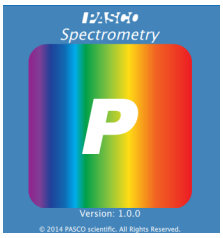
# PASCO Wireless Spectrometer

Contact: Thomas Loschiavo
loschiavo@pasco.com +1 (916) 786-3800 x8270




## Product Overview:

The PASCO Wireless Spectrometer is specifically designed for introductory spectrometry experiments commonly performed in biology, chemistry and physics courses at the secondary and post secondary level. With both Bluetooth and USB connectivity, this device is the world's first wireless spectrometer— enabling direct student use on tablets and computers.

The PASCO Wireless Spectrometer, with integrated light sources and CCD detector, can measure light intensity, absorbance, transmittance and fluorescence and supports a variety of applications. Supported experiments include analysis of emission spectra, absorbance spectra of colored solutions and plant pigments, Beer's law determination of unknown concentrations, and kinetics experiments— all integral in the teaching and learning of content in biology, chemistry and physics.

The device comes with ***free*** PASCO Spectrometry software for tablets or computers. The software features are organized into tabs that are defined by use-cases for the Spectrometer. The software is icon-driven, with all of the most common tools and tasks organized in an intuitive and engaging interface, allowing students and teachers with varying comfort with technology to easily integrate spectrometry into their lab experiments.

*First, let's pair the Spectrometer to your iPad*

- Turn on the Spectrometer. The small power button can be found on the side of the device.
- In the iPad Settings, turn on Bluetooth and you will see a list of Bluetooth devices available for pairing.
- Look for Spectrometer ID# on the bottom of the device.
- Select the device ID# from the Bluetooth list on the iPad.
- The device ID# should now appear as "Connected"
- Launch the Spectrometry app.
- Select the Spectrometer when prompted to "Select a Wireless Interface" then tap "Connect."

*Learning Experience Demonstrations*

We've included a few different demos that are commonly used in the classroom to help guide you through some of the many ways the Spectrometer can be used in teaching and learning.

## Analyzing Lights

A key curricular component of physics and chemistry classrooms involves looking at the emission spectra of light sources and relate the spectra to the development of atomic theory. Typically this can be done quantitatively with very expensive emission spectrometer or, with very crude, quantitative prisms and diffraction gratings.

By allowing student the ability to easily collect, compare and analyze light source data, the PASCO Spectrometer and the Spectrometry App bring the quantitative and qualitative experiences together in a pedagogically appropriate learning environment.

*Collecting and Analyzing Light Data*

- Select the "Analyze Light" experiment type in the top menu of the screen (this should appear as the default selection).
- Insert the square end of Fiber Optics Cable into the Spectrometer so the arrows point toward the detector (indicated by the spectrum).
- Point the Fiber Optics Cable at a Light Source (common options include incandescent bulbs, LEDs, or fluorescent bulbs— whatever is most conveniently found in the class).
- Start Data Recording by selecting the red record button in the bottom left corner.

- AUTOSET the Integration Time in the left-hand tools panel.
- When you have optimized the spectrum, Stop Data Recording.

- Analyze the Graph with the Tools on the bottom of the screen.

*Light Data – What you will see, and why it's important!*

"White" lights appear white because there is a broad spectrum covering the visible range of wavelengths, while colored LEDs have a much narrower spectrum at the wavelengths signifying that color.

Students can use the Spectrometer to look at a gas discharge tube, such as Hydrogen or Helium, and see that these spectra are a collection of very narrow peaks, with each peak representing an electron transition in the atom. Analysis of these types of spectra led to the conceptual development of atomic structure and the modern atomic theory.

## Analyzing Solutions

Chemistry and Biology classrooms will often use the absorbance of wavelengths of light to analyze the type of solute in a solution, the amount of solute, and the rate of a

reaction involving a solution. Typically this can be done quantitatively with very expensive spectrometer, or with limited wavelength colorimeters.

With the PASCO Spectrometer and the Spectrometry App, students can perform full visible spectrum analysis, determine the concentration of an unknown solution, and determine the rate of a reaction - all while move through concept development to application stages of the learning process.

*Collecting and Analyzing Solution Data*

- Select the "Analyze Solution" experiment type in the top menu of the screen.
- Insert a cuvette containing the blank (water solvent) into the PASCO Spectrometer. The smooth sides of the cuvette should be facing the white light source image and the detector image on the Spectrometer.
- Perform a Dark Calibration by tapping on the icon on the screen.

- Allow the internal light source to warm up (~1-2 minutes).
- Perform a Light Calibration by tapping on the icon on the screen.

- Create a clear-colored solution for analysis. A drop of food coloring added to a cup of water will serve a good example. Add a sample of the clear-colored solution to a cuvette.
- Insert the cuvette into the Spectrometer.
- Start Data Recording by selecting the red record button in the bottom left corner.

- Adjust the concentration of the solution if the spectrum is too low (add more food coloring) or too high (add more water).
- When you have optimized the spectrum, Stop Data Recording.

- Analyze the Graph with the Tools on the bottom of the screen.

*Solution Data – What you will see and why it's important!*

Colored solutions will absorb light that is complementary to the color that they appear. For example, a blue food coloring solution will absorb mostly red/orange wavelengths of light, and transmit blue light – this is why it appears blue. Conversely, a red food

coloring solution will absorb most blue/green wavelengths of light, and transmit red light.

The absorbance of light depends on the amount of solute in the solution. This is known as the Beer-Lambert law. Application of this law is instrumental for students as they determine the amount of a solute in a solution of unknown concentration and, and as they determine the amount of solute in a solution as a reaction occurs.

### Additional Experiments

After the full spectrum scan of a solution is performed, and a wavelength is selected, the solution can be analyzed in terms of concentration and kinetics using the "Concentration" and "Time" experiment types in the top menu.

In addition to Absorbance and Transmittance, Solutions can also be terms of "Fluorescence".

### Resources

Go to http://pasco.com/spectrometer for device specifications, documentation, and user resources including a Quick Start Video.

Go to http://pasco.com/blogs/chemistry/introduce-atomic-theory-with-light.cfm for a blog entry about using the PASCO Spectrometer to introduce Atomic Theory.