 27*
*Phase Changes**	*Temperature*	*4, 6, 27*
Motion and Forces		
*Acceleration**	*Motion + Force or Smart Cart*	*20, 23, 26*
Air or Fluid Pressure	Pressure	25
*Buoyancy**	*Force*	*20*
Distance vs. Time	Motion or Smart Cart	23, 26
Force	Force or Smart Cart	20, 26
Gravity	Motion or Smart Cart	23, 26
*Inertia**	*Motion or Smart Cart*	*23, 26*
*Newton's First Law**	*Motion + Force or Smart Cart*	*20, 23, 26*
Newton's Second Law	*Motion + Force or Smart Cart*	*20, 23, 26*
*Newton's Third Law**	*Motion + Force or Smart Cart*	*20, 23, 26*
*Speed**	*Motion or Smart Cart*	*23, 26*
*Velocity**	*Motion or Smart Cart*	*23, 26*
Solutions, Acids, and Bases		
*Changes in pH**	*pH*	*24*
Concentration	Colorimeter	17
*Effects of Acid Rain**	*pH*	*24*
Oxidation	Temperature, pH, Light	4, 6, 17, 24, 27
Salts	pH, Conductivity, Colorimeter & Turbidity	17, 18, 24
Solubility	Colorimeter & Turbidity, Temperature, Conductivity	4, 6, 17, 18, 27
*Solutions**	*Conductivity, pH, Colorimeter & Turbidity*	*17, 18, 24*
Sound		
Echoes	Sound Level	26
Sound Energy	Sound Level	26
Sound Speed	Sound Level	26
Waves		
Frequency	Motion	23
*Harmonic Motion**	*Motion*	*23*
Wavelength	Motion	23
Waves	Motion	23
Work, Energy, and Machines		
Compound Machines	Force	20
Kinetic Energy	Motion + Force or Smart Cart	20, 23, 26
*Mechanical Advantage**	*Force*	*20*
Mechanical Energy	Motion	23
Power	Motion + Force or Smart Cart	20, 23, 26
Pulleys	Force	20
*Simple Machines**	*Force*	*20*
*Work**	*Force*	*20*

The topics with an asterisk (*), at left, are FREE labs available in the PASCO Digital Library.

For more information go to pasco.com

Wireless Physical Science Starter Bundle *(Use to perform all digital labs on opposite page.)*

PS-3306A

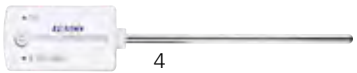
1. Wireless pH PS-3204
2. Wireless Pressure PS-3203
3. Wireless Temperature PS-3201
4. Wireless Light PS-3213
5. Wireless Voltage PS-3211
6. Wireless Force Accelerometer PS-3202
7. Wireless Motion Sensor PS-3219

Wireless Life Science Starter Bundle

Wireless Life Science Starter Bundle *(Use to perform 11 of the digital labs on opposite page.)*

PS-3304A

1. Wireless pH PS-3204
2. Wireless Pressure PS-3203
3. Wireless Hand-Grip Heart Rate PS-3206
4. Wireless Temperature PS-3201
5. Wireless Light PS-3213



Wireless Earth Science Starter Bundle

Wireless Earth Science Starter Bundle *(Use to perform 11 of the digital labs on opposite page.)*

PS-3305B

1. Wireless pH PS-3204
2. Wireless Motion Sensor PS-3219
3. Wireless Light PS-3213
4. Wireless Weather Sensor with GPS PS-3209
5. Wireless Temperature PS-3201

Wireless Physical Science Starter Bundle

Wireless Physical Science Starter Bundle *(Use to perform all digital labs on opposite page.)*

PS-3306A

1. Wireless pH PS-3204
2. Wireless Pressure PS-3203
3. Wireless Temperature PS-3201
4. Wireless Light PS-3213
5. Wireless Voltage PS-3211
6. Wireless Force Accelerometer PS-3202
7. Wireless Motion Sensor PS-3219

**For wireless connectivity, this sensor requires the AirLink (included in the bundle).*

Wireless Middle School Science Starter Bundle

Wireless Middle School Science Standard Sensor Bundle *(Use to perform all Life, Earth, and Physical Science digital labs.)*

PS-3307B

1. Wireless pH PS-3204
2. Wireless Temperature PS-3201
3. Wireless Pressure PS-3203
4. Wireless Voltage PS-3211
5. Wireless Light PS-3213
6. Wireless Force Accelerometer PS-3202
7. Wireless Hand-Grip Heart Rate PS-3206
8. Wireless Weather Sensor with GPS PS-3209
9. Wireless Motion Sensor PS-3219
10. Wireless Conductivity PS-3210

— A —

— B —

— C —

— D —

— E —

— F —

— G —

— H —

— I —

— J-K-L —

— M —

— N —

— O —

— P —

— Q-R —

— S —

– T –

– U –

– V –

– W –

Wireless Sensors

– X-Y-Z –

The PASCO Promise of Learning (90-day Satisfaction Guarantee)

We are confident that PASCO solutions will help your students achieve more in science. Within the first 90 days, if you are not satisfied that your students are more engaged and learning more effectively, return your purchase for a refund. We don't want you spending precious budget dollars on something you don't use. (We are sorry but we must exclude non-PASCO software that has been opened, radioactive products and products that contain perishables.) See instructions for Returns below.

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PASCO products are built to survive. PASCO-manufactured products are covered by a limited warranty for a period of 5 years from delivery date against defects in material and workmanship. This warranty is valid for educational institution customers and only for educational use of these products. The PASCO warranty does not extend to any product, including touch screens, which have been subject to abuse, neglect, accident, improper installation or application, or products that have been repaired or altered outside of our factory. Consumables and limited-life products (such as pH probes, membranes, fast response temperature probes, batteries, chemical solutions, printed materials, etc.) are excluded.

Other Warranty Terms

The SPARK LX and SPARK LXi dataloggers carry a limited warranty for a period of 3 years from delivery date against defects in material and workmanship. This limited warranty applies only to hardware components of the SPARK LX and SPARK LXi that are not subject to accident, misuse, neglect, fire, or other external damage. This warranty can also be voided by unauthorized use, alterations, or repair. This warranty is valid for education institution customers and only for educational use of these products.

Products manufactured by anyone other than PASCO are subject to the conditions of the warranty supplied by the manufacturer (generally 1 year). Additional warranty information on our products is available upon request.

Free Teacher and Technical Support

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Please contact the authorized PASCO representative in your country for assistance in returning equipment for repair. PASCO's International Customer Service team can be reached at +1-916-462-8383 or at custserv@pasco.com. Out-of-Warranty products must be shipped prepaid, door-to-door. Returns for credit or exchange must be in new condition and packaged in original shipping cartons or packaging sufficient to prevent damage during international transport.

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More Product Information

Designed for education. PASCO products are designed for education; they are not intended for use in graduate research or industry, and should not be used in any apparatus involved with life support, patient diagnosis, or industrial control.

PASCO reserves the right to change the specifications of any product without prior notice. If a product is no longer available, PASCO reserves the right to substitute a product of equal, or higher, value and functionality.

FCC

Where appropriate, electrical products are marked to indicate that they conform to Federal Communications Commission (FCC) standards. Most commonly, FCC Part 15, Class A.

CE MARK

Where appropriate, products carry the CE marking which indicates that they conform to the applicable European standards . This almost exclusively applies to products which are designed to meet the following applicable directives:

2004/108/EC	for electromagnetic compatibility (EMC)
2006/95/EC	for low voltage electrical equipment

Other Regulations May Apply

Local, national, and international regulations may restrict the purchase, storage, transport, use or disposal of certain products such as chemicals, radioactive sources, and specialty products and wireless transmission devices. Please consult your local regulations to ensure compliance.

Unless Otherwise Specified:

- Operating Temperature Range: 0°C – 40°C (32°F to 104°F).
- Maximum Altitude (Operational): 10,000 feet
- Recommended Storage Temperature: 10°C to 27°C (50°F to 80°F)

Quality

PASCO scientific Meets the Highest Quality Standards, and our Quality Management System is Registered to ISO 9001.

PASCO and the Environment

PASCO is committed to be in compliance with all laws and requirements in the countries in which our products are sold. PASCO is a responsible steward of the environment and as such, continually seeks to minimize the impact that our manufacturing, distribution, and consumption practices make on the planet's natural resources.

Miscellaneous

The European Union (EU) WEEE (Waste Electrical and Electronic Equipment) symbol (left) and on the product or on its packaging indicates that this product must not be disposed of in a standard waste container.

RoHS All applicable products supplied by PASCO Scientific to the EU meet the requirements as specified in the RoHS directive either by substance limits or by product exemptions.

The battery or batteries used in PASCO products are marked with the European Union symbol for waste batteries (left) to indicate the need for separate collection and recycling.

PASCO

Since 1964

The Global Leader in 21st Century Science Education

Supporting educators in over 100 countries around the globe

When you have questions or need service, we want someone who understands your local needs. We carefully select, train, and support local Science Education Partners to serve our customers in each country.

When you work with a PASCO Science Education Partner, have confidence that the entire company here in California is ready to assist our Partner – and you, our Customer.

Designed in California.
Guaranteed by PASCO.
Supported locally.
Serving science educators.

PASCO 5 YEAR EDUCATIONAL WARRANTY

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IQNet®

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

Nemko AS has issued an IQNet recognized certificate that the organization:

PASCO Scientific
10101 Foothills Blvd.
Roseville, CA 95747, USA

has implemented and maintains a
Quality Management System

for the following scope:
Design, Manufacture, Sale, and Support of Educational Scientific Apparatus, Software, and Textbooks

which fulfils the requirements of the following standard

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Issued on: 2018-06-07
Validity date: 2021-06-21

This attestation is directly linked to the IQNet Partner's original certificate and shall not be used as a stand-alone document
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* The list of IQNet partners is valid at the time of issue of this certificate. Updated information is available under www.iqnet-certification.com

Educators Trust PASCO Professional Development...

PASCO's Professional Development provides teachers with the training, guidance, and innovative solutions they need to lead sensor-based science lessons. Our trainers are curriculum experts who model how to confidently guide students through inquiry-based science lessons.

PASCO training sessions are relevant for teachers at all grade levels. Trainings include classroom-ready activities aligned to STEM-based standards and national and state correlations for:

- *Elementary and Middle School sciences*
- *High school and higher education Biology, Chemistry, Earth Science, Environmental Science, Physical Science, and Physics*
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"When educators learn, students learn more."

Hayes Mizell, in "Why Professional Development Matters." Written for Learning Forward. http://www.learningforward.org/docs/pdf/why_pd_matters_web.pdf

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Make informed decisions on what equipment best meets your needs! PASCO has fully trained Science Education Partners all around the world who are ready to work with you on equipping your lab in the most cost-effective manner. If you would like an introduction to the Science Education Partner in your country, please contact the sales director below for more information.

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PASCO Mission

Providing educators worldwide with innovative solutions for teaching science

Teacher and Technical Support

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BS in Biology from State University of New York Geneseo and an MS in Plant Biology from University of California Davis

Scott Sukrapanna

BS in Physics and an MS in Plant Biology from University of California Davis

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NEW! Dataloggers & Wireless Sensors

Wireless **Optical Dissolved Oxygen Sensor** (page 21)

The Wireless Optical Dissolved Oxygen Sensor makes it easier than ever before to measure dissolved oxygen in the field or lab.

CT-IHS