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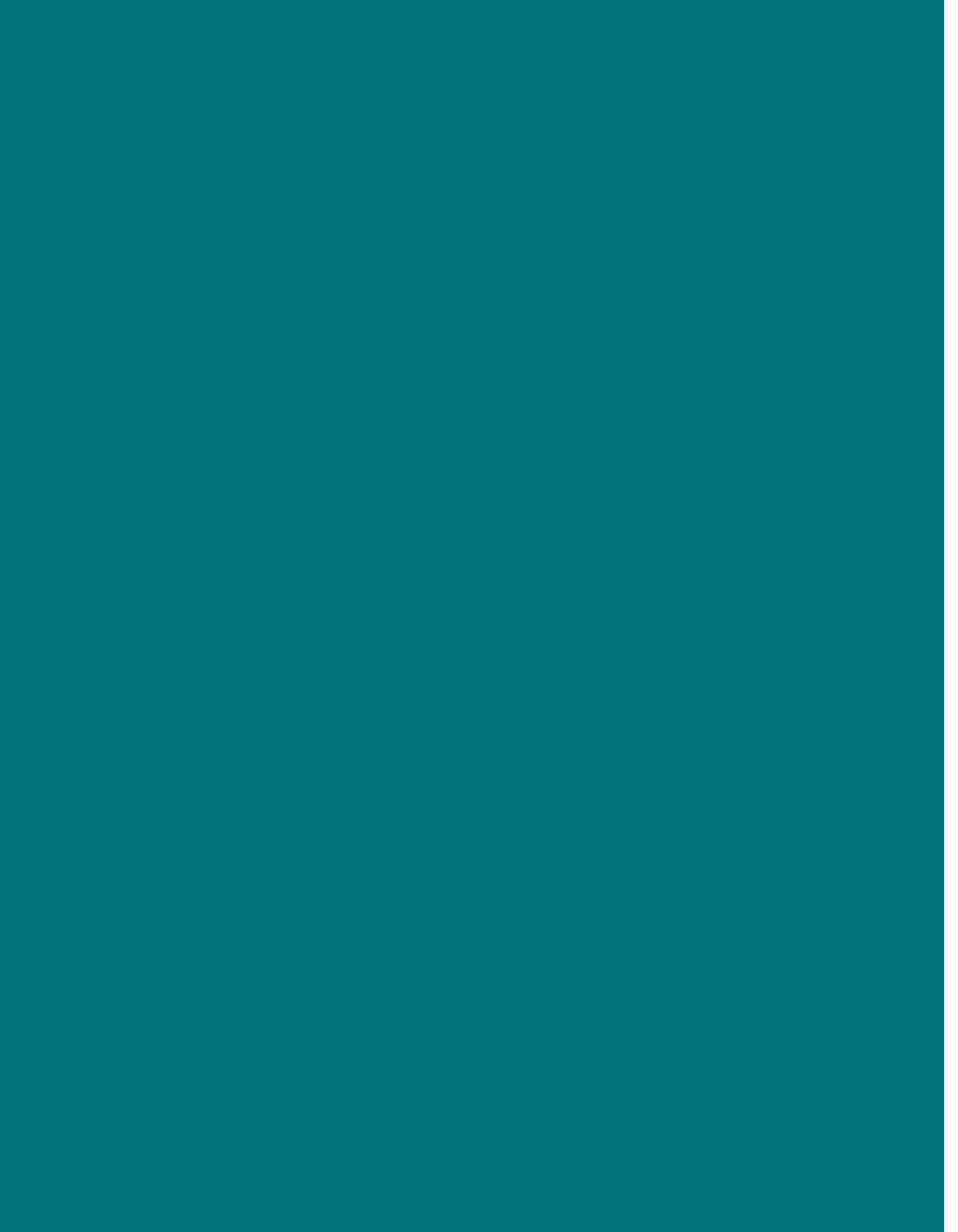


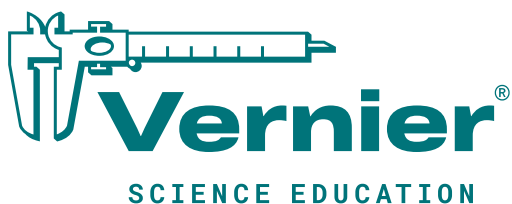
Lab Book Directory

2025

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If you would like a PDF of this book,
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Lab Book Directory

2025

Lab Books by Subject

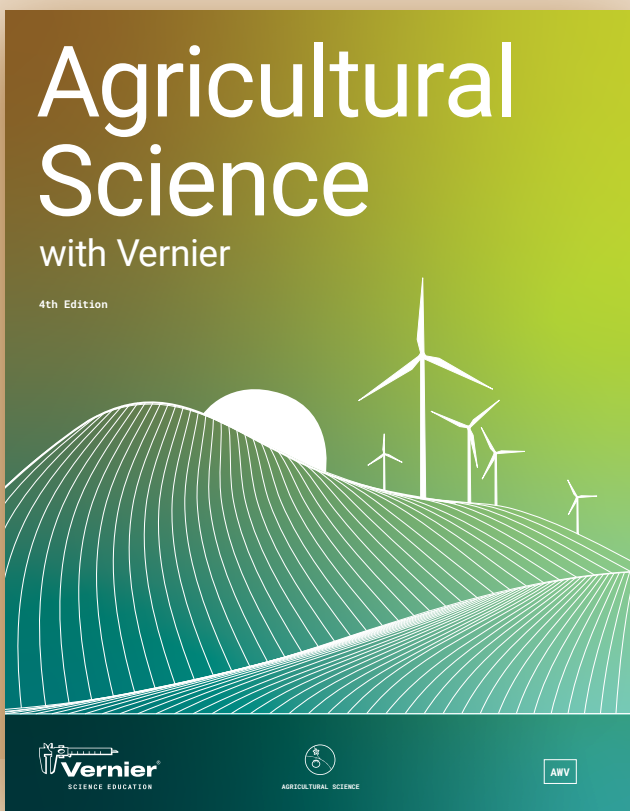
	Agricultural Science	4–5
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Scan QR code to view all lab books
at vernier.com/lab-books



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Agricultural Science with Vernier



This lab book contains experiments specifically chosen for teaching topics in agricultural science at the high school or college level. This lab book provides instructions for data collection with Vernier Graphical Analysis, LabQuest App, and EasyData.

Order Code

AWV

Education Level

**High School
College**

Written for

Vernier Graphical Analysis®

Also supports LabQuest® App and EasyData



To learn more, scan the QR code or visit
[vernier.com/awv](https://www.vernier.com/awv)

Experiment List and Sensors Used

		Sensors										
		Temperature	Flat pH	Conductivity	Gas Pressure	CO ₂ Gas	O ₂ Gas	Light Sensor	Soil Moisture	Dissolved Oxygen	Current	Voltage
1	Introduction to Data Collection	1										
2	Acids and Bases		1									
3	Diffusion through Membranes			1								
4	Conducting Solutions			1								
5	Osmosis				1							
6	Respiration of Sugars by Yeast					1						
7	Reflection and Absorption of Light	1						1				
8	Soil pH		1									
9	Soil Salinity			1								
10	Soil Temperature	3										
11	Soil Moisture								1			
12A	Photosynthesis and Respiration					1						
12B	Photosynthesis and Respiration						1					
12C	Photosynthesis and Respiration					1	1					
13	Transpiration				1							
14A	Cell Respiration					1						
14B	Cell Respiration						1					
14C	Cell Respiration					1	1					
15	The Greenhouse Effect	2										
16	Energy in Food	1										
17A	Enzyme Action: Testing Catalase Activity						1					
17B	Enzyme Action: Testing Catalase Activity				1							
18A	Lactase Action					1						
18B	Lactase Action				1							
19	Oxygen Gas and Respiration						1					
20	Biochemical Oxygen Demand									1		
21	Effects of Insulation on Animal Temperature	2										
22	Lemon Juice											1
23	Ohm's Law										1	1
24	Energy Content of Fuels	1										
25	Photovoltaic Cells							1			1	1
26	Wind Power										1	1
27	Watershed Testing	1	1	1						1		
28	Interdependence of Plants and Animals		1							1		
29	Biodiversity and Ecosystems	1										

Biology with Vernier



Biology with Vernier is the foundational biology book for high school and college courses.

Order Code

BWV

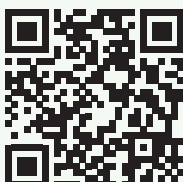
Education Level

**High School
College**

Written for

**Vernier Graphical Analysis®
Vernier Spectral Analysis®**

Also supports LabQuest® App and EasyData



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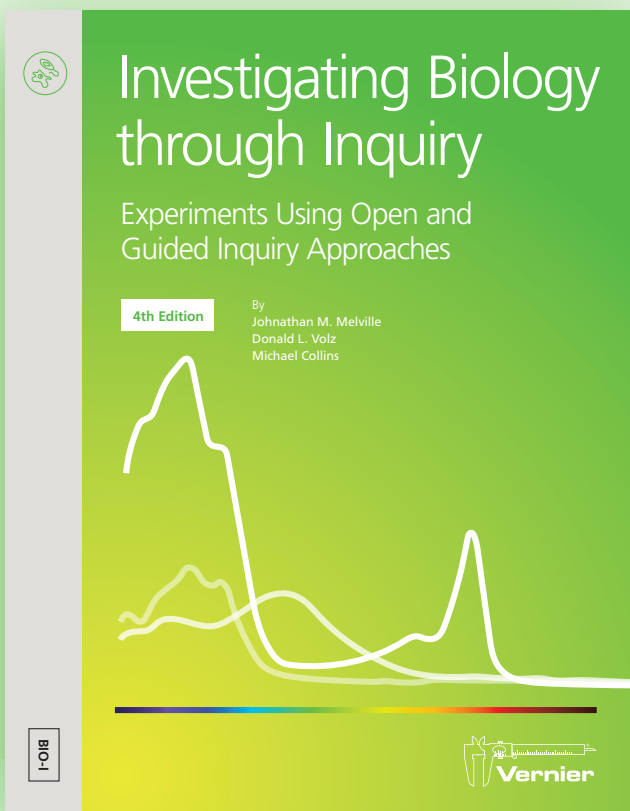
Experiment List and Sensors Used

		Sensors										
		Temperature	Conductivity	pH	Oxygen Gas	Gas Pressure	Colorimeter or Spectrometer	Carbon Dioxide Gas	Dissolved Oxygen or Optical DO	Respiration Belt	Heart Rate	EKG
1	Energy in Food	1										
2	Limitations on Cell Size: Surface Area to Volume		1									
3	Acids and Bases			1								
4	Diffusion Through Membranes		1									
5	Conducting Solutions		1									
6	Enzyme Action (O ₂)				1							
	Enzyme Action (Gas Pressure)*					1						
7	Photosynthesis						1					
8	The Effect of Alcohol on Biological Membranes						1					
9	Biological Membranes						1					
10	Transpiration					1						
11	Cell Respiration (CO ₂)							1				
	Cell Respiration (O ₂)*				1							
	Cell Respiration (CO ₂ and O ₂)*				1			1				
	Cell Respiration (Gas Pressure)*					2						
12A	Respiration of Sugars by Yeast							1				
12B	Sugar Fermentation					1						
13	Population Dynamics						1					
14	Interdependence of Plants and Animals			1					1			
15	Biodiversity and Ecosystems	1										
16A	Effect of Temperature on Respiration							1				
16B	Effect of Temperature on Fermentation					1						
17	Aerobic Respiration	1							1			
18	Acid Rain			1								
19	Dissolved Oxygen in Water	1**							1			
20	Watershed Testing	1	1	1					1			
21	Physical Profile of a Lake	1**	1	1					1			
22	Osmosis					1						
23	Effect of Temp on Cold-Blooded Organisms (CO ₂)							1				
	Effect of Temp on Cold-Blooded Organisms (O ₂)*				1							
24	Lactase Action (CO ₂)							1				
	Lactase Action (Gas Pressure)*					1						
25	Primary Productivity								1			
26	Control of Human Respiration					1				1		
27	Heart Rate and Physical Fitness										1	
28	Monitoring EKG											1
29	Ventilation and Heart Rate										1	
30	Oxygen Gas and Human Respiration				1							
31	Photosynthesis and Respiration (CO ₂ and O ₂)				1			1				
	Photosynthesis and Respiration (CO ₂)*							1				
	Photosynthesis and Respiration (O ₂)*				1							

* Student pages can be found in the Electronic Resources. See the Instructor Information for additional details.

** If using Go Direct® Optical DO Probes, the Temperature Probe is not required for this experiment.

Investigating Biology through Inquiry



Investigating Biology through Inquiry will help you integrate inquiry into your existing biology curriculum, whether you teach high school, AP¹ Biology, IB² Biology, or at the college level. This lab book provides many possible researchable questions for your students to investigate.

¹ AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.

² The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

Order Code

BIO-I

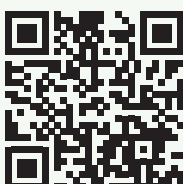
Education Level

High School
College

Written for

Vernier Graphical Analysis[®]
Vernier Spectral Analysis[®]

Also supports LabQuest[®] App



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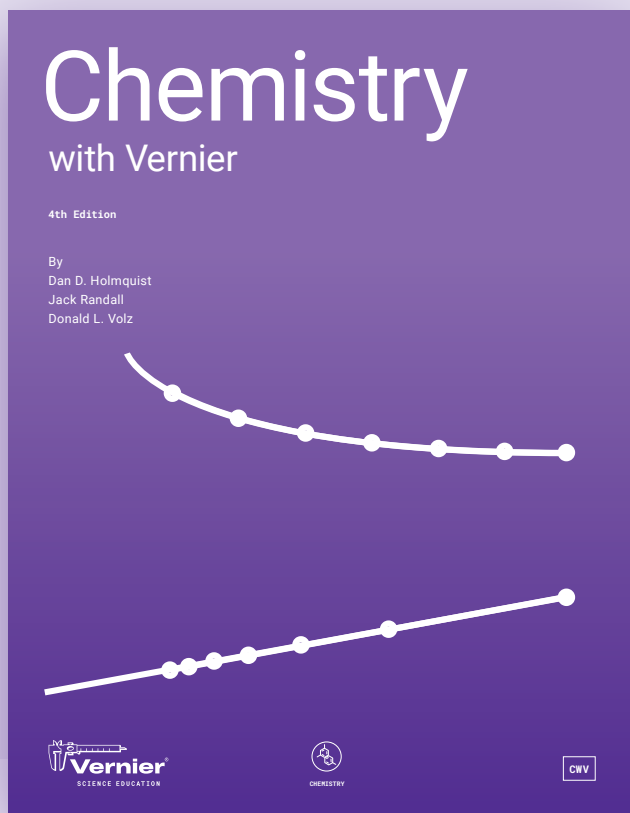
Experiment List and Sensors Used

		Sensors										Kits				
		pH	Conductivity	Gas Pressure	Spectrophotometer	Oxygen Gas	Carbon Dioxide Gas	Temperature	Heart Rate	Dissolved Oxygen	Ethanol	Got Protien? Kit*	Biofuel Enzyme Kit*	Comparative Proteomics Kit I*	Peroxidase Enzyme Activity [^]	Evolution of Yeast with a Carbon Dioxide Gas Sensor [^]
1	Investigating Buffers	X														
2	Diffusion		X													
3	Investigating Osmosis			X												
4	Chemistry of Membranes				X											
5	Investigating Protein				X							X				
6A	Testing Enzyme Activity (Oxygen Gas)					X										
6B	Testing Enzyme Activity (Gas Pressure)			X												
6C	Testing Enzyme Activity (Spectrometer)				X										X	
7	Introduction to Biofuels: Enzyme Action				X								X			
8	Analysis of Enzymes using Tyrosinase				X											
9	Cellular Respiration						X									
10A	Sugar Metabolism with Yeast (Carbon Dioxide Gas)					X	X									
10B	Sugar Metabolism with Yeast (Ethanol)										X					
11	Fermentation with Yeast			X				X								
12	Photosynthesis by Chloroplasts				X											
13	Transpiration of Plants			X												
14	Plant Pigments				X											
15	Heart Rate								X							
16	Investigating Dissolved Oxygen									X						
17	Investigating Primary Productivity									X						
18	Modeling Population Dynamics	No sensor used														
19	Water Monitoring	X	X							X						
20	Evolution of Cellobiase in Fungi				X								X			
21	Introduction to Molecular Evolution	No sensor used												X		
22	Evolution of Yeast						X									X

* Kit available from Bio-Rad Laboratories

[^] Kit available from Flinn Scientific

Chemistry with Vernier



Chemistry with Vernier is the foundational chemistry book for high school and college courses.

Order Code

CWV

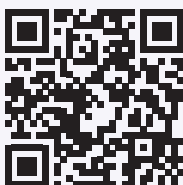
Education Level

High School
College

Written for

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Also supports LabQuest® App and EasyData

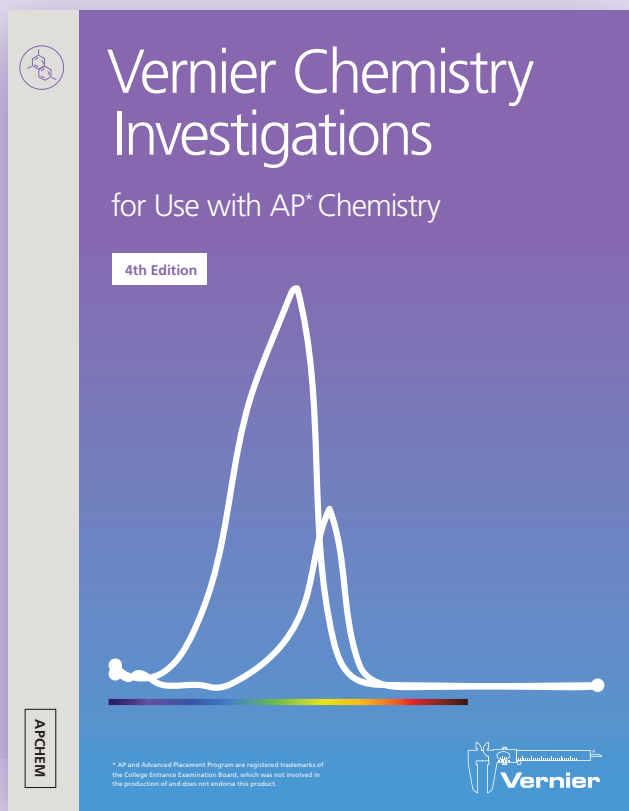


To learn more, scan the QR code or visit
vernier.com/cwv

Experiment List and Sensors Used

		Sensors					
		Temperature	Gas Pressure	pH	Voltage	Conductivity	Colorimeter or Spectrometer
1	Endothermic and Exothermic Reactions	1					
2	Freezing and Melting of Water	1					
3	Another Look at Freezing Temperature	2					
4	Heat of Fusion of Ice	1					
5	Find the Relationship: An Exercise in Graphing Analysis						
6	Boyle's Law: Pressure-Volume Relationship in Gases		1				
7	Pressure-Temperature Relationship in Gases	1	1				
8	Fractional Distillation	1					
9	Evaporation and Intermolecular Attractions	2					
10	Vapor Pressure of Liquids	1	1				
11	Determining the Concentration of a Solution: Beer's Law						1
12	Effect of Temperature on Solubility of a Salt	1					
13	Properties of Solutions: Electrolytes and Non-Electrolytes					1	
14	Conductivity of Solutions: The Effect of Concentration					1	
15	Using Freezing Point Depression to Find Molecular Weight	1					
16	Energy Content of Foods	1					
17	Energy Content of Fuels	1					
18	Additivity of Heats of Reaction: Hess's Law	1					
19	Heat of Combustion: Magnesium	1					
20	Chemical Equilibrium: Finding a Constant, K_c						1
21	Household Acids and Bases			1			
22	Acid Rain			1			
23	Titration Curves of Strong and Weak Acids and Bases			1			
24	Acid-Base Titration			1			
25	Titration of Diprotic Acid: Identifying an Unknown			1			
26	Using Conductivity to Find an Equivalence Point					1	
27	Acid Dissociation Constant, K_a			1			
28	Establishing a Table of Reduction Potentials: Micro-Voltaic Cells				1		
29	Lead Storage Batteries				1		
30	Rate Law Determination of the Crystal Violet Reaction						1
31	Timed-Release Vitamin C Tablets			1			
32	The Buffer in Lemonade			1			
33	Determining the Free Chlorine Content of Swimming Pool Water						1
34	Determining the Quantity of Iron in a Vitamin Tablet						1
35	Determining the Phosphoric Acid Content in Soft Drinks			1			
36	Microscale Acid-Base Titration			1			

Vernier Chemistry Investigations for Use with AP* Chemistry



This lab book provides AP* Chemistry students with 16 inquiry-based laboratory experiments aligned with the inquiry investigations published by the College Board. Each experiment guides students to investigate key principles of AP Chemistry using electronic sensors to collect important data.

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

Order Code

APCHEM

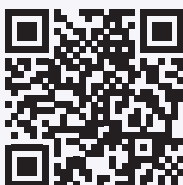
Education Level

High School

Written for

Vernier Graphical Analysis® Pro

Also supports LabQuest® App



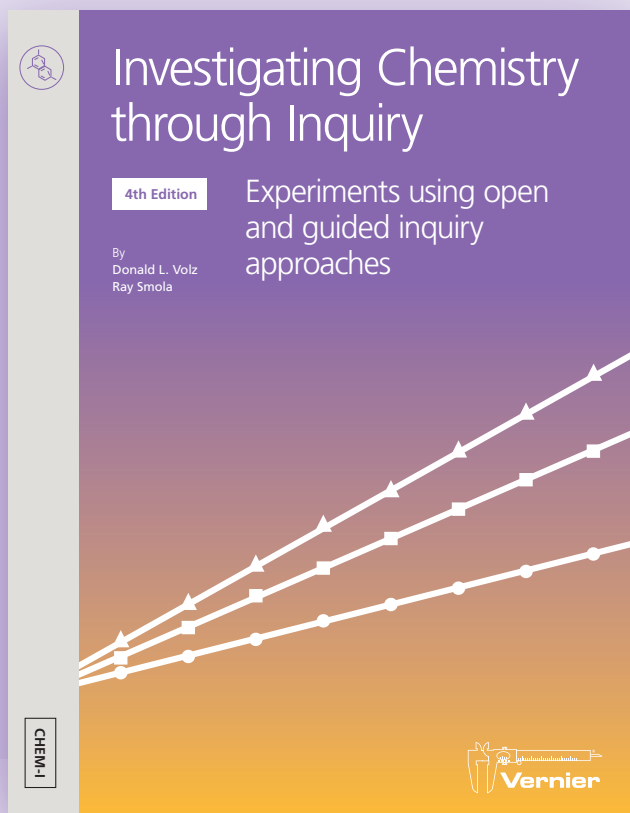
To learn more, scan the QR code or visit
[vernier.com/apchem](https://www.vernier.com/apchem)

Experiment List and Sensors Used

		Sensors							
		pH Sensor	Conductivity Probe	Drop Counter	SpectroVis Plus	Gas Pressure Sensor	ORP Sensor	Temperature Probe	Melt Station
1	Investigating Food Dyes in Sports Beverages				X				
2	Determining the Copper Content in Brass				X				
3	Investigating Water Hardness		X	O					
4	The Acidity of Juices and Soft Drinks	X		O					
5	Separating Molecules				X				
6	Investigating the Contents of an Unlabeled Container	O	X						X
7	Investigating the Purity of a Mixture		X			X			
8	Determining the Percent Hydrogen Peroxide in a Commercial Product			O			X		
9	Investigating the Components of a Commercial Tablet								X
10	The Effect of Acid Rain on Marble Structures					X			
11	Investigating the Kinetics of a Crystal Violet Reaction				X				
12	Investigating Commercial Hand Warmers							X	
13	Investigating LeChatelier's Principle				X				
14	Investigating Acid-Base Titrations	X		O					
15	The Buffering Ability of Commercial Products	X		O					
16	Testing the Effectiveness of a Buffer	X		O					

KEY X = Required
 O = Optional

Investigating Chemistry through Inquiry



This book contains 25 inquiry-based chemistry investigations covering topics such as thermochemistry, acids and bases, stoichiometry, chemical kinetics, and properties of solutions.

Order Code

CHEM-I

Education Level

**High School
College**

Guided and open with general instructions for

Vernier Graphical Analysis®

Vernier Spectral Analysis®

Also supports LabQuest® App and EasyData

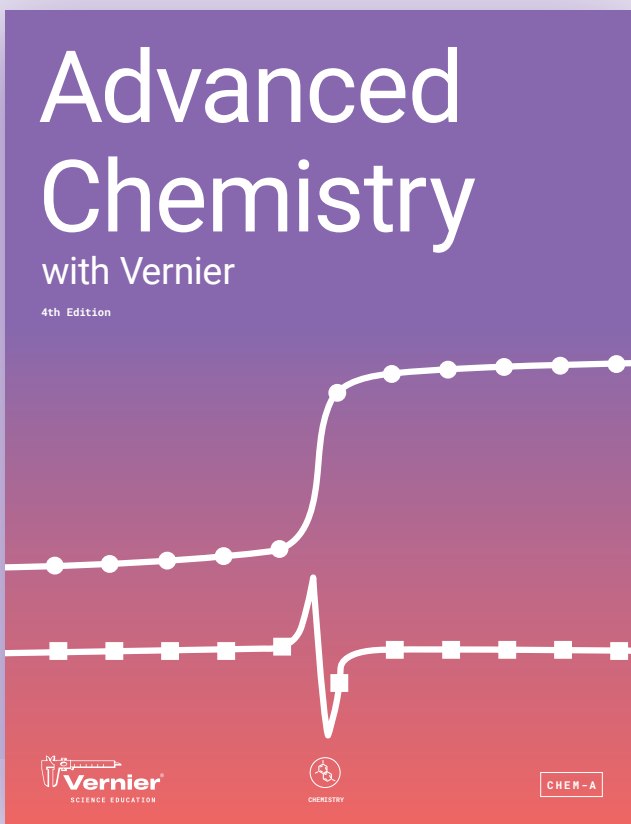


To learn more, scan the QR code or visit
vernier.com/chem-i

Experiment List and Sensors Used

		Sensors							
		Temperature	Gas Pressure	pH	Voltage	Conductivity	Colorimeter	ORP Sensor	Radiation Monitor
1	Physical Properties of Water	1							
2	Baking Soda and Vinegar Investigations	1							
3	An Investigation of Urea-Containing Cold Packs	1							
4	Conductivity of Aqueous Solutions					1			
5	Identifying a Pure Substance	1							
6	Investigating the Energy Content of Foods	1							
7	Investigating the Energy Content of Fuels	1							
8	Evaporation and Intermolecular Attractions	2							
9	Enthalpy Changes	1							
10	Reaction Stoichiometry	1							
11	Beer's Law Investigations						1		
12	Colligative Properties of Solutions	1							
13	Long Term Water Monitoring	1		1		1			
14	Vapor Pressure and Heat of Vaporization Investigations	1	1						
15	Acid-Base Properties of Household Products			1					
16	The Effect of Acid Deposition on Aqueous Systems			1		1			
17	Acid-Base Titrations			1					
18	Conductimetric Titrations					1			
19	Oxidation-Reduction Titrations							1	
20	Investigating Voltaic Cells				1				
21	Baking Soda and Vinegar Investigations Revisited	1	1	1					
22	Reaction Rates	1	1						
23	Enzyme Activity	1	1						
24	Sugar Fermentation by Yeast	1	1						
25	Nuclear Radiation								1

Advanced Chemistry with Vernier



Advanced Chemistry with Vernier contains 35 experiments appropriate for AP* Chemistry or college general chemistry. Use it in addition to *Vernier Chemistry Investigations for Use with AP* Chemistry* for a comprehensive set of topics.

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Order Code

CHEM-A

Education Level

**High School
College**

Written for

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Vernier Spectral Analysis®**

Also supports LabQuest® App and EasyData



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[vernier.com/chem-a](https://www.vernier.com/chem-a)

Experiment List and Sensors Used

		Sensors									
		Colorimeter or Spectrometer	Conductivity	Current Probe or Constant Current System	Drop Counter	Gas Pressure	ORP Sensor	pH	Radiation	Temperature	Voltage
1	The Determination of a Chemical Formula	No sensor required									
2	The Determination of the Percent Water in a Compound	No sensor required									
3	The Molar Mass of a Volatile Liquid					O				X	
4	Using Freezing-Point Depression to Find Molecular Weight									X	
5	The Molar Volume of a Gas					X				X	
6	Standardizing a Solution of Sodium Hydroxide				O			X			
7	Acid-Base Titration				O			X			
8	An Oxidation-Reduction Titration: The Reaction of Fe(II) and Ce(IV)				O		X				
9	Determining the Mole Ratios in a Chemical Reaction									X	
10	The Determination of an Equilibrium Constant	X									
11	Investigating Indicators				O			X			
12	The Decomposition of Hydrogen Peroxide					X				O	
13	Determining the Enthalpy of a Chemical Reaction									X	
14	(Parts A and B) Separation and Qualitative Analysis of Cations and Anions							O			
15	(Parts A and B) The Synthesis and Analysis of Alum									X	
16	Conductimetric Titration and Gravimetric Determination of a Precipitate		X		O						
17	Determining the Concentration of a Solution: Beer's Law	X									
18	Liquid Chromatography	No sensor required									
19	Buffers							X			
20	Electrochemistry: Voltaic Cells										X
21	Electroplating			X							
22	The Synthesis and Analysis of Aspirin*	X								X	
23	Determining the K_{sp} of Calcium Hydroxide							X			
24	Determining K_a by the Half-Titration of a Weak Acid							X			
25	The Rate and Order of a Chemical Reaction	X									
26	The Enthalpy of Neutralization of Phosphoric Acid									X	
27	Alpha, Beta, and Gamma								X		
28	Radiation Shielding								X		
29	The Base Hydrolysis of Ethyl Acetate		X							O	
30	Exploring the Properties of Gases					X				X	
31	Determining Avogadro's Number			X							
32	Potentiometric Titration of Hydrogen Peroxide				O		X				
33	Determining the Half-Life of an Isotope								X		
34	Vapor Pressure and Heat of Vaporization					X				X	
35	Rate Determination and Activation Energy	X								X	

KEY X = Required
 O = Optional

* This activity can also be performed with a Melt Station.

Food Chemistry Experiments



This book includes 14 experiments that use food as a means to explore crucial chemistry concepts.

Order Code

HSB-FOOD

Education Level

High School
College

Written for

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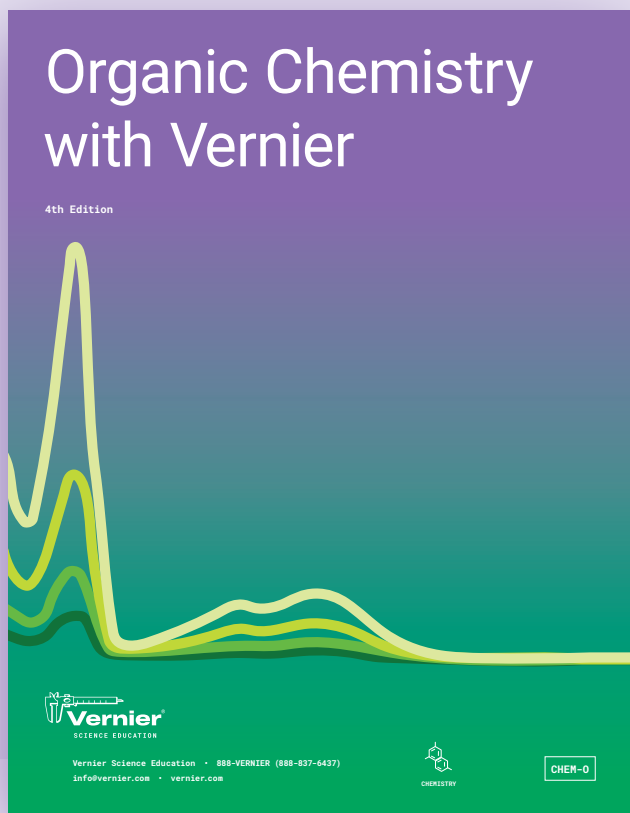


To learn more, scan the QR code or visit
[vernier.com/hsb-food](https://www.vernier.com/hsb-food)

Experiment List and Sensors Used

		Sensors								
		Temperature	Gas Pressure	pH	Conductivity	Carbon Dioxide Gas	Ethanol	Spectrometer	ORP	Chemical Polarimeter
1	Food is Fuel	X								
2	Cooking Under Pressure	X	X							
3	What's the Difference Between Baking Soda and Baking Powder?			X		X				
4	My Flat Soda Pop					X				
5	I'm Drinking Acid?!			X						
6	Electrolytes in Energy Drinks				X					
7	Fermenting Carbohydrates					X	X			
8	True Colors: Separating Food Dyes							X		
9	Quantifying Iron in Cereal							X		
10	Do Vegetables Have Carotenoids?							X		
11	Why Does Your Energy Drink Glow?							X		
12	Vitamin C in Orange Juice								X	
13	Using Polarimetry to Identify Sugar and Sweeteners in Beverages									X
14	Confectionary Chemistry: Measuring Sugar Inversion									X

Organic Chemistry with Vernier



Organic Chemistry with Vernier contains 26 experiments that represent a broad range of topics and techniques taught in most college organic chemistry lab courses. The experiments in this book build upon prior knowledge, laboratory techniques, and skills students have learned in general chemistry courses.

Order Code

CHEM-0

Education Level

College

Written for

Vernier Graphical Analysis® Pro
Vernier Instrumental Analysis®
Vernier Spectral Analysis®

Also supports LabQuest® App



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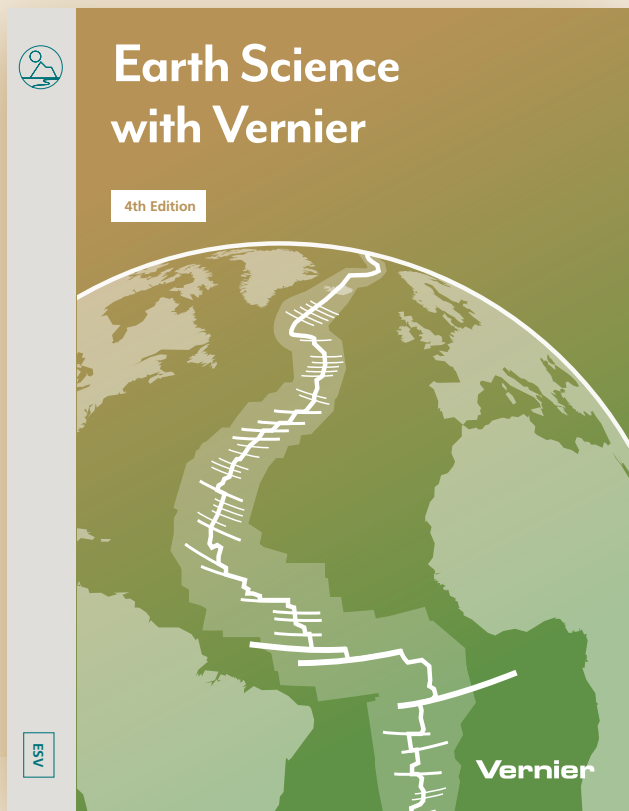
Experiment List and Sensors Used

		Sensors						
					Spectrometer (Choose One)			
		Melt Station	Mini GC	Polarimeter	SpectroVis Plus	Vernier UV-VIS Spectrophotometer	Vernier Fluorescence/UV-VIS Spectrophotometer	Wide-Range Temperature
1	Determining Melting Temperature							
2	Recrystallization	X						O
3	Determination of a Boiling Point		X*					X
4	Identifying an Unknown Analgesic by Three Methods	X				/	/	
5	Separation of Organic Compounds by Acid-Base Extraction Techniques	X						
6	Understanding Polarimetry			X				
7	Identification of Organic Unknowns Using Polarimetry			X				
8	Investigating Gas Chromatography		X					
9	Fractional Distillation of Esters		X					X
10	Understanding Intermolecular Forces Using a Gas Chromatograph: Enthalpy of Vaporization		X					
11	Investigating Thermodynamic Relationships of Substituted Hydrocarbons		X					
12	Extraction of Spinach Pigments and Analysis by Electronic Absorption Spectroscopy				/	/	/	O
13	SN1: Synthesis of tert-Butyl Chloride		X					
14	SN2: Synthesis of 1-Bromobutane		X					O
15	Observing the Reaction Kinetics of Sucrose with Polarimetry			X				
16	The Synthesis and Analysis of Aspirin	X			/	/	/	O
17	Isolation of R-(+)-Limonene from Oranges Using Steam Distillation			X				X
18	Synthesizing Ethyl Acetate by Fischer Esterification		X					O
19	Synthesis of Dibenzalacetone by Aldol Condensation	X				/	/	O
20	The Diels-Alder Reaction of Anthracene with Maleic Anhydride	X				/	/	O
21	Friedel-Crafts Acylation of Ferrocene	X				/	/	O
22	Grignard Formation of Crystal Violet				/	/	/	O
23	Synthesis of Fluorescein				/		/	O
24	Synthesis of Methyl Orange and Its Application to Textiles				/	/	/	
25	Analysis of Natural Products			X				
26	Using a Gas Chromatograph: Identifying an Unknown Compound		X					

KEY X = Required
 / = Choose One
 O = Optional

* Requires Go Direct® Mini GC

Earth Science with Vernier



Earth Science with Vernier contains 33 experiments covering topics on geology, soil analysis, water quality, hydrology, oceanography, meteorology, and energy.

Order Code

ESV

Education Level

**Middle School
High School**

Written for

Vernier Graphical Analysis®

Also supports LabQuest® App and EasyData

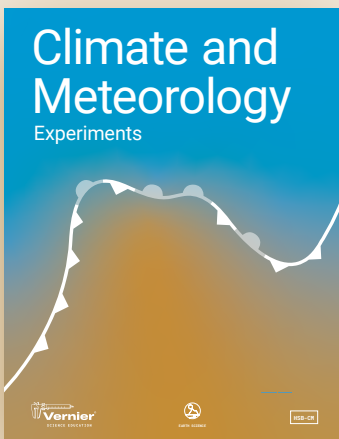


To learn more, scan the QR code or visit
[vernier.com/esv](https://www.vernier.com/esv)

Experiment List and Sensors Used

		Sensors									
		Temperature	Light	pH	Conductivity	Motion Detector	Turbidity	Magnetic Field	Energy Sensor	Relative Humidity	Barometer
1	Introduction to Data Collection	1									
2	Exploring Magnetism							1			
3	Where IS North?							1			
4	Searching for Iron Ore							1			
5	Sea Floor Spreading							1			
6	Soil pH			1							
7	Soil Salinity				1						
8	Soil and Acid Rain			1							
9	Soil Temperature	3									
10	Water Quality: Temperature	1									
11	Water Quality: pH			1							
12	Water Quality: Turbidity						1				
13	Water Quality: Total Dissolved Solids				1						
14	Water Treatment			1	1		1				
15	Salinity of Ocean Water				1						
16	Acid Rain and Its Effect on Surface Water			1							
17	Freezing of Ocean Water	1									
18	Desalinization				1						
19	Mapping the Ocean Floor					1					
20	Are All Sunglasses Created Equal?		1								
21	Comparing Sunscreens		1								
22	UV Light and Clothing		1								
23	Reflection and Absorption of Light	1	1								
24	The Greenhouse Effect	2									
25	Land and Sea Breezes	2									
26	Relative Humidity	2									
27	Dew Point	1									
28	Wind Chill	2									
29	Seasons and Angle of Insolation	1									
30	Fossil Fuels	1									
31	Solar Homes	2									
32	Photovoltaic Cells		1						1		
33	Wind Power								1		
P1	Air Temperature	2									
P2	Air Temperature and Relative Humidity	1								1	
P3	Ground Temperature	2									
P4	Barometric Pressure										1
P5	Measuring Particulates		1								
P6	Weather Stations										

Climate and Meteorology Experiments



Climate and Meteorology Experiments includes 11 experiments with interactive investigations that challenge students to use data-collection technology to explore weather, climate, and other important weather-related topics.

Order Code

HSB-CM

Education Level

Middle School

High School

Written for

Vernier Graphical Analysis®

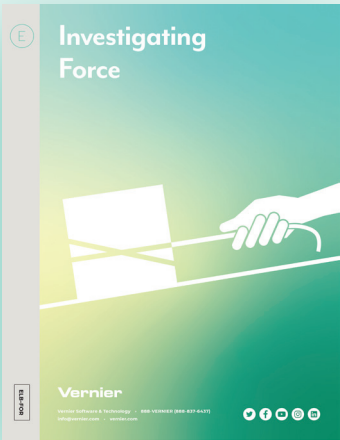
Experiment List		Sensors Used		
		Light and Color	Surface Temperature	Weather
1	Modeling Solar Insolation	1		
2	Investigating Albedo	1	1	
3	What Causes Land and Sea Breezes?		2	
4	Exploring the Greenhouse Effect		2	
5	Effect of Air Temperature on Humidity		2	1
6	What is Dew Point?		2	
7	Measuring Wind Chill		2	
8	Changes in Barometric Pressure			1
9	Formation of Clouds			1
10	Measuring Wind Direction			1*
11	Studying Microclimates: Urban Heat Islands	1	1	1

* Weather Vane also required

To learn more, scan the QR code or visit [vernier.com/hsb-cm](https://www.vernier.com/hsb-cm)

Investigating Force

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



Order Code

ELB-FOR-E

Education Level

Elementary

Written for

Vernier Graphical Analysis



Experiment List		Sensor Used
1	Learning to Use a Force Sensor	Force Sensor
2	Lift the Load!	
3	What a Drag!	
4	Oh! My Aching Back! How Ramps Make Lifting Easier	

To learn more, scan the QR code or visit [vernier.com/elb-for-e](https://www.vernier.com/elb-for-e)

Investigating Gas Pressure



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

Order Code

ELB-GP-E

Education Level

Elementary

Written for

Vernier Graphical Analysis®



Experiment List		Sensor Used
1	Learning to Use a Pressure Sensor	Gas Pressure Sensor
2	Under Pressure	
3	Get a Grip!	
4	Bubbles in Your Bread	

To learn more, scan the QR code or visit [vernier.com/elb-gp-e](https://www.vernier.com/elb-gp-e)

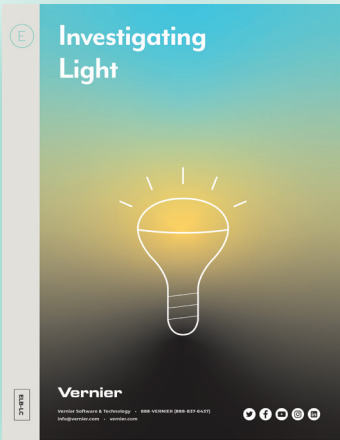
Investigating Light

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

Order Code
ELB-LC-E

Education Level
Elementary

Written for
Vernier Graphical Analysis



Experiment List		Sensor Used
1	Learning to Use a Light Sensor	Light Sensor
2	Sunshine on My Shoulders	
3	Summer and Winter	
4	Reflectivity of Light	
5	Distance From the Sun	

To learn more, scan the QR code or visit [vernier.com/elb-lc-e](https://www.vernier.com/elb-lc-e)

Investigating Magnetism



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

Order Code

ELB-3MG-E

Education Level

Elementary

Written for

Vernier Graphical Analysis®



Experiment List		Sensor Used
1	Learning to Use a Magnetic Field Sensor	Magnetic Field Sensor
2	Exploring the Poles (Without Leaving Your Classroom!)	
3	Making Magnets	
4	Electromagnets	

To learn more, scan the QR code or visit [vernier.com/elb-3mg-e](https://www.vernier.com/elb-3mg-e)

Investigating Motion

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

Order Code
ELB-MD-E

Education Level
Elementary

Written for
Vernier Graphical Analysis



Experiment List		Sensor Used
1	Learning to Use a Motion Detector	Motion Detector
2	e-Motion	
3	Spring into Action	
4	Air Ball!	
5	Driving with Energy	
6	Weigh Station—All Trucks Stop!	
7	Batty About Science	

To learn more, scan the QR code or visit [vernier.com/elb-md-e](https://www.vernier.com/elb-md-e)

Investigating Temperature

Written especially for elementary teachers, this lab book contains 10 engaging temperature experiments.

Order Code

ELB-TEMP

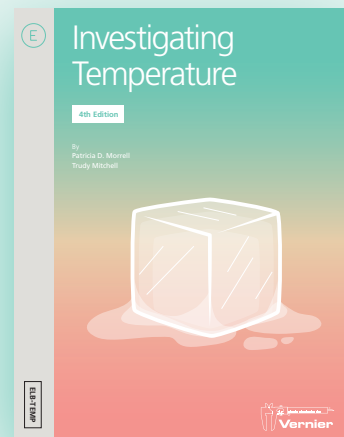
Education Level

Elementary

Written for

Vernier Graphical Analysis®

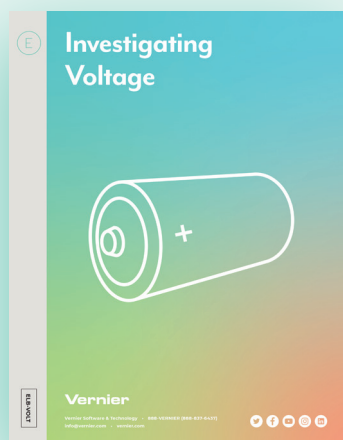
Also supports LabQuest® App



Experiment List		Sensor Used
1	Are We Cool or What?	Temperature Probe
2	Why Do We Need Thermometers?	
3	Celsius or Fahrenheit What's the Difference?	
4	Getting it Just Right! Adjusting Water Temperature	
5	The Temperature Probe Spends the Night	
6	Hold Everything! Comparing Insulators	
7	Keepin' it Cool! Design Your Own Thermos	
8	I'm Melting! Water Changes States	
9	Solid, Liquid, Gas: Water Can Do It All	
10	Cool Reaction! The Reaction of Baking Soda and Vinegar	

To learn more, scan the QR code or visit vernier.com/elb-temp

Investigating Voltage



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

Order Code

ELB-VOLT-E

Education Level

Elementary

Written for

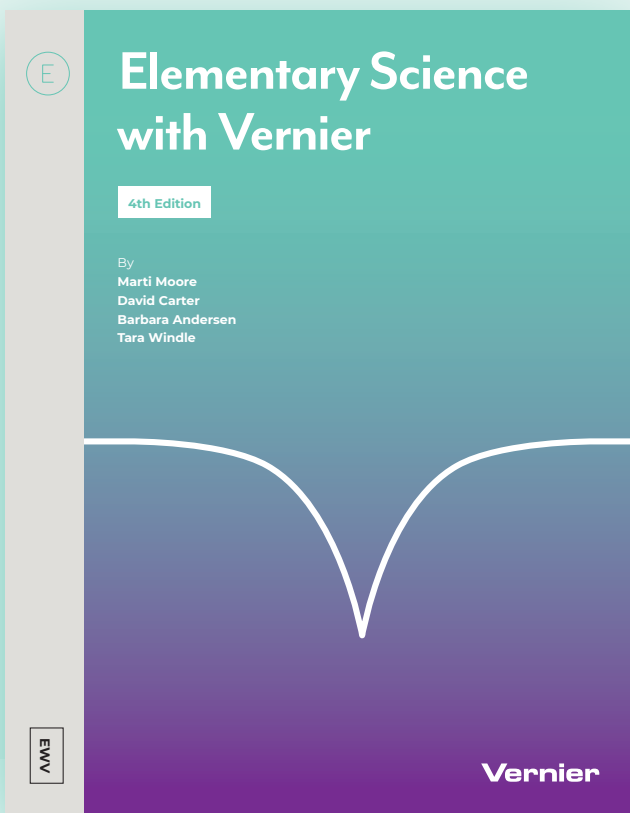
Vernier Graphical Analysis



Experiment List		Sensor Used
1	Learning to Use a Voltage Probe	Voltage Probe
2	Are All Batteries the Same?	
3	Stacked Batteries	
4	All Worn Out!	

To learn more, scan the QR code or visit [vernier.com/elb-volt-e](https://www.vernier.com/elb-volt-e)

Elementary Science with Vernier



Elementary Science with Vernier contains 43 fun and engaging experiments for elementary students.

Order Code

EWV

Education Level

Elementary

Written for

Vernier Graphical Analysis®

Also supports LabQuest® App

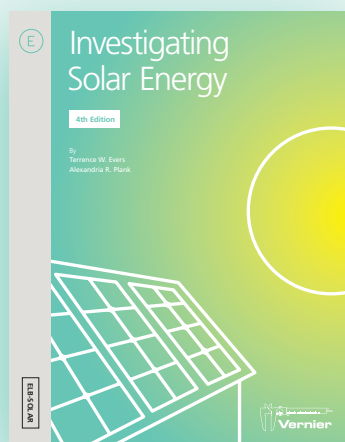


To learn more, scan the QR code or visit
[vernier.com/ewv](https://www.vernier.com/ewv)

Experiment List and Sensors Used

		Sensors						
		Go! Temp or Temperature Probe	Go! Motion or Motion Detector	Dual-Range Force Sensor	Gas Pressure Sensor	Light	Magnetic Field Sensor	Differential Voltage Probe
1	Learning to Use Go!Temp	X						
2	How Do Mittens Keep You Warm?	X						
3	Baggie Mittens	X						
4	The Sole Purpose	X						
5	Cool Reaction!	X						
6	Cold as Ice	X						
7	Are We Cool or What?	X						
8	Why Do We Need Thermometers?	X						
9	Celsius or Fahrenheit. What's the Difference?	X						
10	Getting it Just Right!	X						
11	Go!Temp Spends the Night	X						
12	Hold Everything! Comparing Insulators	X						
13	Keepin' it Cool! Design Your Own Thermos	X						
14	I'm Melting! Water Changes States	X						
15	Solid, Liquid, Gas: Water Can Do it All!	X						
16	Learning to Use the Pressure Sensor				X			
17	Get a Grip!				X			
18	Under Pressure				X			
19	Bubbles in Your Bread				X			
20	Learning to Use Go! Motion		X					
21	e-Motion		X					
22	Batty about Science		X					
23	Spring into Action!		X					
24	Air Ball!		X		X			
25	Driving with Energy		X					
26	Weigh Station—All Trucks Stop!		X					
27	Learning to Use the Force Sensor			X				
28	Lift the Load			X				
29	What a Drag!			X				
30	Oh! My Aching Back! How Ramps Make Lifting Easier			X				
31	Learning to Use the Light Probe					X		
32	Distance From the Sun					X		
33	Summer and Winter					X		
34	Sunshine on my Shoulders					X		
35	Reflectivity of Light					X		
36	Learning to Use the Magnetic Field Sensor						X	
37	Exploring the Poles						X	
38	Making Magnets						X	
39	Electromagnets						X	
40	Learning to Use the Voltage Sensor							X
41	Are All Batteries the Same?					X		X
42	Stacked Batteries							X
43	All Worn Out!							X

Investigating Solar Energy



This book contains nine hands-on experiments and two culminating engineering projects that allow elementary students to learn about solar energy and develop solutions to real-world problems.

Order Code

ELB-SOLAR



Education Level

Elementary

Written for

Vernier Graphical Analysis®

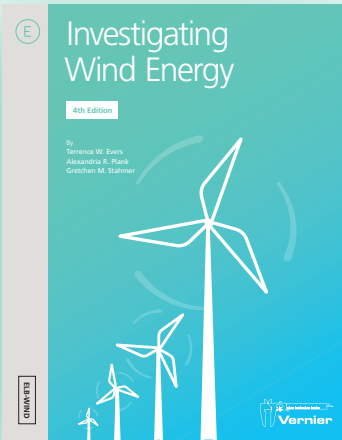
Also supports LabQuest® App

Experiment List		Sensors Used							
		Energy Sensor	Surface Temperature Sensor	Resistor Board	Solar Energy Exploration Kit				
					2 V Solar Panel	Sound and Light Board	LED set (red, green, blue)	Pump and Tubing	Motor
1	Introduction to Solar Panels				1	1			
2	Exploring Solar Energy				1	1	1		
3	Intro to the Energy Sensor	X		X	3				
4	Making Connections: Circuits	X		X	3				
5	Solar Panel Output: Effect of Load	X		X	3				
6	Solar Panel Output: Effect of Shade	X		X	3				
7	Solar Panel Output: Effect of Angle	X		X	3				
8	Pumping Water with Solar Energy	X			3			1	
9	Exploring Surface Temperature		X						
10	Project: Solar Homes		X		3				1
11	Project: What's Cookin'?		X						

To learn more, scan the QR code or visit [vernier.com/elb-solar](https://www.vernier.com/elb-solar)

Investigating Wind Energy

The *Investigating Wind Energy* lab book contains 10 hands-on, engaging wind energy experiments for elementary students and a culminating wind energy engineering project.



Order Code
ELB-WIND

Education Level
Elementary

Written for
Vernier Graphical Analysis

Also supports LabQuest® App

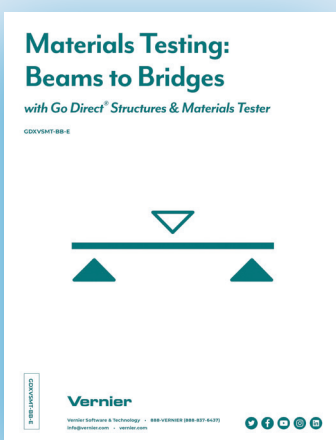


Experiment List		Sensors Used			
		KidWind Mini Wind Turbine	KidWind Sound and Light Board	Energy Sensor	Resistor Board
1	Introduction to Wind Turbines	X	X		
2	Exploring Wind Energy	X	X		
3	Introduction to the Energy Sensor	X	X	X	X*
4	Wind Turbine Output: The Effect of Load	X		X	X*
5	Exploring Wind Turbine Blades	X		X	X*
6	Blade Design: Pitch	X		X	X*
7	Blade Design: Area	X		X	X*
8	Blade Design: Quantity	X		X	X*
9	Blade Design: Mass	X		X	X*
10	Blade Design: Material	X		X	X*
11	Project: Power Up!	X		X	X*

* Required only if collecting data with Vernier Energy Sensors (order code: VES-BTA); not required for Go Direct® Energy Sensors (order code: GDX-NRG).

To learn more, scan the QR code or visit [vernier.com/elb-wind](https://www.vernier.com/elb-wind)

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



With the investigations in this e-book, students use the Go Direct® Structures & Materials Tester to investigate the relationship between dimensions and flexibility, explore why trusses fail and how to compensate for weaknesses, and how to use the engineering design process to build and test bridges.

This e-book is free with the purchase of the Go Direct Structures & Materials Tester.

Order Code

GDXVSMT-BB-E



Education Level

High School
College

Written for

Vernier Graphical Analysis®

Investigation 5 supports Bridge Competition
Software

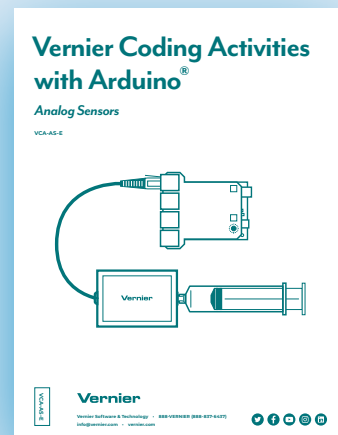
Experiment List		Sensor Used
1	Deflection of a Center-Loaded Rectangular Beam	Go Direct Structures & Materials Tester
2	Beam Deflection: Investigating Cross-Sectional Shape	
3	Determining the Modulus of Elasticity	
4	Study of Trusses	
5	Bridge Competition	

To learn more, scan the QR code or visit vernier.com/gdxvsmt-bb-e

Vernier Coding Activities with Arduino: Analog Sensors

Integrating Vernier sensor technology with Arduino® connects the physical world to the computer-centric activity of learning to code. Teaching students about the underlying physics in our technology opens the door for them to explore and become interested in how technology works. Students get excited when they see coding come to life through hands-on technology.

This e-book is also included for free with the purchase of the Vernier Coding with Arduino—Analog Sensor Package, or with the purchase of the Vernier Arduino Interface Shield.



Order Code

VCA-AS-E



Education Level

High School

College

Written for

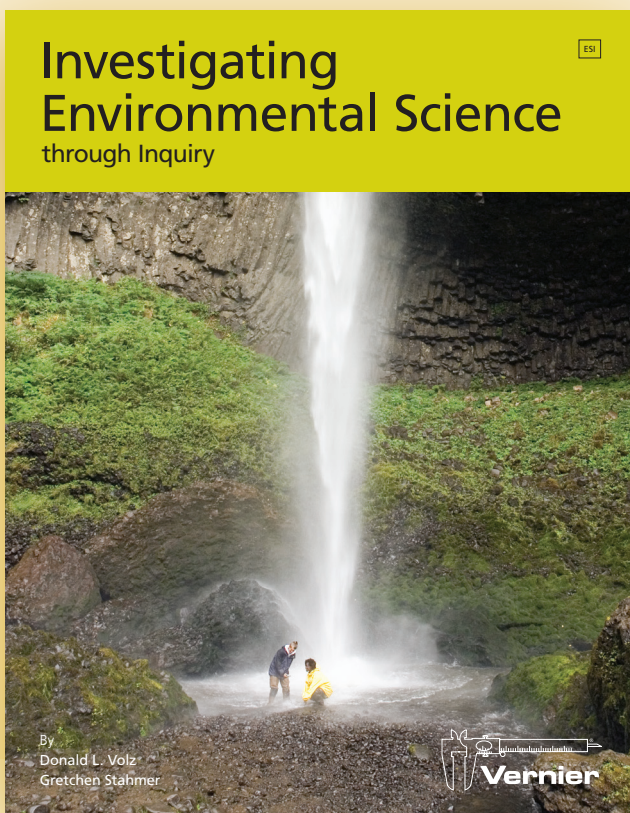
Arduino IDE

Also supports web editor

Experiment List		Sensors Used
1	Introduction to Arduino Programming	• SparkFun RedBoard (or equivalent) with USB cable and power supply • Vernier Analog Protoboard Adapter or Vernier Interface Shield • Vernier Gas Pressure Sensor
2	Using Vernier Sensors with Arduino	
3	Calibrating a Sensor	
4	Displaying Data	
5	Functions: Part 1	
6	Functions: Part 2	
7	Output and Logic Statements	
8	Using the VernierLib Library: Accessing Additional Sensor Information	

To learn more, scan the QR code or visit vernier.com/vca-as-e

Investigating Environmental Science through Inquiry



Investigating Environmental Science through Inquiry contains 34 inquiry-based investigations that prompt students' interest in the environment.

Order Code

ESI

Education Level

**High School
College**

Written for

Generic Instructions

Also supports LabQuest® App



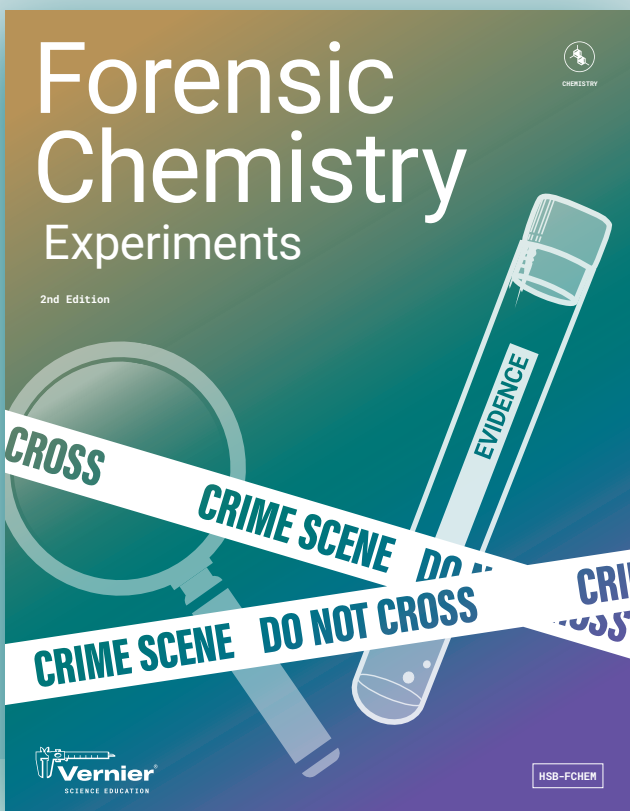
To learn more, scan the QR code or visit
vernier.com/esi

Experiment List and Sensors Used

Experiment List and Sensors Used		Sensors												
		Temperature	Relative Humidity	Soil Moisture	pH	Conductivity	UVA/UVB	Energy	Voltage	Current	Dissolved Oxygen	Turbidity	Light	Carbon Dioxide Gas
	Earth Systems and Resources/Air and Water													
1	Seasons and Angle of Insolation	X												
2	A Local Weather Study	X	X				X							
3	Investigating Dissolved Oxygen										X			
4	Water Quality	X			X	X					X	X		
5	Long Term Water Monitoring	X			X	X					X	X		
6	Water Treatment				X	X						X		
7	Investigating Salinity					X								
	Earth Systems and Resources/Soil													
8	Soil Temperature	X												
9	Soil Salinity					X								
10	Soil pH				X									
11	Soil Moisture			X										
12	Soil and Acid Precipitation				X									
13	Managing Garden Soil Moisture			X										
	The Living World													
14	Cell Respiration													X
15	Biodiversity in Ecosystems	O	O	O									X	
16	Biochemical Oxygen Demand										X			
17	Water Cycle Column Investigations	X	X	X	X	X							X	X
18	Decomposition Column Investigations	X	X		X								X	X
19	Ecocolumn Investigations	X	X	X	X	X							X	X
	Global Change and Population													
20	Global Warming	X												
21	UV Investigations						X							
22	Sunscreen Comparison						X							
23	Primary Productivity										X			
24	Modeling Population	No sensor required												
	Energy Resources and Consumption													
25	Insulation Study	X												
26	Fossil Fuel Energy	X												
27	Energy Conversion	O											X	
28A	Wind Energy (Current and Voltage)							X	X					
28B	Wind Energy (Energy)							X						
29A	Solar Energy: Photovoltaic Cells (Current and Voltage)								X	X				
29B	Solar Energy: Photovoltaic Cells (Energy)							X						
30	An Investigation of Passive Solar Heating	X												
	Pollution													
31	The Effect of Acid Deposition on Aquatic Ecosystems				X	X								
32	Measuring Particulates												X	
33	Investigating Indoor Carbon Dioxide Concentrations													X
34	A Pollution Study	O	O	O	O	O					O	O		O

KEY X = Required
 O = Optional

Forensic Chemistry Experiments



Engage students in fundamental chemistry concepts through forensic chemistry experiments. Each of the 15 experiments in this lab book begins with a case study to encourage phenomenon-based learning and outlines how the lesson aligns with 3D and NGSS standards.

Order Code

HSB-FCHEM

Education Level

High School
College

Written for

Vernier Graphical Analysis®
LabQuest® App

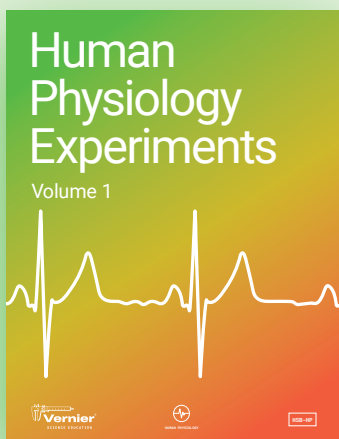


To learn more, scan the QR code or visit
[vernier.com/hsb-fchem](https://www.vernier.com/hsb-fchem)

Experiment List and Sensors Used

		Sensors								
		Temperature	Gas Pressure	pH	Drop Counter	Conductivity	Carbon Dioxide Gas	Colorimeter	Spectrophotometer	Mini GC
1	Accelerant Evaporation	X								
2	Drowning Victim					X				
3	Unusually Cool Beverage	X								
4	Fish Kill			X						
5	Avogadro's Law and Order		X							
6	Burning Accelerants	X								
7	Color Countdown Timer							X	X	
8	Cold Case for Carbon Dioxide						X			
9	Messed Up Makeup			X	X					
10	Secret Message								X	
11	Poisoned Wine								X	
12	Metal Poisoning								X	
13	Under Pressure	X	X							
14	Mystery Powder			X		X				
15	Arson Analysis									X

Human Physiology Experiments: Volume 1



Human Physiology Experiments: Volume 1 contains 14 experiments designed to encourage students to explore the physiology of various human organ systems. This lab book provides instructions for data collection using Vernier Graphical Analysis and Go Direct® sensors; select experiments also include support for LabQuest sensors.

Order Code

HSB-HP



Education Level

High School

College

Written for

Vernier Graphical Analysis®

Experiment List		Sensors Used						
		EKG	Force	Hand Dynamometer	Heart Rate	Oxygen Gas	Respiration	Surface Temperature
1	Body Temperature							X
2	Limb Position and Grip Strength			X				
3	Introduction to Electromyography	X		X				
4	Simple Neuromuscular Reflexes	X	X*					
5	Balance		X					
6	Homeostasis and Autonomic Reflexes				X			
7	Effect of Exercise on Heart Rate				X			
8	Introduction to Electrocardiography	X						
9	Blood Flow and Skin Temperature							X
10	Respiration and Ventilation						X	
11	Ventilation and Heart Rate				X		X	
12	Oxygen Extraction During Respiration					X		
13	Effect of Exercise on Oxygen Usage					X**		
14	Heart Rate and Calories				X			

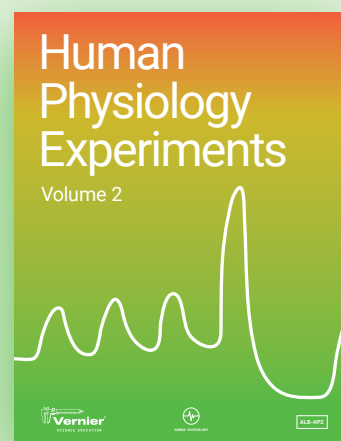
* Requires the Reflex Hammer Accessory Kit

** Requires the BioChamber 250

To learn more, scan the QR code or visit [vernier.com/hsb-hp](https://www.vernier.com/hsb-hp)

Human Physiology Experiments: Volume 2

Human Physiology Experiments: Volume 2 contains 15 experiments designed to encourage students to explore the physiology of various human organ systems. This lab book provides instructions for data collection using Vernier Graphical Analysis and Go Direct® sensors; select experiments also include support for LabQuest sensors.



Order Code

ALB-HP2

Education Level

High School
College

Written for

Vernier Graphical Analysis

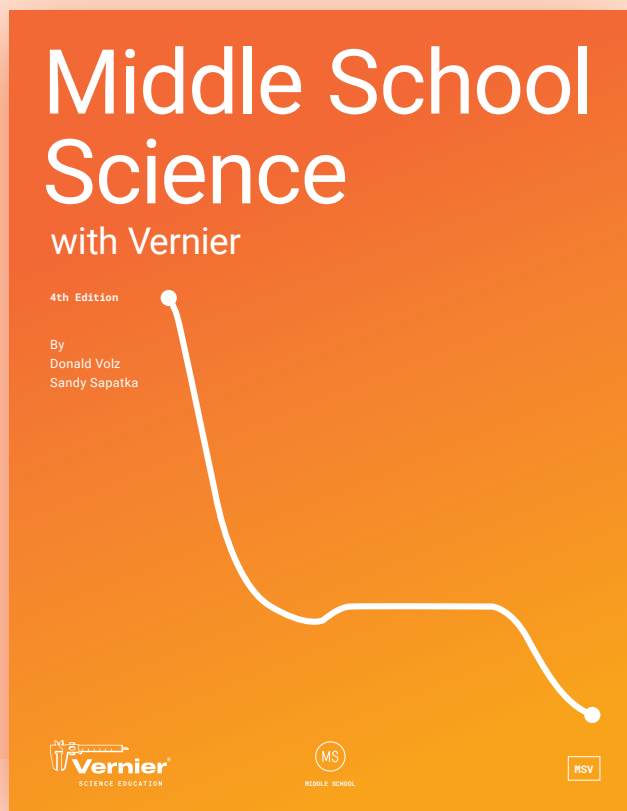


Experiment List		Sensors Used				
		Blood Pressure	EKG	Respiration Belt	Spirometer	Hand Dynamometer
1	Blood Pressure and Autonomic Reflexes	X				
2	Blood Pressure and Exercise	X				
3	Diurnal Blood Pressure Variation	X				
4	Pulse Transit Time	X	X			
5	EKG and Electrode Position		X			
6	Diving Reflex		X	X		
7	Lung Volumes and Capacities*				X	
8	Spirometry and Body Position*				X	
9	Respiratory Response to Physiological Challenges*				X	
10	Analysis of Lung Function*				X	
11	Simulating Asthma*				X	
12	Analysis of Barefoot Running			X		
13	Biofeedback		X	X		
14	Advanced Analysis of EMG		X			X
15	Analysis of Muscle Function		X			

* Requires the use of bacterial filters and disposable cardboard mouthpieces.

To learn more, scan the QR code or visit vernier.com/alb-hp2

Middle School Science with Vernier



This book is written specifically for students in grades 6–8. It contains 38 experiments in Earth science, life science, and physical science.

Order Code

MSV

Education Level

Middle School

Written for

Vernier Graphical Analysis®

Also supports LabQuest® App and EasyData

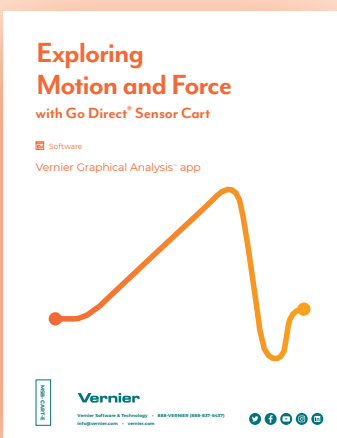


To learn more, scan the QR code or visit
[vernier.com/msv](https://www.vernier.com/msv)

Experiment List and Sensors Used

		Sensors									
		Temperature	Motion	Force	Conductivity	Gas Pressure	Heart Rate	Light	Magnetic Field	pH	Voltage
1	A Hot Hand	1									
2	Heating of Land and Water	2									
3	The Greenhouse Effect	2									
4	Relative Humidity	2									
5	Soil Study									1	
6	Absorption of Radiant Energy	2									
7	Reflectivity of Light							1			
8	Schoolyard Study	1						1			
9	A Good Sock	2									
10	What Causes Seasons?	1									
11	Solar Homes	2									
12	Ocean Floor Mapping		1								
13	Boiling Temperature of Water	1									
14	Freezing Temperature of Water	1									
15	How Low Can You Go?	1									
16	A Good Cold Pack	1									
17	Lemon "Juice"										1
18	Get a Grip!					1					
19	Fun with Pressure					1					
20	Water Hardness Study				1						
21	Diffusion: How Fast?				1						
22	A Water Field Study	1			1					1	
23	Cooling Rates: Shaq vs. Susie	2									
24	Yeast Beasts in Action					1					
25	Heart Rate and Body Position						1				
26	Heart Rate and Exercise						1				
27	Mapping a Magnetic Field								1		
28	Electromagnets								1		
29	Friction			1							
30	First Class Levers			1							
31	Pulleys			1							
32	Buoyancy			1							
33	Graphing Your Motion		1								
34	Speeding Up		1								
35	The Indy 100		1								
36	Crash Dummies		1								
37	Falling Objects		1								
38	A Speedy Slide		1								

Exploring Motion and Force with Go Direct Sensor Cart



This download includes seven motion and force experiments for middle school students that can be done with Go Direct® Sensor Cart.

The experiments are suitable for grades 6–9.

Order Code

MSB-CART-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®



Experiment List		Sensor Used
1	Investigating Friction	Go Direct Sensor Cart
2	Levers as Machines	
3	Pulleys as Machines	
4	Ramps as Machines	
5	Getting Faster	
6	Crash Test	
7	Newton's Second Law	

To learn more, scan the QR code or visit [vernier.com/msb-cart-e](https://www.vernier.com/msb-cart-e)

Middle School Explorations: Chemical Reactions

Students investigate various types of chemical reactions as they build a model to explain what goes on at the molecular level during a chemical reaction. Students investigate endothermic and exothermic reactions, precipitate formation, conservation of mass, and other reactions.

Order Code

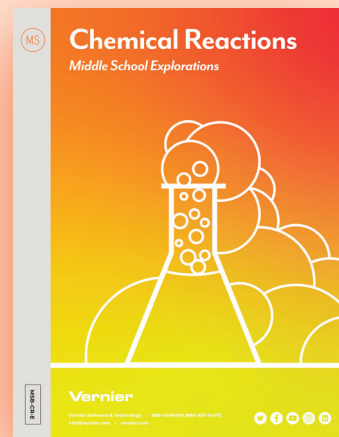
MSB-CR-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®



Experiment List		Sensor Used
1	Conservation of Mass	No sensor required
2	Endothermic Reaction	Go Direct Temperature Probe
3	Synthesis/Exothermic Reaction	
4	Double Replacement/Endothermic Reaction	
5	Single Replacement/Exothermic Reaction	
6	Decomposition Reaction	
7	Chemical Reactions Review	No sensor required

To learn more, scan the QR code or visit [vernier.com/msb-cr-e](https://www.vernier.com/msb-cr-e)

Exploring Earth and Space Science



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

Order Code

MSB-ESS-E



Education Level

Middle School

Written for

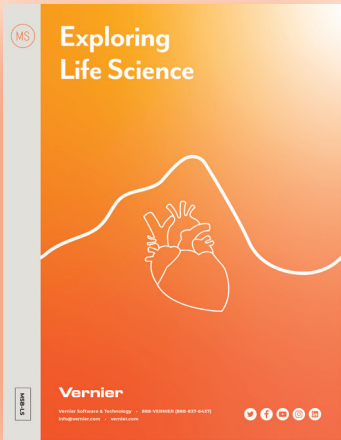
Vernier Graphical Analysis®

Experiment List		Sensors Used				
		Temperature Sensor	pH Sensor	Motion Detector	Conductivity Probe	Light and Color Sensor
1	Introduction to Data Collection	1				
2	Soil Study		1			
3	Ocean Floor Mapping			1		
4	Water Hardness Study				1	
5	A Water Field Study	1	1		1	
6	Heating of Land and Water	2				
7	The Greenhouse Effect	2				
8	Relative Humidity	2				
9	Absorption of Radiant Energy	2				
10	Reflectivity of Light					1
11	Schoolyard Study	1				1
12	What Causes Seasons	1				
13	Solar Homes (Engineering Design)	2				

To learn more, scan the QR code or visit [vernier.com/msb-ess-e](https://www.vernier.com/msb-ess-e)

Exploring Life Science

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



Order Code

MSB-LS-E

Education Level

Middle School

Written for

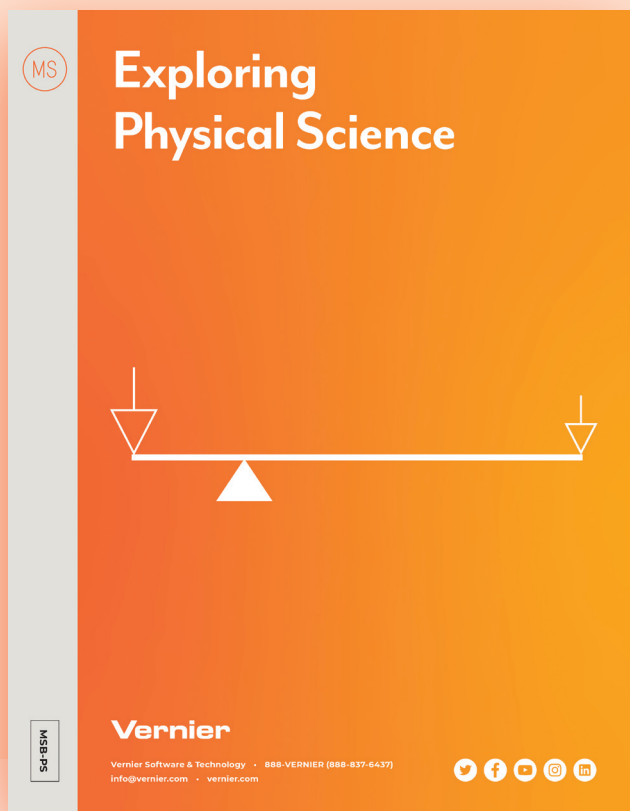
Vernier Graphical Analysis®



Experiment List		Sensors Used			
		Gas Pressure Sensor	Gas Pressure Sensor Bulb	Heart Rate Monitor	Conductivity Probe
1	Introduction to Data Collection	1			
2	Get a Grip	1	1		
3	Heart Rate and Body Position			1	
4	Heart Rate and Exercise			1	
5	Diffusion: How Fast				1
6	Yeast Beasts in Action	1			

To learn more, scan the QR code or visit [vernier.com/msb-ls-e](https://www.vernier.com/msb-ls-e)

Exploring Physical Science



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

Order Code

MSB-PS-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®



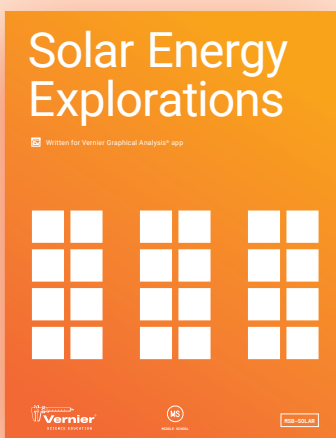
To learn more, scan the QR code or visit
vernier.com/msb-ps-e

Experiment List and Sensors Used

		Sensors						
		Temperature Probe	Gas Pressure Sensor	Force Sensor	Motion Detector	Voltage Probe	Light and Color Sensor	3-Axis Magnetic Field Sensor
1	Introduction to Data Collection	1						
2	Fun with Pressure		1					
3	Boiling Temperature of Water	1						
4	Freezing Temperature of Water	1						
5	How Low Can You Go? Freezer Bag Ice Cream	1						
6	A Good Cold Pack	1						
7	Cooling Rates: Shaq vs. Suzie	2						
8	Friction			1*				
9	First Class Levers			1*				
10	Pulleys			1*				
11	Buoyancy			1				
12	Graphing Your Motion				1			
13	Speeding Up				1*			
14	The Indy 100/Pencil Car (Engineering Design)				1			
15	Crash Dummies				1*			
16	Falling Objects				1			
17	A Speedy Slide (Engineering Design)				1			
18	A Hot Hand	1						
19	A Good Sock	1						
20	Lemon "Juice"					1		
21	Reflectivity of Light						1	
22	Mapping a Magnetic Field							1
23	Electromagnets							1

* Can also be done with a Go Direct® Sensor Cart

Solar Energy Explorations



Examine renewable energy, solar power, and engineering design with these nine downloadable experiments written for middle school science.

Suitable for grades 4–8.

Order Code

MSB-SOLAR



Education Level

Middle School

Written for

Vernier Graphical Analysis®

Experiment List		Sensors		Equipment	
		Surface Temperature Sensor	Energy Sensor	Solar Energy Exploration Kit	Resistor Board
1	Renewable Energy	X			
2	Introduction to Solar Panels and Solar Energy			X	
3	Measuring Energy		X	X	X
4	Making Connections: Circuits		X	X	X
5	Solar Panel Output: Effect of Load		X	X	X
6	Solar Panel Output: Effect of Shade		X	X	X
7	Solar Panel Output: Effect of Angle		X	X	X
8	Solar Panel Output: Effect of Temperature	X	X	X	X
9	Project: Build a Solar Car		X	X	X

To learn more, scan the QR code or visit [vernier.com/msb-solar](https://www.vernier.com/msb-solar)

Wind Energy Explorations

Examine renewable energy, wind power, and engineering design with these nine downloadable experiments written for middle school science.

Suitable for grades 4–8.

Order Code

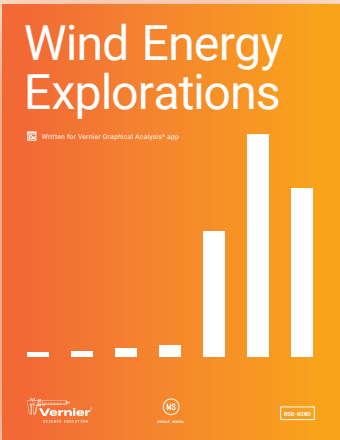
MSB-WIND

Education Level

Middle School

Written for

Vernier Graphical Analysis®



Experiment List		Sensor	Equipment	
		Go Direct® Energy Sensor	Basic Wind Experiment Kit	Vernier Resistor Board
1	Energy Transformation		X	
2	Measuring the Transformation of Energy	X	X	
3	Exploring Wind Turbines	X	X	
4	Wind Turbines: Effect of Load	X	X	X
5	Blade Variable: Pitch	X	X	
6	Blade Variable: Quantity	X	X	
7	Blade Variable: Area	X	X	
8	Blade Variable: Shape	X	X	O
9	Engineering Project: Max Power	X	X	O

KEY X = Required
 O = Optional

To learn more, scan the QR code or visit [vernier.com/msb-wind](https://www.vernier.com/msb-wind)

Light and Matter

Vernier Supplement to OpenSciEd Unit 6.1



Student curiosity is sparked by watching a perplexing movie involving a one-way mirror. Students use a Go Direct® Light and Color Sensor to quantify amounts of transmitted and reflected light, and then compare the sensor readings with what they perceive with their own senses. Using various models, students develop an understanding of two of the ways light interacts with matter and answer the question, “How can something act like a mirror and a window at the same time?”

As a companion to OpenSciEd Unit 6.1, the Vernier Supplement incorporates data-collection technology into the lessons to complement the existing curriculum.

Order Code

OSE-61LM-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®

OpenSciEd Lesson		Sensor Used
3	What happens when light shines on the one-way mirror?	Go Direct Light and Color

OpenSciEd Unit 6.1 Light and Matter includes 8 lessons. The Vernier Supplement to Unit 6.1 includes 1 lesson enhanced with Vernier data-collection technology.

To learn more, scan the QR code or visit vernier.com/ose-61lm-e

Thermal Energy

Vernier Supplement to OpenSciEd Unit 6.2

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

The Vernier Supplement to Unit 6.2 is a complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.

Order Code

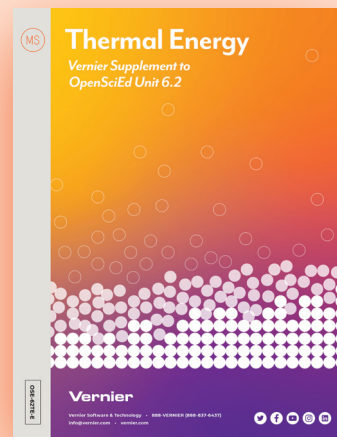
OSE-62TE-E

Education Level

Middle School

Written for

Vernier Graphical Analysis



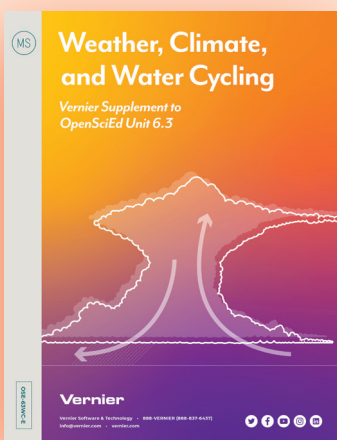
OpenSciEd Lessons		Sensors Used	
		Go Direct Temperature Probe	Go Direct Light and Color
1	Why does the temperature of the liquid in some cup systems change more than in others?	2	
2	What cup features seem most important for keeping a drink cold?	2	
3	How are the cup features that keep things cold the same or different for keeping things hot?	2	
4	How does a lid affect what happens to the liquid in the cup?	2	
8	How does a cup's surface affect how light warms up a liquid inside the cup?		1
9	How does the temperature of a liquid on one side of a cup wall affect the temperature of a liquid on the other side of the wall?	2	
14	Does our evidence support that cold is leaving the system or that heat is entering the system?	2	
16	How can we design a cup system to slow energy transfer into the liquid inside it?	2	
17	How can we improve our first design to slow energy transfer into the cup system even more?	2	

OpenSciEd Unit 6.2 Thermal Energy includes 18 lessons. The Vernier Supplement to Unit 6.2 includes 9 lessons enhanced with Vernier data-collection technology.

To learn more, scan the QR code or visit vernier.com/ose-62te-e

Weather, Climate, and Water Cycling

Vernier Supplement to OpenSciEd Unit 6.3



Students explain small-scale storms by exploring hailstorms from different locations across the country at different times of the year. Students explore mesoscale weather systems and climate-level patterns of precipitation through analysis of weather reports of winter storms.

The Vernier Supplement to Unit 6.3 is a complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.

Order Code

OSE-63WC-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®

OpenSciEd Lessons		Sensor Used
4	Why is the air near the ground warmer than the air higher up?	- Go Direct® Temperature (2) - Go Direct Light and Color (1) - Go Direct Weather System (1)
7	Where did all that water in the air come from, and how did it get into the air?	
12	What causes more lift in one cloud versus another?	

OpenSciEd Unit 6.3 Weather, Climate, and Water Cycling includes 22 lessons. The Vernier Supplement to Unit 6.3 includes 3 lessons enhanced with Vernier data-collection technology.

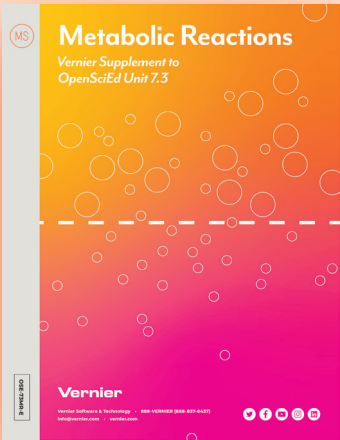
To learn more, scan the QR code or visit vernier.com/ose-63wc-e

Metabolic Reactions

Vernier Supplement to OpenSciEd Unit 7.3

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

The Vernier Supplement to Unit 7.3 is a complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.



Order Code
OSE-73MR-E

Education Level
Middle School

Written for
Vernier Graphical Analysis

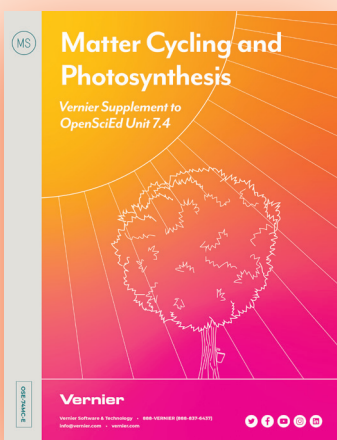
OpenSciEd Lessons		Sensor Used
11	What happens to matter when it is burned?	Go Direct CO ₂ Gas
12	Does this chemical reaction to burn food happen inside our bodies?	

OpenSciEd Unit 7.3 Metabolic Reactions includes 14 lessons. The Vernier Supplement to Unit 7.3 includes 2 lessons enhanced with Vernier data-collection technology.

To learn more, scan the QR code or visit vernier.com/ose-73mr-e

Matter Cycling and Photosynthesis

Vernier Supplement to OpenSciEd Unit 7.4



Students begin this unit by reflecting on what they eat. They consider where their food comes from and consider which items might be from plants. Students discover that they can trace all food back to plants, including processed and synthetic foods. The research information explains how matter cycles back through processes done by decomposers. Students explain that the pieces of their food are constantly recycled between living and nonliving parts of a system.

The Vernier Supplement to Unit 7.4 is a complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.

Order Code

OSE-74MC-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®

OpenSciEd Lessons		Sensor Used
4	Are any parts that make up food molecules coming into the plant from above the surface?	Go Direct® CO ₂ Gas
10	Why don't plants die at night?	

OpenSciEd Unit 7.4 Matter Cycling and Photosynthesis includes 15 lessons. The Vernier Supplement to Unit 7.4 includes 2 lessons enhanced with Vernier data-collection technology.

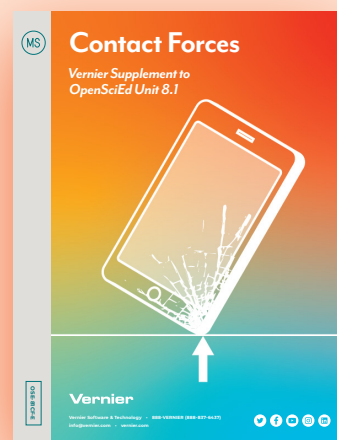
To learn more, scan the QR code or visit vernier.com/ose-74mc-e

Contact Forces

Vernier Supplement to OpenSciEd Unit 8.1

This unit on contact forces begins as students consider situations in which they have seen their phones break. Students make general observations about what happens to objects during collisions and quickly move to analyzing data that show that objects deform when forces are applied. Students then design solutions to protect an object of their choice in a collision.

The Vernier Supplement to Unit 8.1 is a free complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.



Order Code

OSE-81CF-E

Education Level

Middle School

Written for

Vernier Graphical Analysis

OpenSciEd Lessons		Sensors
2	What causes changes in the motion and shape of colliding objects?	OpenSciEd Sensor Cart Package
4	How much do you have to push on any object to get it to deform (temporarily vs. permanently)?	
5	How does changing the mass or speed of a moving object before it collides with another object affect the forces on those objects during the collision?	
7	How much does doubling the speed or doubling the mass affect the kinetic energy of an object and the resulting damage that it can do in a collision?	
9	How do other contact forces from interactions with the air and the track cause energy transfers in the launcher system?	
12	What materials best reduce the peak forces in a collision?	
13	How (and why) does the structure of a cushioning material affect the peak forces produced in a collision?	

OpenSciEd Unit 8.1 Contact Forces includes 16 lessons. The Vernier Supplement to Unit 8.1 includes 7 lessons enhanced with Vernier data-collection technology.

To learn more, scan the QR code or visit vernier.com/ose-81cf-e

Sound Waves

Vernier Supplement to OpenSciEd Unit 8.2



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

The Vernier Supplement to Unit 8.2 is a complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.

Order Code

OSE-82SW-E

Education Level

Middle School

Written for

Vernier Graphical Analysis®

OpenSciEd Lessons		Sensor Used
4	How do the vibrations of the sound source compare for louder versus softer sounds?	Go Direct® Motion Detector
5	How do the vibrations from a sound source compare for higher-pitch versus lower-pitch sounds?	

OpenSciEd Unit 8.2 Sound Waves includes 14 lessons. The Vernier Supplement to Unit 8.2 includes 2 lessons enhanced with Vernier data-collection technology.

To learn more, scan the QR code or visit vernier.com/ose-82sw-e

Forces at a Distance

Vernier Supplement to OpenSciEd Unit 8.3

In this unit, students analyze a slow-motion video of a speaker as it plays music to investigate the cause of a speaker's vibration in addition to the effect. Students dissect speakers to explore the inner workings, and engineer homemade cup speakers to manipulate the parts of the speaker. They identify that most speakers have the same parts—a magnet, a coil of wire, and a membrane. Students investigate each of these parts to figure out how they work together in the speaker system.

The Vernier Supplement to Unit 8.3 is a complement to the OpenSciEd curriculum and includes data-collection technology enhanced lessons to supplement the existing curriculum.



Order Code

OSE-83FD-E

Education Level

Middle School

Written for

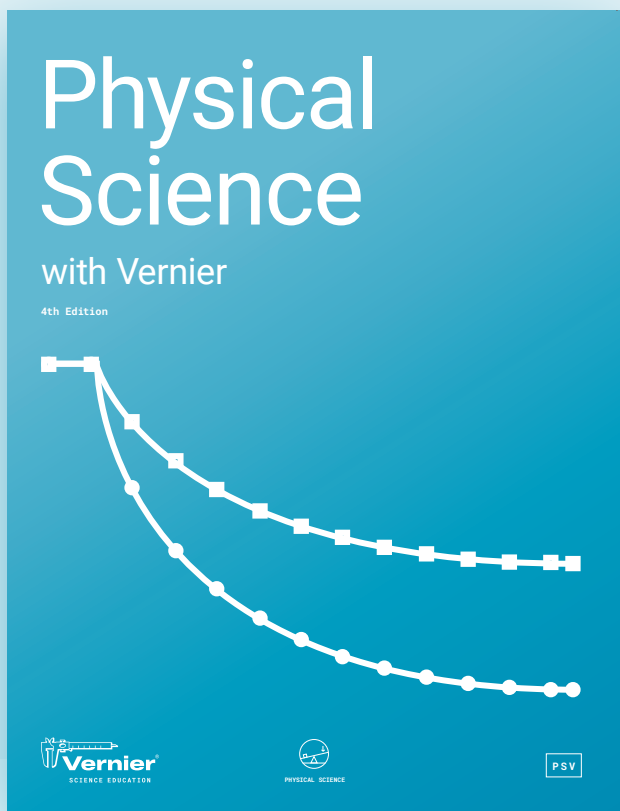
Vernier Graphical Analysis

OpenSciEd Lessons		Sensors Used
7	How does changing the distance between two magnets affect the amount of energy transferred out of the field?	OpenSciEd Sensor Cart Package
10	How does distance affect the strength of force pairs in a magnetic field?	
11	What else determines the strength of the force pairs between two magnets in a magnetic field?	

OpenSciEd Unit 8.3 Forces at a Distance includes 14 lessons. The Vernier Supplement to Unit 8.3 includes 3 lessons enhanced with Vernier data-collection technology.

To learn more, scan the QR code or visit vernier.com/ose-83fd-e

Physical Science with Vernier



Containing 40 experiments, *Physical Science with Vernier* is perfect for introductory physical science and integrated science classes.

Order Code

PSV

Education Level

Middle School
High School

Written for

Vernier Graphical Analysis®

Also supports LabQuest® App

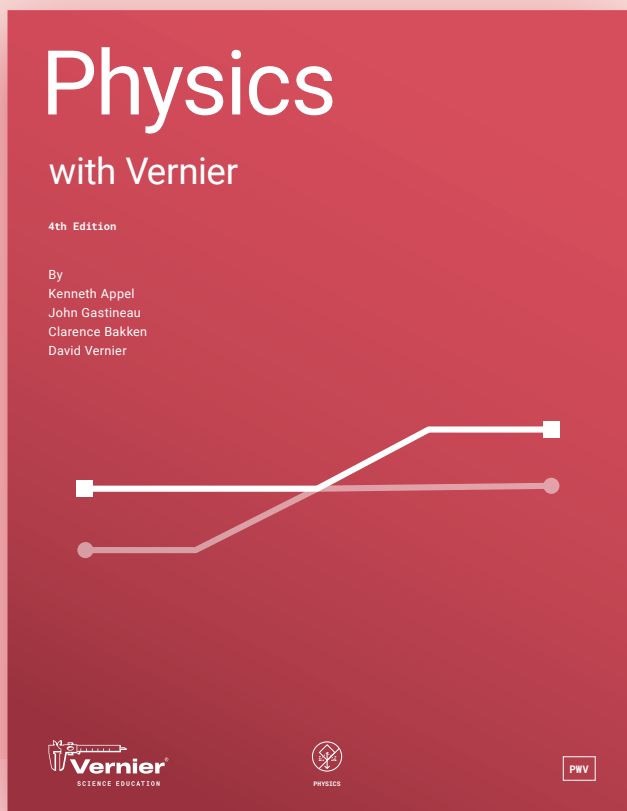


To learn more, scan the QR code or visit [vernier.com/psv](https://www.vernier.com/psv)

Experiment List and Sensors Used

		Sensors								
		Temperature	Conductivity	Force	Light	Magnetic Field	pH	Pressure	Voltage	Motion
1	Temperature Probe Response Time	1								
2	Boiling Temperature of Water	1								
3	Freezing and Melting of Water	1								
4	Evaporation of Alcohols	2								
5	Endothermic and Exothermic Reactions	1								
6	Neutralization Reactions	1	1							
7	Mixing Warm and Cold Water	2								
8	Heat of Fusion	1								
9	Energy Content of Fuels	1								
10	Energy Content of Foods	1								
11	Absorption of Radiant Energy	2								
12	An Insulated Cola Bottle	2								
13	A Good Sock	2								
14	Insolation Angle	2								
15	Solar Homes and Heat Sinks	2								
16	Conducting Solutions		1							
17	Conductivity of Saltwater: The Effect of Concentration		1							
18	Acid Strengths		1							
19	Frictional Forces			1						
20	First-Class Levers			1						
21	Pulleys			1						
22	An Inclined Plane			1						
23	Reflectivity of Light				1					
24	Polarizing Light				1					
25	How Bright is the Light				1					
26	Electromagnets: Winding Things Up					1				
27	Magnetic Field Explorations					1				
28	Household Acids and Bases						1			
29	Acid Rain						1			
30	Gas Pressure and Volume							1		
31	Gas Temperature and Pressure	1						1		
32	Fun with Pressure							1		
33	Lemon "Juice"								1	
34	Simple Circuits								1	
35	Graphing Your Motion									1
36	Speeding Up									1
37	It's Race Day									1
38	Crash Lesson									1
39	Newton's Second Law									1
40	Falling Objects									1

Physics with Vernier



This book contains 35 experiments in mechanics, sound, light, electricity, and magnetism.

Order Code

PWV

Education Level

**High School
College**

Written for

Vernier Graphical Analysis® Pro

Also supports LabQuest® App and EasyData



To learn more, scan the QR code or visit
[vernier.com/pwv](https://www.vernier.com/pwv)

Experiment List and Sensors & Accessories Used

Experiment List and Sensors & Accessories Used		Sensors													Accessories									
		Motion	Sensor Cart	Photogate	Acceleration	Force and Acceleration	Current	Voltage	3-Axis Magnetic Field	Light and Color	Sound	Temperature	Rotary Motion	Picket Fence	Bumper/Launcher Kit	Extech Power Supply	Optics Expansion Kit	Polarizer/Analyzer Set	Springs Set	Ultra Pulley	Vernier Circuit Board	Dynamics Cart/Track	Projectile Launcher	
1	Graph Matching	1																						
2	Back and Forth Motion	1																1				1		
3	Cart on a Ramp*	1	1																			1		
4	Determining g on an Incline*	1	1																			1		
5	Picket Fence Free Fall			1										1										
6	Ball Toss	1																						
7	Bungee Jump Accelerations				1	1																		
8A	Projectile Motion (Photogate)			1																				
8B	Projectile Motion (Launcher)																						1	
9	Newton’s Second Law		1			1																		
10	Atwood’s Machine			1															1					
11	Newton’s Third Law					2																		
12	Static and Kinetic Friction*	1	1			1																1**		
13	Air Resistance	1																						
14	Pendulum Periods			1																				
15	Simple Harmonic Motion	1																	1					
16	Energy of a Tossed Ball	1																						
17	Energy in Simple Harmonic Motion	1																	1					
18	Momentum, Energy, Collisions*	2	2																			1		
19	Impulse and Momentum*	1	1			1									1							1		
20	Centripetal Accelerations				1																			
21	Accelerations in the Real World				1																			
22	Ohm’s Law						1	1								1					1			
23	Series and Parallel Circuits						2	1								1					1			
24	Capacitors							1													1			
25	The Magnetic Field in a Coil								1							1								
26	The Magnetic Field in a Slinky								1							1								
27	Electrical Energy						1	1								1								
28A	Polarization of Light									1							1	1				1		
28B	Polarization of Light (Rotary Motion)									1			1				1	1				1		
29	Light, Brightness, and Distance									1							1					1		
30	Newton’s Law of Cooling											1												
31	Magnetic Field of a Magnet								1															
32	Sound Waves and Beats										1													
33	Speed of Sound										1	1												
34	Tones, Vowels, and Telephones^										1													
35	Mathematics of Music^										1													

* Experiment can be performed with more than one type of sensor. Refer to the Instructor Information for details.

** Optional

^ Supported in Graphical Analysis Pro only; not supported in Graphical Analysis.

Physics Explorations and Projects



This book contains over 30 guided-inquiry-based investigations for physics students to explore and analyze key physics concepts included in NGSS.

Order Code

PEP

Education Level

**High School
College**

Written for

Inquiry-Style Experiments

No software-specific steps

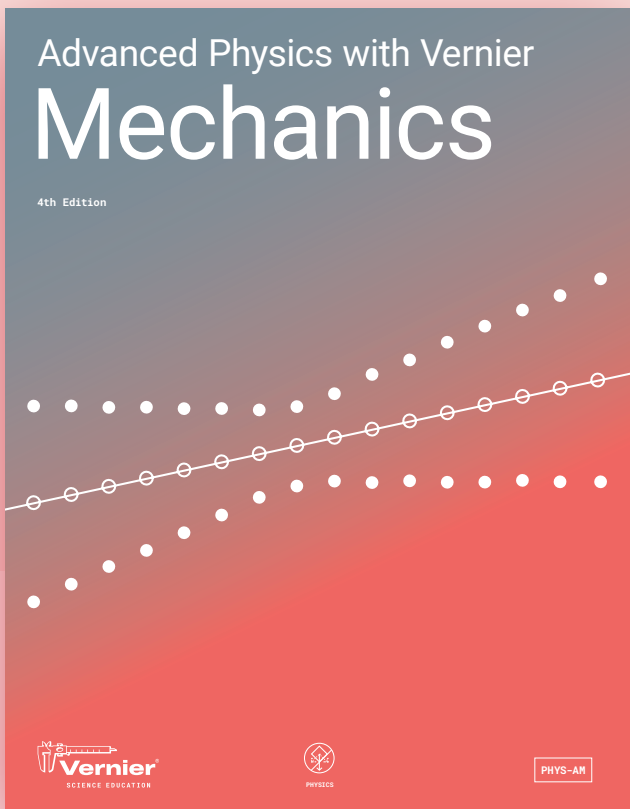


To learn more, scan the QR code or visit
[vernier.com/pep](https://www.vernier.com/pep)

Experiment List and Sensor Suggestions

		Sensors
		Sensor Suggestions
1	Constant Motion and Changing Motion	Dynamics Cart and Track System with Go Direct® Sensor Carts
2	Balanced Forces and Unbalanced Forces	Dynamics Cart and Track System with Go Direct Sensor Carts
3	Gravitation on Earth	Go Direct Photogate, Picket Fence, Go Direct Force and Acceleration Sensor
4	Newton's Second Law	Dynamics Cart and Track System with Go Direct Sensor Carts
5	Projectile Challenge	Go Direct Projectile Launcher
6	Impulse and Momentum	Dynamics Cart and Track System with Go Direct Sensor Carts
7	Equilibrium of Forces	Fan Cart, Combination Track/Optics Bench, Go Direct Motion Detector, Ultra Pulley Attachment, Pulley Bracket
8	Circular Motion	Go Direct Centripetal Force Apparatus, Go Direct Force and Acceleration Sensor
9	Conservation of Momentum	Dynamics Cart and Track System with Go Direct Sensor Carts
10	Egg Protection Challenge	—
11	Springs Making Things Move	Dynamics Cart and Track System with Go Direct Sensor Carts
12	Kinetic Energy and Mass	Dynamics Cart and Track System with Go Direct Sensor Carts
13	Work and Kinetic Energy	Dynamics Cart and Track System with Go Direct Sensor Carts
14	Work Done by Gravity	Dynamics Cart and Track System with Go Direct Sensor Carts
15	Energy in Collisions	Dynamics Cart and Track System with Go Direct Sensor Carts
16	Rube Goldberg Machine	—
17	Charge and Charge Models	Go Direct Static Charge
18	Coulomb's Law	Go Direct Static Charge
19	Measuring Electric Current	Go Direct Current Probe, Vernier Circuit Board 2
20	Conservation of Charge	Go Direct Current Probe, Vernier Circuit Board 2
21	Voltage in a Circuit	Differential Voltage Probe
22	Battery Challenge	Go Direct Voltage Probe, Go Direct Current Probe
23	Magnetic Field of a Current	Go Direct 3-Axis Magnetic Field Sensor, Go Direct Current Probe
24	Current from a Changing Field	Go Direct 3-Axis Magnetic Field Sensor, Go Direct Current Probe
25	Generating Electricity	Go Direct Energy Sensor, KidWind simpleGEN
26	Speaker	Power Amplifier
27	Wave Speed on a String	Power Amplifier, Power Amplifier Accessory Speaker
28	Speed of Sound	Microphone
29	Interference and Diffraction	Diffraction Apparatus, Combination Track/Optics Bench
30	Sound and Loudness	Go Direct Sound Sensor
31	Wave Communication Challenge	Go Direct Light and Color Sensor
32	Energy Storage in Capacitors	Go Direct Voltage Probe, Go Direct Current Probe
33	Oscillations	Go Direct Motion Detector
34	Heat as Energy Transfer	FLIR ONE Gen 3, Vernier Thermal Analysis® Plus for FLIR ONE™
35	Solar Cells	KidWind 2V/400mA Solar Panel, Go Direct Energy Sensor, Vernier Variable Load, Go Direct Surface Temperature Sensor, Go Direct Light and Color Sensor
36	Rube Goldberg Machine Revisited	—

Advanced Physics with Vernier—Mechanics



Use Vernier probeware to teach mechanics concepts at the college physics, AP* Physics, or IB** Physics level. Use it in addition to *Physics with Vernier* for a comprehensive set of topics. This book has been updated so we have separate instructions for Vernier Graphical Analysis Pro and LabQuest App.

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

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

Order Code

PHYS-AM

Education Level

**High School
College**

Written for

Vernier Graphical Analysis® Pro

Also supports LabQuest® App



To learn more, scan the QR code or visit
[vernier.com/phys-am](https://www.vernier.com/phys-am)

Experiment List and Sensors & Accessories Used

Experiment List and Sensors & Accessories Used		Sensors				Accessories							
		Motion Detector	Photogate	Force Sensor	Rotary Motion	Dynamics System	Bumper and Launcher Kit	Cart Friction Pad	Picket Fence	Cart Picket Fence	Ultra Pulley and Bracket	Centripetal Force Apparatus	Rotary Motion Accessory Kit
A1	An Exploration of Graphical Methods	No sensor or accessory needed											
A2	Investigating Motion	1				1							
A3	Working with Analytical Tools	No sensor or accessory needed											
A4	Introduction to the Vernier Photogate		1						1	1			
1	Motion on an Incline	1				1							
2	Error Analysis		1						1				
3	Newton's First Law	1				1	1	1					
4	Newton's Second Law		1	1		1				1	1		
5	Newton's Third Law			2		1	1						
6	Projectile Motion	Video analysis: No sensor or accessory needed											
7	Energy Storage and Transfer: Elastic Energy			1		1	1						
8	Energy Storage and Transfer: Kinetic Energy		1			1	1			1			
9	Energy Storage and Transfer: Gravitational Energy		1^			1	1			1^			
10A	Impulse and Momentum	1		1		1	1						
10B	Impulse and Momentum		1	1		1	1			1			
11A	Momentum and Collisions	2				1							
11B	Momentum and Collisions		2			1				2			
12A	Centripetal Acceleration		1	1								1	
12B	Centripetal Acceleration		1	1		No accessory needed							
13	Rotational Dynamics				1								1
14	Conservation of Angular Momentum				1								1
15	Simple Harmonic Motion: Mathematical Model	1				No accessory needed							
16	Simple Harmonic Motion: Kinematics and Dynamics	1		1		No accessory needed							
17	Pendulum Periods				1								1
18	Physical Pendulum				1								1
19	Center of Mass	Video analysis: No sensor or accessory needed											

^ For use in the Extension

Advanced Physics with Vernier—Beyond Mechanics



Use Vernier probeware to teach concepts at the college physics, AP* Physics, or IB** Physics level.

Use it in addition to *Advanced Physics with Vernier—Mechanics* and *Physics with Vernier* for a comprehensive set of topics.

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

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

Order Code

PHYS-ABM

Education Level

High School
College

Written for

Vernier Graphical Analysis® Pro

Also supports LabQuest® App



To learn more, scan the QR code or visit
[vernier.com/phys-abm](https://www.vernier.com/phys-abm)

Experiment List and Sensors & Accessories Used

		Sensors								Accessories													
		Gas Pressure Sensor	Temperature Probe	Power Amplifier	Microphone	Charge Sensor	Differential Voltage Probe	Current Probe	Instrumentation Amplifier	Emissions Spectrometer	Power Amp Accessory Speaker	Vernier Ultra Pulley	Electrostatics Kit	Resistivity Rod Set	Vernier Circuit Board	Vernier Inductor	Optics Expansion Kit	Mirror Set	Dynamics Track ¹	Diffraction Apparatus	VIS-NIR Optical Fiber		
1	Behavior of a Gas	X	X																				
2	Heat Engines	X	X																				
3	Standing Waves on a String			X							X	X											
4	Standing Waves in a Column of Air		O		X																		
5	Doppler Effect																						
6	Electrostatics					X							X										
7	Coulomb's Law																						
8	Mapping Electric Potential			X ²			O ³		O ³														
9	Factors Affecting Electrical Resistance			O ⁴				O ⁴	X					X									
10	Series and Parallel Circuits			X ⁵			X	X							X								
11	Faraday's Law: Moving Magnet								X														
12	Faraday's Law: Alternating Current								X														
13	Capacitors and Inductors						X	X							X	X							
14	RLC Circuits			X			X	X							X	X							
15	Curved Mirrors and Images																X	X	X				
16	Thin Lenses and Real Images																X		X				
17	Thin Lenses and Virtual Images																X		X				
18	Aperture and Depth of Field																X		X				
19	Interference																X		X	X			
20	Diffraction																X		X	X			
21	Spectrum of Atomic Hydrogen									X													X
22	Planck's Constant			X			X	X		X													X

KEY X = Required
 O = Optional

¹ The Dynamics Track is included in the Vernier Dynamics System; it can also be purchased separately.

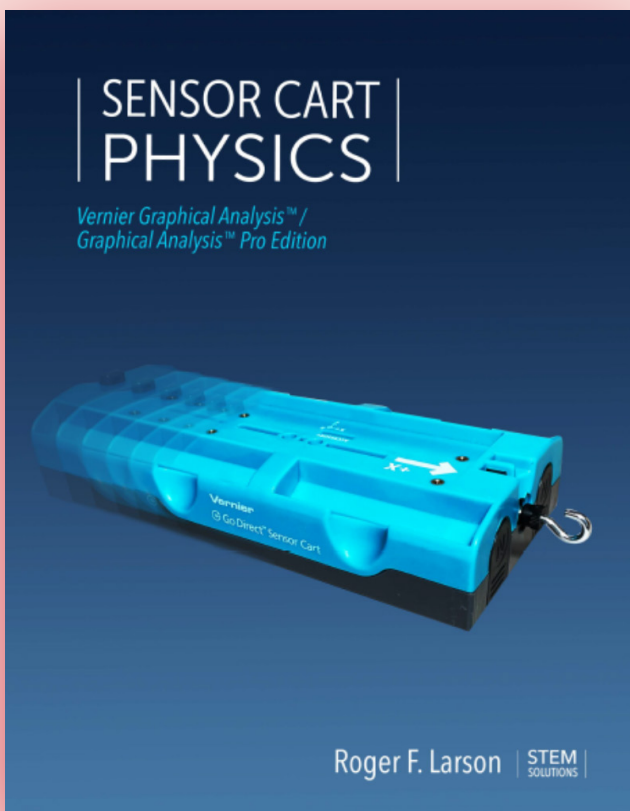
² If a Vernier Power Amplifier is not available, a conventional power supply can be used.

³ A Voltage Probe or Instrumentation Amplifier is required.

⁴ If a Vernier Power Amplifier is not available, a conventional power supply and Current Probe can be used.

⁵ If a Vernier Power Amplifier is not available, two D-cell batteries can be used.

Sensor Cart Physics



Sensor Cart Physics features 23 guided-inquiry investigations. It provides a stimulating structure to explore kinematics. The investigations make exclusive use of the Vernier Go Direct® Sensor Cart.

Each investigation utilizes the synced video and data featured in the new subscription-based Vernier Graphical Analysis Pro app. The graphical display correlates videos of the events to the data communicated by the Sensor Cart using Bluetooth® wireless technology. This offers remote learners the opportunity to conduct the investigations without the physical presence of a Sensor Cart.

Order Code

HSB-SCP-E

Education Level

High School

Written for

Vernier Graphical Analysis®

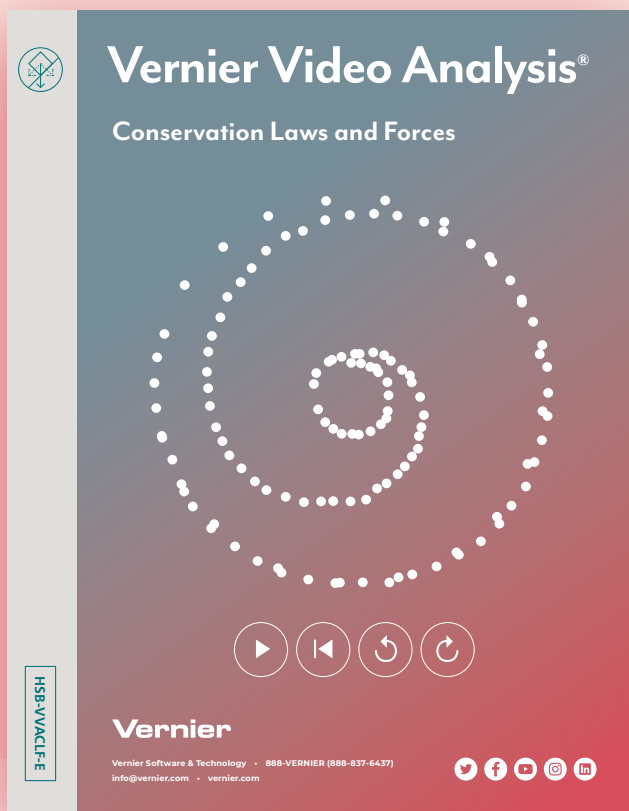


To learn more, scan the QR code or visit
[vernier.com/hsb-scp-e](https://www.vernier.com/hsb-scp-e)

Experiment List and Sensors Used

		Sensors & Accessories	
		Required	Optional
	Part 1: Kinematics	- Go Direct Sensor Cart - Go Direct Sensor Cart Accessory Kit - Friction Pad DTS	- Dynamics Cart and Track System with Go Direct Sensor Cart - Combination Track/Optics Bench
1	Motion with Constant Velocity: Slow, Slower, Slowest		
2	Motion on an Incline: Rollin' Down		
3	Motion on an Incline: Coasting Up and Down		
	Part 2: Newton's Laws of Motion		
4	Newton's First Law of Motion: The Law of Inertia		
5	Newton's Second Law of Motion: $F = ma$		
6	Newton's Third Law of Motion: Action—Reaction		
	Part 3: Forces		
7	Gravitational Field Strength: F_g/m		
8	Inertial and Gravitational Mass: What's the Difference?		
9	Hooke's Law: Stretching Rubber Bands		
10	Specific Gravity: Density Without Units		
11	The Force of Friction: The Weight Variable		
12	The Force of Friction: The Surface Area Variable		
13	The Coefficient of Friction μ : Comparing Two Methods		
14	Magnets: Force vs. Separation Distance		
	Part 4: The Conservation Laws		
15	Impulse and Momentum: Collisions Analyzed		
16	Converting PE to KE: Downhill Racers		
17	Elastic PE: Plunger Spring Energy		
18	Elastic PE to KE: Launch Speed		
19	Kinetic Energy and Momentum: Elastic Collisions		
20	Kinetic Energy and Momentum: Inelastic Collisions		
21	Kinetic Energy and Momentum: Super-elastic Collisions		
22	Energy and Momentum: Exploding Carts		
23	The Magical Mystery Bounce: Hidden Phases		

Vernier Video Analysis: Conservation Laws and Forces



This e-book, *Vernier Video Analysis: Conservation Laws and Forces*, explores mechanics topics beyond basic motion, such as conservation of energy and conservation of translational and angular momentum.

Order Code

HSB-VVACLF-E

Education Level

High School
College

Written for

Vernier Video Analysis®

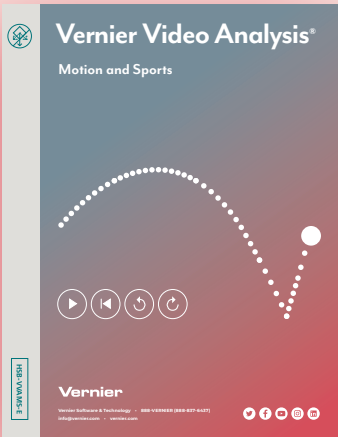


To learn more, scan the QR code or visit
vernier.com/hsb-vvaclf-e

Experiment List and Topics Covered

Experiment List and Topics Covered		Topics														
		Forces	Torques	Work & Power	Linear Momentum	Angular Momentum	Types of Energies	Rotational KE	Energy Transformation	1-D Motion	2-D Motion			Polar Coordinates	Number of videos analyzed	Number of objects tracked
											Linear	Parabolic	Circular/Pendulum			
1	Energy of a Bouncing Ball						X		X	X					1	1
2	Introduction to Weight Lifting	X		X						X					2	1
3	Loop the Loop						X	X	X		X		X		1	4
4	Analysis of Jumping	X								X					2	1
5	Energy in Simple Harmonic Motion	X					X		X	X					2	1
6	Pendulum to Projectile						X		X			X	X		1	1
7	Water Flow From a Tank: Parabolic Trajectory						X		X			X			1	2
8	Conservation of Momentum in Curling				X						X				1	2
9	Collision: Physical Pendulum and Cart				X	X					X		X	X	2	2
10	More Weight Lifting: Bicep Curls		X										X	X	1	1
11	Angular Momentum and Energy					X		X					X	X	1	1
12	Coulomb's Law	X								X					1	2

Vernier Video Analysis: Motion and Sports



This e-book features 12 investigations in which students use Vernier Video Analysis to explore velocity, acceleration, and sports activities.

Order Code

HSB-VVAMS-E

Education Level

High School
College

Written for

Vernier Video Analysis®



Experiment List		Software Used
1	Constant Velocity Motion	Vernier Video Analysis
2	Accelerated Motion	
3	Analysis of Running	
4	Projectile Motion	
5	Kinetic Friction	
6	Terminal Velocity	
7	Refining the Air Drag Model	
8	Analysis of Running with Resistance	
9	1-Dimensional Elastic Collisions	
10	1-Dimensional Inelastic Collisions	
11	Angular Velocity	
12	2-Dimensional Collision	

To learn more, scan the QR code or visit [vernier.com/hsb-vvams-e](https://www.vernier.com/hsb-vvams-e)

Nuclear Radiation with Vernier

Nuclear Radiation with Vernier contains six free experiments for data collection with a radiation monitor.

Order Code

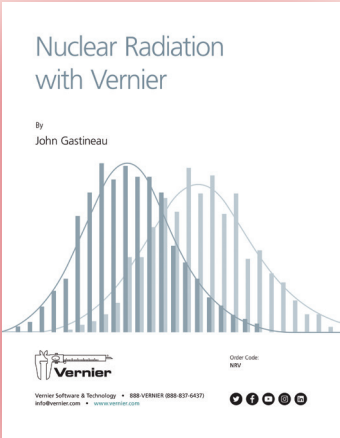
NRV-E

Education Level

High School
College

Written for

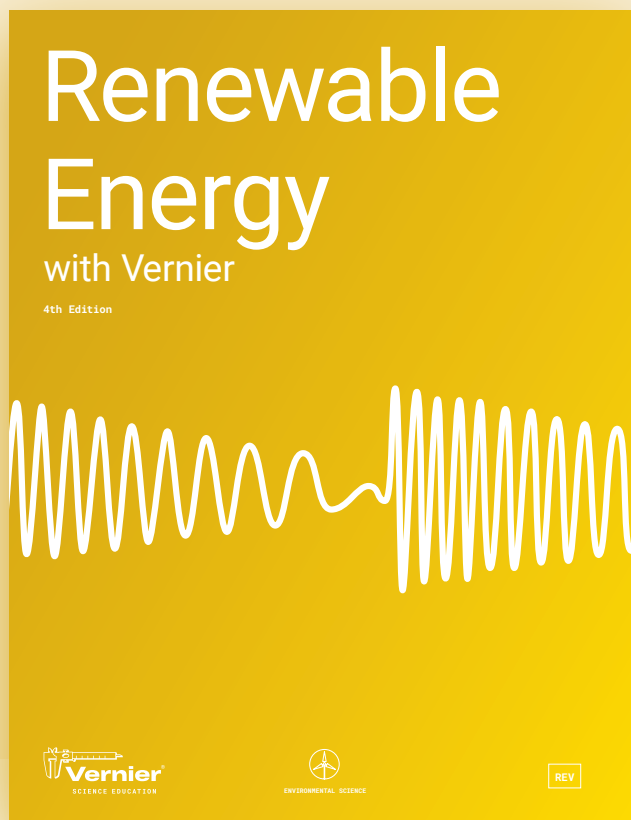
LabQuest® App
EasyData



Experiment List		Sensor Used
1	α , β , and γ	Radiation Monitor
2	Distance and Radiation	
3	Lifetime Measurement	
4	Counting Statistics	
5	Background Radiation Sources	
6	Radiation Shielding	

To learn more, scan the QR code or visit vernier.com/nrv-e

Renewable Energy with Vernier



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

Order Code

REV

Education Level

High School
College

Written for

Vernier Graphical Analysis®

Also supports LabQuest® App



To learn more, scan the QR code or visit
[vernier.com/rev](https://www.vernier.com/rev)

Experiment List and Sensors & Accessories Used

		Sensors				Accessories				
		Light Sensor	Surface Temperature Sensor	Energy Sensor	Anemometer or Weather Sensor	Vernier Variable Load	KidWind Advanced Wind Experiment Kit	KidWind SimpleGEN Kit	KidWind 2V/400mA Solar Panel	KidWind Solar Thermal Exploration Kit
1	Renewable Energy: Why is it So Important?	1								
2	What is Energy?		1							
3	Project: Energy Audit		1							
4	Voltage and Circuits			1^		1*				
5	Current and Resistors			1						
6	Mechanical Power						1			
7	Generators			1				1		
8	Exploring Wind Turbines			1		1	1			
9	Effect of Load on Wind Turbine Output			1		1	1			
10	Blade Variables and Power Output			1		1	1			
11	Solidity			1		1	1			
12	Turbine Efficiency			1	1	1	1			
13	Power Curves			1	1	1	1			
14	Power and Energy			1		1	1			
15	Project: Maximum Energy Output			1		1	1			
16	Project: Build a Wind Farm			1		1	1			
17	Exploring Solar Panels	1		1		1			1	
18A	Effect of Load on Solar Panel Output			1		1			1	
18B	Fill Factor and IV Curve of a Solar Panel			1^^		2				
19	Variables Affecting Solar Panel Output	1**		1		1			1	
20	Effect of Temperature on Solar Panel Output		1	1		1			1	
21	Project: Build a Solar Charger			1		1			2–4	
22	Exploring Passive Solar Heating		1							
23	Variables Affecting Passive Solar Heating		2							
24	Exploring Solar Collectors	1	1							1
25	Variables Affecting Solar Collectors		1							1
26	Project: Solar Cooker		1							

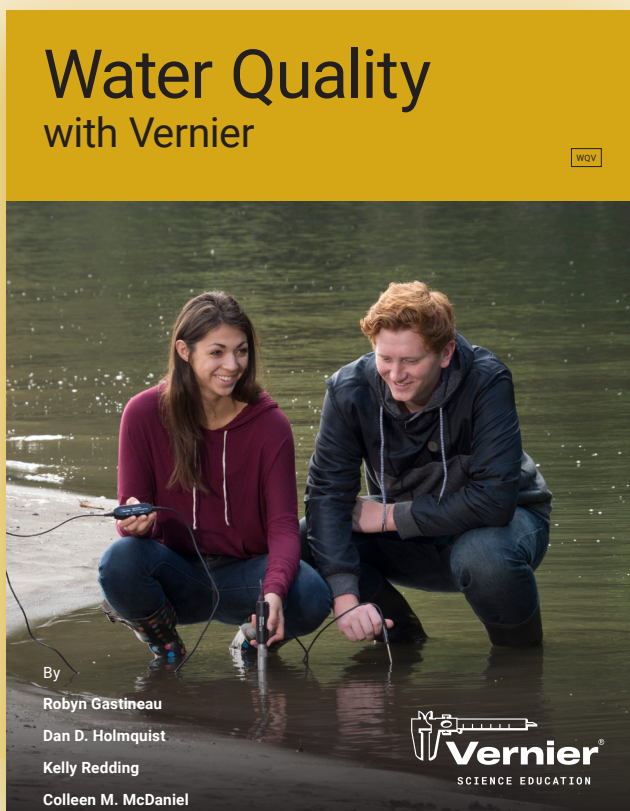
^ If using Go Direct® sensors, Go Direct Voltage is required; Go Direct Energy cannot be used.

^^ If using Go Direct sensors, Go Direct Voltage is required in addition to Go Direct Energy.

* Vernier Resistor Board can be used in place of Variable Load

** Optional sensor

Water Quality with Vernier



This book contains 18 water quality tests, including pH, total dissolved solids, dissolved oxygen, BOD, flow rate, turbidity, nitrates, and phosphates.

Order Code

WQV

Education Level

Middle School

High School

College

Written for

LabQuest® App

EasyData



To learn more, scan the QR code or visit
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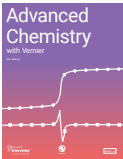
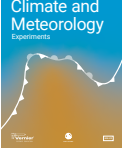
Test List and Sensors Used

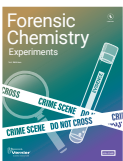
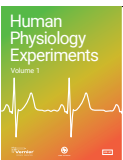
Test List and Sensors Used		Sensors																
		Ammonium ISE	Calcium ISE	Chloride ISE	Colorimeter	Conductivity Probe	Dissolved Oxygen Probe	Drop Counter	Extra-Long Temperature Probe	Flow Rate Sensor	Nitrate ISE	Optical DO Probe	PAR Sensor	pH Sensor	Salinity Sensor	SpectroVis Plus	Stainless Steel Temperature Probe	Turbidity Sensor
1	Temperature							/									/	
2	pH												X					
3	Turbidity																	X
4	Total Solids	No sensor required																
5	Dissolved Oxygen						/				/							
6	Biochemical Oxygen Demand						/				/							
7	Phosphates				/											/		
8	Nitrate				/					/					/			
9	Bacterial Concentration	No sensor required																
10	Ammonium Nitrogen	X																
11	Alkalinity							O					X					
12	Total Dissolved Solids					X												
13	Calcium and Water Hardness		X															
14	Total Water Hardness							O										
15	Chloride and Salinity			/		/									/			
16	Stream Flow								X									
17	Physical Profile of a Lake					X	/*		/*		/*		X				/*	
18	PAR Attenuation in Water											X						

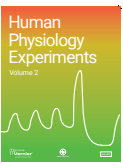
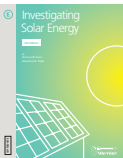
KEY X = Required
 / = Choose One
 O = Optional

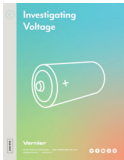
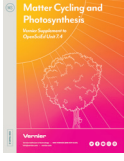
* Choose one between extra-long or stainless steel temperature probes; and choose one between optical DO probe or dissolved oxygen probe

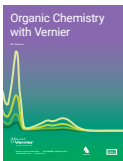
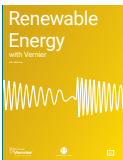
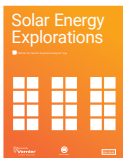
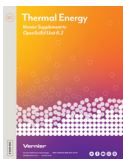
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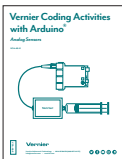
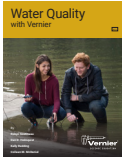
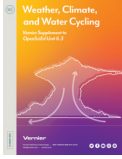
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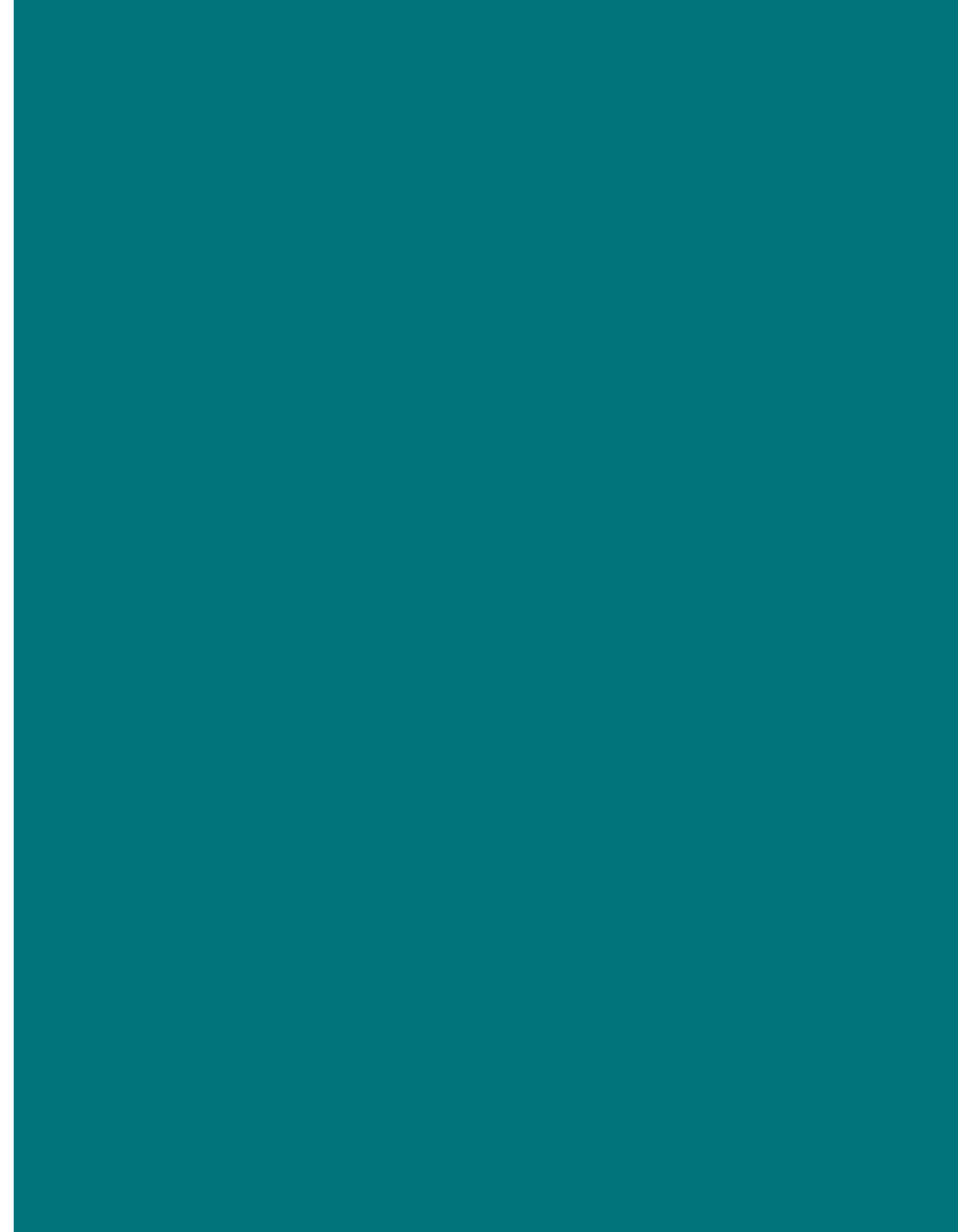
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