



# Education

The Ocean Optics Education Division provides cost-effective, easy-to-use spectrometers, software and accessories for your teaching lab. We also provide curricula, workshops and multimedia learning to help you bring excitement to the classroom. Our educational offerings take your students beyond traditional technology and into the possibilities of the future.

When you invest in Ocean Optics for your teaching lab or educational application, you tap into the collective power of over 150,000 spectrometers' worth of application know-how.



## Tip

As a long-time supporter of science and spectroscopy in the classroom, Ocean Optics offers funding resources to public and private teaching institutions. Grant funds are available for promoting the use of spectroscopy measurement tools in science and engineering curricula. Hundreds of institutions have benefitted from our support.

# Chem4 Spectrometers

## Smart Systems for Education

The CHEM4 Series Spectrometers from Ocean Optics are small, PC-based systems that are ideal for science and chemistry educators in the classroom or the teaching laboratory. These fully integrated systems include spectrometer, light source and cuvette holder and are available at dramatic discounts for qualified educators and learning institutions.

For bringing the excitement of learning to your classroom or teaching lab, nothing is easier.

### USB for Easy Startup

The spectrometers feature a USB interface and are fully calibrated. Just plug and play.

### Programmable Microcontroller

CHEM4 Series Spectrometers feature an onboard microcontroller that delivers incredible flexibility and control with your system and accessories. Through a 22-pin connector, you can implement operating parameters in your software, control light sources, create processes and retrieve information on external objects.

### Light Source and Sample Holders

CHEM4 Fiber Systems come complete with a spectrometer, an integrated sampling system and an optical fiber.

### CHEM4-UV-FIBER

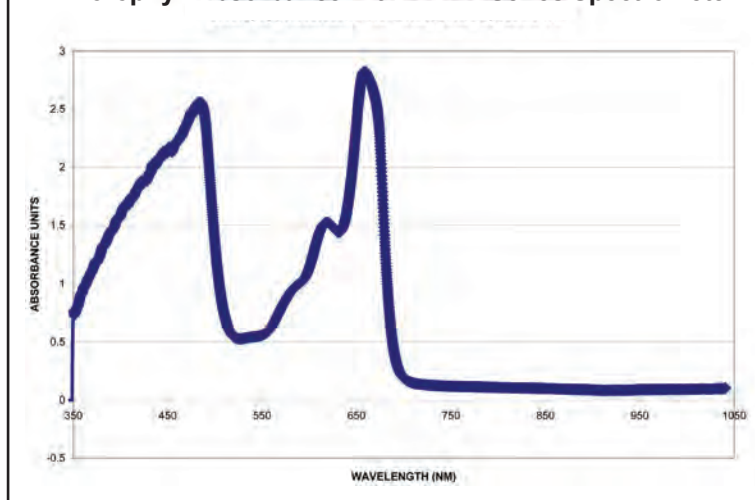
The CHEM4-UV-FIBER is ideal for absorbance measurements and combines a USB4000 Spectrometer with modular accessories including an ISS-UV-VIS Integrated Sampling System, a 300  $\mu\text{m}$  solarization-resistant optical fiber and a 1-cm cuvette holder.

Item Code: CHEM-4-UV-FIBER



Spectrometer	USB4000
Wavelength range:	200-885 nm
Light source and sample holder:	ISS-UV-VIS integrated deuterium tungsten halogen light source and cuvette holder for 1-cm square cuvettes
Optical fiber:	Light source/sample holder connects to spectrometer via 300 $\mu\text{m}$ solarization-resistant fiber
Software:	SpectraSuite (available for an additional charge)

### Chlorophyll Absorbance with CHEM Series Spectrometer



### CHEM4-VIS-FIBER

Our CHEM4-VIS-FIBER is perfect for relative irradiance and emission measurements. The CHEM4-VIS-FIBER combines our USB4000 Spectrometer with an ISS-2 Integrated Sampling System, a 400  $\mu\text{m}$  optical fiber and a 1-cm cuvette holder. Add accessories like reflectance probes or dip probes for even more measurement options.

Item Code: CHEM4-VIS-FIBER



Spectrometer	USB4000
Wavelength range:	430-990 nm
Light source and sample holder:	ISS-2 integrated tungsten halogen light source and cuvette holder for 1-cm square cuvettes
Optical fiber:	Light source/sample holder connects to spectrometer via 400 $\mu\text{m}$ fiber
Software:	SpectraSuite (available for an additional charge)

# ChemUSB Spectrometer

Smart Systems for Education

Our CHEMUSB4 Spectrometer Systems are the ideal combination of our USB-interface spectrometer technology and modular accessories. This system is made up of our popular USB4000 spectrometer, a deuterium tungsten halogen or tungsten halogen and LED light source and 1-cm cuvette holder.

With its high-speed electronics and small footprint, the CHEMUSB4 makes a perfect teaching tool in the classroom or lab.

The CHEMUSB4-UV-VIS covers the 210-880 nm range at 1.0 nm (FWHM) optical resolution and the CHEM4-VIS-NIR covers 370-985 nm at 1.0 nm resolution.

- Fully integrated, preconfigured system
- Small footprint
- Fast, hassle-free spectrometer-to-PC connection

Item Codes: CHEMUSB4-UV-VIS, CHEMUSB4-VIS-NIR



## CHEMUSB4-UV-VIS

Physical	
Spectrometer dimensions:	89.1 mm x 63.3 mm x 34.4 mm
Spectrometer weight:	190 g
Light source dimensions:	89.1 mm x 77.79 mm x 34.4 mm
Light source weight:	200 g
Detector Specifications	
Detector:	Toshiba TCD1304AP Linear CCD array
Pixels:	3648 pixels
Pixel size:	8 $\mu\text{m}$ x 200 $\mu\text{m}$
Pixel well depth:	100,000 electrons
Sensitivity:	130 photons/count at 400 nm; 60 photons/count at 600 nm
Optical Bench	
Design:	f/4, Asymmetrical crossed Czerny-Turner
Focal length:	42 mm input; 68 mm output
Entrance aperture:	25 $\mu\text{m}$ wide slit
Spectroscopic	
Wavelength range:	210-880 nm
Optical resolution:	1.0 nm FWHM
Signal-to-noise ratio:	300:1 (at full signal)
A/D resolution:	16 bit
Dark noise:	50 RMS counts
Integration time:	3.8 ms to 10 seconds
Dynamic range:	$2 \times 10^8$ (system), 1300:1 for a single acquisition
Stray light:	<0.05% at 600 nm; 0.10% at 435 nm
Light Source/Sample Holder	
Light source:	Deuterium tungsten
Bulb life (hours):	800 deuterium; 2,000 tungsten

## CHEMUSB4-VIS-NIR

Physical	
Spectrometer dimensions:	89.1 mm x 63.3 mm x 34.4 mm
Spectrometer weight:	190 g
Light source dimensions:	40.7 mm x 88.8 mm x 34.1 mm
Light source weight:	130 g
Detector Specifications	
Detector:	Toshiba TCD1304AP Linear CCD array
Pixels:	3648 pixels
Pixel size:	8 $\mu\text{m}$ x 200 $\mu\text{m}$
Pixel well depth:	100,000 electrons
Sensitivity:	130 photons/count at 400 nm; 60 photons/count at 600 nm
Optical Bench	
Design:	f/4, Asymmetrical crossed Czerny-Turner
Focal length:	42 mm input; 68 mm output
Entrance aperture:	25 $\mu\text{m}$ wide slit
Spectroscopic	
Wavelength range:	370-985 nm
Optical resolution:	1.0 nm FWHM
Signal-to-noise ratio:	300:1 (at full signal)
A/D resolution:	16 bit
Dark noise:	50 RMS counts
Integration time:	3.8 ms to 10 seconds
Dynamic range:	$2 \times 10^8$ (system), 1300:1 for a single acquisition
Stray light:	<0.05% at 600 nm; 0.10% at 435 nm
Light Source/Sample Holder	
Light source:	Tungsten halogen and violet LED
Bulb life (hours):	2,000 (tungsten); 45,000 (LED)

# Red Tide Spectrometers

Flexible, Low-Cost, Ideal for Education



## USB-650 Red Tide Spectrometer

**Wavelength Range: 350-1000 nm**

The USB650 Red Tide from Ocean Optics is a low-cost, small-footprint spectrometer that is perfect for teaching laboratories as well as the classroom. This preconfigured, off-the-shelf spectrometer can be used with various Ocean Optics accessories, light sources and sampling optics to create application-specific systems for absorbance, reflection and emission applications. With its small footprint, convenient USB interface and integration times as fast as 3 ms, the USB650 Red Tide is a great tool for basic lab measurements. The Red Tide is not recommended for absolute irradiance measurements.

- Compatible with PASCO's Xplorer GLX
- Compatible with Vernier's Logger Pro Software
- Works with Ocean Optics' SpectraSuite Spectroscopy Operating Software

Item Code: USB-650



## USB-650-UV-VIS Red Tide Spectrometer

**Wavelength Range: 200-880 nm**

The USB650-UV-VIS Red Tide is a fully integrated, preconfigured system that covers the 200-880 nm range at 2.0 nm optical resolution (FWHM). Equipped with a direct-attach deuterium tungsten light source and sample holder, this spectrometer delivers fast, hassle-free operation and spectrometer-to-PC performance. Its modular design allows you to complement your system with Ocean Optics fiber optic sampling accessories, reflection probes and transmission dip probes.

- Observe changes as small as 0.1 absorbance units
- Direct-attach deuterium tungsten light source and sample holder
- Plug and Play operation

Item Code: USB-650-UV-VIS



## USB-650-VIS-NIR Red Tide Spectrometer

**Wavelength Range: 350-1000 nm**

The USB650-VIS-NIR Red Tide includes a high-tech, built-in light source, a holder for a 1-cm cuvette and high-speed electronics. This small-footprint system provides real-time, PC-based spectroscopy and captures full spectra from 350-1000 nm in milliseconds. Its USB-ISS-VIS is a combination sample holder and violet LED-boosted tungsten light source that is perfect for measuring relative absorbance and provides over 45,000 hours of use.

- Fully integrated system covering 350-1000 nm at 2.0 nm (FWHM) optical resolution
- Violet LED light source and sample holder
- Interfaces to PC via USB

Item Code: USB-650-VIS-NIR

# Educational Accessories

## Round Out Your Lab Right

### Transmission Dip Probes

Our Transmission Dip Probes are perfect for absorbance and transmission measurements and are especially useful for embedding into process streams for in situ, real-time monitoring. More on page 141.



Item Code	Description
T300-RT-UV-VIS	Transmission Dip Probe with 300 $\mu\text{m}$ diameter UV/SR optical fiber (200-1100 nm) in 6.35 mm diameter ferrule
T300-RT-VIS-NIR	Transmission Dip Probe with 300 $\mu\text{m}$ diameter VIS-NIR optical fiber (400-2500 nm) in 6.35 mm diameter ferrule
T200-RT-VIS-NIR	Transmission Dip Probe with 200 $\mu\text{m}$ diameter VIS-NIR optical fiber (400-2500 nm) in 6.35 mm diameter ferrule
RT-2MM	2 mm pathlength tip for T200-RT and T300-RT Transmission Probes
RT-5MM	5 mm pathlength tip for T200-RT and T300-RT Transmission Probes
RT-10MM	10 mm pathlength tip for T200-RT and T300-RT Transmission Probes

### Disposable Cuvettes

Our plastic CVD-UV cuvettes are for 220-900 nm applications while our CVD-VIS cuvettes handle 350-900 applications. Both types have a 1-cm pathlength and are perfect for use with Ocean Optics educational spectrometers and, since they are disposable, no cleaning is required.

Item Code: CVD-UV15  
CVD-VIS15



### SpectraSuite Site Licensing

Educators can take advantage of bundled pricing on our SpectraSuite Spectroscopy Operating Software with site licensing packages. Plus, our annual upgrade license ensures your students always have the latest version of SpectraSuite.

Item Code: SPECTRASUITE-E  
Software Site License (1-40 Seats)  
SPECTRASUITE-E-U  
Annual Upgrade License (1-40 Seats)



# SpectraSuite

### Beer's Law

Beer's law says that absorbance of a molecule or solution is:  $A_{\lambda} = bc/\epsilon_{\lambda}$

where  $A_{\lambda}$  is the absorbance,  $\epsilon$  is the absorptivity (mole per cm),  $b$  is the pathlength (in centimeters) and  $c$  is the concentration (molar). Absorbance is linearly proportional to the thickness of the sample, the concentration of the absorbing medium and the absorptivity, which is a measure of a given molecule's ability to absorb light.



# EduPack Kits for Teaching

Complete Kits for Your Classroom or Lab

Our EduPacks give you a convenient tool for bringing the excitement of spectroscopy to your science classroom. Each one contains the perfect combination of equipment and curricula to help you deliver a more interesting and memorable learning experience for your pupils.



## EDU-CHEMPACK

Developed for Chemistry Labs

- USB650-VIS-NIR Red Tide Spectrometer
  - SpectraSuite Spectroscopy Operating Software
  - Applications in Spectroscopy Curricula on CD or Booklet
- Item Code: EDU-CHEMPACK

## EDU-PHYSPACK

Developed for Physics Labs

- USB650 Red Tide Spectrometer
  - P400-2-VIS-NIR Fiber
  - SpectraSuite Spectroscopy Operating Software
  - Applications in Spectroscopy Curricula on CD or Booklet
- Item Code: EDU-PHYSPACK

## EDU-CHEMPACK-UV

Developed for Chemistry Labs

- USB650-UV-VIS Red Tide Spectrometer
  - SpectraSuite Spectroscopy Operating Software
  - Applications in Spectroscopy Curricula on CD or Booklet
- Item Code: EDU-CHEMPACK-UV

## EDU-PCPACK

Developed for Chemistry and Physics Labs

- USB650-VIS-NIR Red Tide Spectrometer
  - Optical Fiber
  - SpectraSuite Spectroscopy Operating Software
  - Applications in Spectroscopy Curricula on CD or Booklet
- Item Code: EDU-PCPACK



## Spectroscopy 101 Educator Training

Our Spectroscopy 101 Seminars are full-day training for science educators that help you bring excitement back into the classroom. Get engaging, new approaches to teaching Beer's Law, kinetics and absorbance and transmission measurements. Find out more by contacting our Education Division at [education@oceanoptics.com](mailto:education@oceanoptics.com).

# Curricula

Flexible, Low-Cost, Ideal for Education

Bringing the excitement of spectroscopy to your classroom or teaching lab has never been easier. With curricula from the Education Division of Ocean Optics, you have the ideal tools for teaching and lesson-building.

## An Introduction to the Spectroscopy Lab

EDU-SPEC-BOOK	Printed version of <i>An Introduction to the Spectroscopy Lab</i>
EDU-SPEC-BOOK-S	Printed version of <i>An Introduction to the Spectroscopy Lab</i> when purchased with a spectrometer
EDU-SPEC-CD	CD version of <i>An Introduction to the Spectroscopy Lab</i> (PDF file format) and includes how-to video for making basic measurements
EDU-SPEC-CD-S	CD version of <i>An Introduction to the Spectroscopy Lab</i> (PDF file format) and includes how-to video for making basic measurements; when purchased with a spectrometer
EDU-SPEC-D	Online version of <i>An Introduction to the Spectroscopy Lab</i> in PDF file format.

## Applications in Spectroscopy

EDU-SPEC-B-APP	Printed version of Applications in Spectroscopy
EDU-SPEC-B-S-AP	Printed version of Applications in Spectroscopy when purchased with a spectrometer
EDU-SPEC-CD-AP	CD version of Applications in Spectroscopy (PDF file format) and includes how-to video for making basic measurements
EDU-SPEC-CD-S-AP	CD version of Applications in Spectroscopy (PDF file format); when purchased with a spectrometer
EDU-SPEC-D-APP	Online version of Applications in Spectroscopy (PDF file format)

## Spectroscopy 101 Workshop Manual - Biology and Life Sciences

EDU-SPEC-B-BIO	Printed version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i>
EDU-SPEC-B-S-BI	Printed version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i> when purchased with a spectrometer
EDU-SPEC-CD-B	CD version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i> (PDF file format) and includes how-to video
EDU-SPEC-CD-S-B	CD version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i> (PDF file format); when purchased with a spectrometer
EDU-SPEC-D-BIO	Online version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i>

## Spectroscopy 101 Workshop Manual - SpectraSuite/Vernier Version

EDU-SPEC-B-V	Printed version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i>
EDU-SPEC-B-S-V	Printed version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i> when purchased with a spectrometer
EDU-SPEC-CD-V	CD version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i> (PDF file format) and includes how-to video
EDU-SPEC-CD-S-V	CD version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i> (PDF file format); when purchased with a spectrometer
EDU-SPEC-D-V	Online version of <i>Spectroscopy 101 Workshop Manual Using Ocean Optics Spectrometers</i>

