

## Digital science education – The complete solution by PHYWE



### Data logging in science education: Innovative. Future-proof. Intuitive

Modern science education is characterized by use of digital media.

Sensors in combination with matching measurement software and mobile devices enable exciting and effective lessons.

Classical experiments, the best devices and quality products combined with modern measurement and evaluation systems - this is the future of education by PHYWE...

...all from a single partner.

### Advantages

- Complete solution - everything from a single partner
- A secure and future-proof investment - Your system can grow alongside you
- Outstanding price-performance ratio
- Modern design and latest transmission technology: Bluetooth 4.0  / USB 
- All operating systems iOS  Android  Windows 
- Intuitive, simple and modern

Physics **Phy**

Chemistry **Che**

Biology **Bio**

Sciences **Sci**

# PHYWE offers the complete solution – for your digital science education

- More than 100 years of experience as a manufacturer of science teaching and learning systems
- More than 30 years of expertise and competence in digital science education
- In-house soft- and hardware development, including the latest generation of innovative, digital sensors and measuring devices combined with state-of-the-art measuring software
- Fully integrated solutions appropriate to your curriculum
- The full range of services and products for your digital science education from PHYWE



Student experiments **TESS** | PHYWE

Teacher experiments **Demo** | PHYWE

## Experiment sets - all in one

- Over 70 student and teacher experiment sets
- For more than 1200 Hands-on experiments
- Covering more than 100 topics from the curriculum
- Analog and digital sets available





**Cobra SMARTsense** | PHYWE



**Cobra DigiCart** | PHYWE

**Cobra Xpert-Link** | PHYWE

## Sensors and measuring systems

- Latest transmission technology, e.g. Bluetooth 4.0  and USB 
- Powerful but easy to use
- From standard uses up to expert devices
- Compatible with PHYWE teaching systems

## Software

- Intuitive handling
- Connection via Bluetooth 4.0  or USB 
- Extensive evaluation functions, Data exchange, Data processing
- Experiment guides available directly in the software
- Connection of sensors via plug & play



**measureAPP** | PHYWE

**DigiCartAPP** | PHYWE

**measureLAB** | PHYWE

# Sets and sensors for digital science education – Everything at a glance





The best from all PHYWE areas combined for your modern digital science education.

More than **50** Student experiment sets  
**19** Demonstration experiment sets  
more than **1200** Hands-on-Experiments











Faculty/ Subject	Topic	TESS set (Item No.)	Qty. experi- ments	Demo sets (Item No.)	Qty. experi- ments	Recommended Cobra SMART- sense sensors	TESS Digital set (Item No.)	
<b>SCIENCE</b>	Substances in everyday use	15234-88	15			12903-00	15234-88D	
	Mechanical devices in everyday use	15239-88	12			12904-01	15239-88D	
	Electrical and magnetic devices in everyday use	15238-88	15			12901-01; 12902-01	15238-88D	
	Light and shadow in everyday life	15236-88	12					
	Senses	15241-88	15					
	Water	15233-88	14	13234-88	5	12903-00	15233-88D	
	Heat	15235-88	13	13236-88	5	12903-00	15235-88D	
<b>PHYSICS</b>	<b>MECHANICS</b>	Physical quantities, forces, simple machines, ...	25271-88	32	15510-88	24	12904-01	25271-88D
		Force effect, friction, liquids and gases	25272-88	20	15511-88	19	12904-01	
		Linear motion	25284-88	11	15514-88	13	12945-00; 12908-01	
		Acoustics, basics	25289-88	14			12939-00	
		Acoustics, Supplements	15321-88	8			12939-00	
	<b>THERMODYNAMICS</b>	Temperature, thermal properties of liquids, ...	25274-88	21	15530-88	15	12903-00	25274-88D
		Specific heat capacity, thermal properties of..	25275-88	13			12903-00	
	<b>ELECTRICITY</b>	Electrostatics	25240-88	16				
		Magnetism	15230-88	11			12947-00	
		Equipotential lines and electric field	25250-88	5			12901-01	15250-88D
Simple circuits and electrical resistance, ...		25264-88	28	15569-88	30	12901-01, 12902-01	25264-88D	
Induction and electric motor		25266-88	18	15571-88	24	12901-01, 12902-01		
Electromagnetism				25574-88	8	12947-00 (included)	25269-88	
Electric motor / Generator		15221-88	10	25573-88	8	12901-01, 12902-01, 12947-00	15221-88D	
Semiconductor components		25267-88	23	15572-88	27	12901-01, 12902-01		
Renewable energies: basics and thermal energy		25287-88	17	15580-88	10	12903-00; 12901-01, 12902-01	25287-88D	
Solar cells, wind energy and hydropower		25288-88	26	15581-88	17	12903-00; 12901-01, 12902-01		
Fuel cells		25286-88	10	15582-88	7	12903-00; 12901-01, 12902-01		
Electrics on the board: simple circuits, ...		15281-88	35			12901-01, 12902-01		
Electrics on the board: electrochemistry, electro mag., ...		15291-88	33			12901-01, 12902-01		
<b>OPTICS</b>	Geometrical optics	25276-88	40	15550-88	60			
	Optical instruments	25277-88	30	15560-88	5	12906-01	25277-88D	
	Wave optics	15280-88	29	15565-88	12	12906-01		
	Optics / Atomic physics	15350-88	16			12901-01, 12902-01	15350-88D	
<b>RADIOACTIVITY</b>	Radioactivity			15590-88	15	12937-00 (included)	25261-88	
<b>CHEMISTRY</b>	General chemistry	25300-88	25			12903-00	25300-88D	
	Inorganic chemistry	25301-88	35			12903-00	25301-88D	
	Acids, bases, salts	25302-88	31			12903-00; 12921-00	25302-88D	
	Analytical chemistry	25303-88	14			12921-00; 12923-01	25303-88D	
	Organic chemistry	25304-88	36			12903-00	25304-88D	
	Polymer chemistry	15305-88	18			12903-00	15305-88D	
	Food chemistry	15306-88	39			12903-00	25306-88D	
	Electrochemistry	30505-88	23			12901-01; 12902-01	30505-88D	
<b>BIOLOGY</b>	Microscopy	25290-88	50					
	General biology	25296-88	41			12903-00	25296-88D	
	Biochemistry and Plant physiology			15620-88	10	12921-00; 12906-01; 12905-01; 12903-00; 12922-00; 12932-01; 12933-01 (included)	15620-88D	
	Environment and outdoor					12931-01; 12921-00, 12922-00, 12903-00, 12906-01 (included)	12626-88D	
	Soil examination	30836-88	20					
	Determination of water quality	30834-88	6					
	Human and Electrophysiology					12934-01, 12936-01, 12935-01, 12903-00 (included)	25674-88D	
Genetics	15310-88	4						

# Cobra SMARTsense: SMART. Intuitive. Measuring.











The smart solution for digital measurement – for school or university

- 45 plug and play sensors
- Bluetooth 4.0  and USB 
- measureAPP for all operating systems ( iOS ) and all devices
- Outstanding price-performance ratio
- More than 400 interactive experiment descriptions for digital lessons in physics, chemistry, biology and science
- Reliable, long-lasting lithium-ion batteries with automatic charge protection easy to recharge via USB
- Battery life up to 50 teaching lessons











## 168 experiments in Physics

Sensor	Voltage	Current	Force	Temperature	Photogate	Pressure	Acceleration	Motion	Magnetic field	Light
Figure										
Measured value	voltage	current	force	temperature	time	pressure	acceleration	distance	magnetic flux	brightness
Meas. range	± 30 V *	± 1 A *	± 50 N	- 40...120 °C	0 ... ∞ s	20...400 kPa	± 8 g	0.20...2 m	130 mT / 5 mT	1...128 klx
Resolution	0.02 V	0.5 mA	30 mN	0.01 °C	0.01 ms	0.1 kPa	0.01 g	1 mm	0.1 mT / 0.001 mT	1 lx
Sampling rate	1 kHz / 10 kHz	1 kHz / 10 kHz	1000 Hz	10 Hz	1000 Hz	500 Hz	100 Hz	50 Hz	20 Hz	10 Hz
Battery	Li-ion battery	Li-ion battery	Li-ion battery	CR2032	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery
Item number	12901-00 / 01	12902-00 / 01	12904-01	12903-00	12945-00	12905-01	12907-01	12908-01	12947-00	12906-01

## 64 experiments in Chemistry

Sensor	pH	Conductivity	Dropcounter	Colorimeter	Thermocouple	Nitrate Ion	Ammonium Ion	Chloride Ion	Calcium Ion	Potassium Ion
Figure										
Measured value	pH	conductivity	drop count	transmission	temperature	nitrate concentration	ammonium concentration	chloride concentration	calcium concentration	potassium concentration
Meas. range	0...14 pH	0...20,000 µS/cm 0...100 °C	0...∞ Imp	0...100 %, 0...3 abs, 0...400 NTU	-200...1200 °C	0.6...6200 ppm	0.9...1800 ppm	1.8...3550 ppm	0.4...4000 ppm	0.4...3900 ppm
Resolution	0.01 pH	8 µS/cm, 0.1 °C	30 Imp/s	0.1%, 0.01 abs	0.1 °C	2 ppm	0,5 ppm	1 ppm	1 ppm	1 ppm
Sampling rate	100 Hz	10 Hz	50 Hz	1 Hz	10 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz
Battery	CR2032	CR2032	Li-ion battery	Li-ion battery	Li-ion battery	CR2032	CR2032	CR2032	CR2032	CR2032
Item number	12921-00	12922-00	12923-00	12924-01	12938-01	12912-00	12913-00	12914-00	12915-00	12916-00

## 72 experiments in Biology

Sensor	Humidity	EKG	CO <sub>2</sub>	Spizometer	Heart Rate	Oxygen	Blood pressure	Skin resistance	Ethanol vapor	Weather station
Figure										
Measured value	humidity	voltage	CO <sub>2</sub> concentration	volume flow	heart rate	O <sub>2</sub> -concentration	blood pressure	skin resistance	ethanol concentration	Air pressure, humidity, temperature
Meas. range	0...100 % rH	0...4.5 mV	0...100,000ppm	± 10 l/s	30...200 bpm	0...20 mg/l 0...100 %	30...200 bpm	0...10 µS	0...3 %	0...10 µS
Resolution	0.1 % rH	4.5 µV	2 ppm	0.01 l/s	1 bpm	0.01 mg/l, 0.1 %	1 bpm	0.01 µS	..	0.01 µS
Sampling rate	10 Hz	1000 Hz	1 Hz	200 Hz	10 Hz	100 Hz	10 Hz	100 Hz	100 Hz	0.01 µS
Battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery
Item number	12931-01	12934-00 / 01	12932-01	12936-01	12935-01	12933-01	12944-00	12942-00	12948-00	12946-00

\* Overvoltage protected

Item number: -00 = Bluetooth 4.0 / -01 = USB + Bluetooth 4.0

96 experiments in Science							
Sensor	Voltage	Current	Temperature	Force	Light	CO <sub>2</sub>	Humidity
Figure							
Measured value	voltage	current	temperature	force	brightness	CO <sub>2</sub> concentration	humidity
Meas. range	± 30 V *	± 1 A *	- 40...120 °C	± 50 N	1...128 klx	0...100,000ppm	0...100 % rH
Resolution	0.02 V	0.5 mA	0.01 °C	30 mN	1 lx	2 ppm	0.1 % rH
Sampling rate	1 kHz / 10 kHz	1 kHz / 10 kHz	10 Hz	1000 Hz	10 Hz	1 Hz	10 Hz
Battery	Li-ion battery	Li-ion battery	CR2032	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery
Item number	12901-00 / 01	12902-00 / 01	12903-00	12904-01	12906-01	12932-01	12931-01

Radioactivity	Surface Temperature	Rotary Motion	Energy	Sound	Wide Range Temperature	Force & Acceleration
radioactivity	surface temperature	angle	current, voltage, work	sound level	temperature	acceleration
0...40000 c/min	- 25...125 °C	30 rps	± 30 V / ± 1 A	0.1...15 kHz/55...110dB	- 20...330 °C	± 50 N / ± 16 g
1 c/min	0.1 °C	0.125°	-	0.1 dB	0.01°	30 mN
100 Hz	10 Hz	100 Hz	100 Hz	-	10 Hz	1000 Hz
Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	Li-ion battery	CR2032	Li-ion battery
12937-01	12917-00	12918-00	12919-00	12939-00	12910-00	12943-00



Oxygen Reduction Potential (ORP)	Temperature
redox potential	temperature
2000...2000 mV	- 40...120 °C
1 mV	0.01 °C
100 Hz	10 Hz
CR2032	CR2032
12927-00	12903-00

pH	Conductivity
pH	conductivity
0...14 pH	0...20,000 µS/cm
0.01 pH	8 µS/cm, 0.1 °C
100 Hz	10 Hz
CR2032	CR2032
12921-00	12922-00

Matching the sensors, the measurement software **measureAPP** PHYWE for simple and fast data acquisition with numerous advantages:

- **Simplicity** - Quick and intuitive measurements
- **Individualization** - Creation of individual notes, photos or videos to document the measurement results
- **Connectivity** - Wireless data exchange and connection of sensors via Bluetooth 4.0 or USB
- **Platform independency** - Availability of the app for all operating systems ( **Android**, **iOS**, **Windows**) and devices (smartphone, tablet and desktop PCs)
- **Completeness** - Find and open experiment guides directly in the app


Free download:

iOS

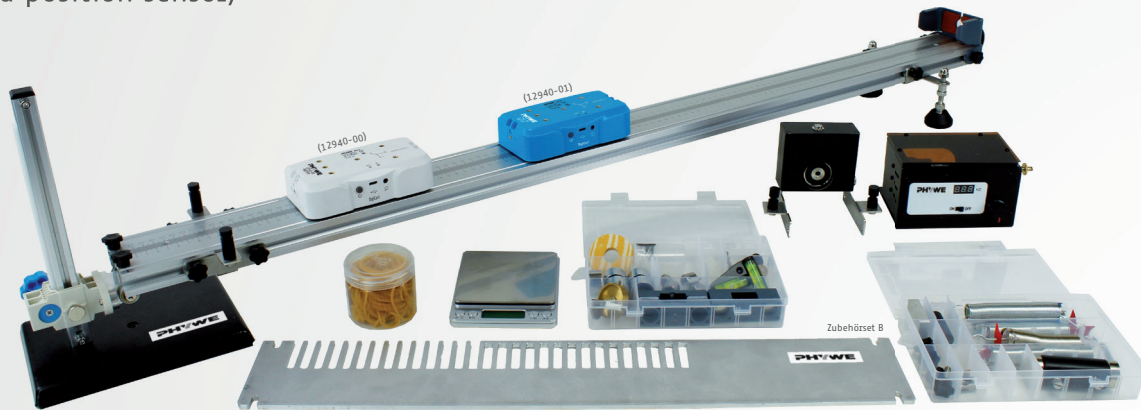
Products	Item number
USB fast charger with 5 USB ports	07934-99
measureAPP	14581-61

# Cobra DigiCart: Simple. Complete. Dynamic.

Everything for the school curriculum topic dynamics in one set


- Up to 20 experiments in one set
- Bluetooth 4.0 
- Reliable, long-lasting lithium-ion batteries with automatic charge protection easy to recharge via USB
- Integrated sensors (force, velocity, acceleration and position sensor)

	Force sensor	Velocity sensor	Acceleration sensor	Position sensor
Measuring ranges	10N/50N	3m/s	16g	-
Resolution	0.01N/0.03N	0.001 m/s	0.01g	0.1mm
Sampling rate	1000Hz/5000Hz	800Hz	500Hz	800Hz



DigiCart Expert Set

The matching measurement software **DigiCartAPP** | PHYWE for mobile digital measurement, recording, evaluation and direct viewing with various advantages:

- **Completeness** - Open experiment guides in the APP
- **Connectivity** - Connect the DigiCart via Bluetooth 4.0  and start measuring
- **Functionality** - Evaluate measurements directly in the APP
- **Availability** - Up to 20 experiments from dynamics at a glance

Free download:



iOS



Products	Item No.
<b>DigiCart Expert Set</b> 2 DigiCarts (white and blue) and track with complete accessories, for 12 experiments	
DigiCart Expert Set	12940-88
<b>DigiCart Basic Set</b> 1 DigiCart (white) and track inclusive basic accessories, for 8 experiments	
DigiCart Basic Set	12940-77
DigiCart Supplementary set	12940-30
DigiCart Expert Set (without Carts)	12940-20
DigiCart Basic Set (without Carts)	12940-10
DigiCart, white (Technically identical, individual colors for didactical purposes only.)	12940-00
DigiCart, blue (Technically identical, individual colors for didactical purposes only.)	12940-01
DigiCartAPP	14582-61

# Cobra Xpert-Link: Fast. Precise. Measuring.

Data acquisition at the expert level

- Fast: High-end system for high-speed measurements up to **100 nanoseconds**
- Efficient: The perfect replacement for your **classic oscilloscope**
- Precise: High-precision amplifier for measurements down to the **Nanoampere range**
- Versatile: Complex measurements can be perfectly coordinated with different **measurement and timer inputs**

### Current measurement on 2 channels

- Channels **galvanically** isolated
- 1 mA...10 A, 2 MHz

### Oscilloscope function

- A special presentation in measureLAB replaces the Oscilloscope
- Measurement of voltages, currents, phase shift and TrueRMS possible

### Voltage measurement on 2 channels

- Channels galvanically isolated
- 10 mV...30 V, 10 MHz



### Supplementary connection options

- Up to 2 fork light barriers or other triggers
- Integrated power supply for the experiment with 5 V / 2 A

### Remote controllable relay




- Relay is simple and safely switchable
- Maximum 30 V / 2 A

### USB connection

- Connection to Computer via USB



The matching measurement software **measureLAB** | PHYWE for precise data evaluation with various advantages:

- **Speed** - Record up to 10 million measurement values per second
- **Accuracy** - High-precision measurements down to the nano range
- **Functionality** - Extensive evaluation functions and data processing capabilities, e.g. oscilloscope function
- **Usability** - Quick and easy measurements, optimized for touch operation
- **Connectivity** - Wireless data exchange and sensor connection via Bluetooth 4.0 , WLAN  or USB 
- Perfect for demonstration experiments and university courses
- Load over 100 preconfigured experiments from all departments



Download:



## Products

Cobra4 Xpert-Link

Item No.

12625-99

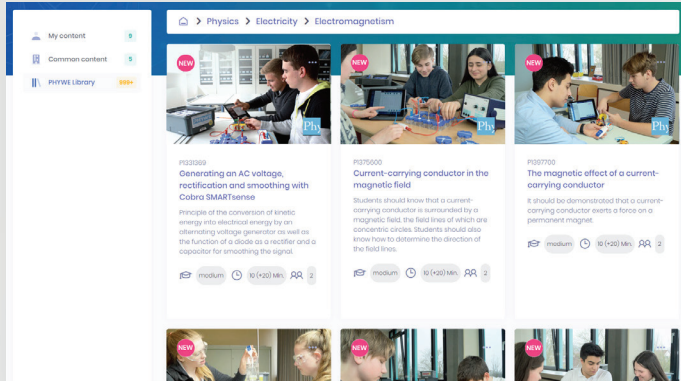
measureLAB

14580-61

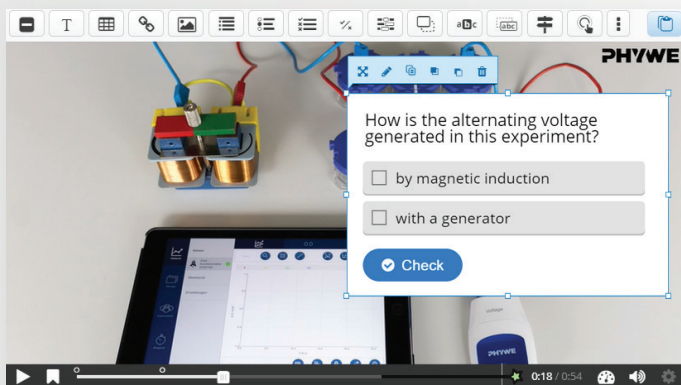
# curricuLAB®: Simple. Perfect. Teaching.

The digital teaching and learning platform for science

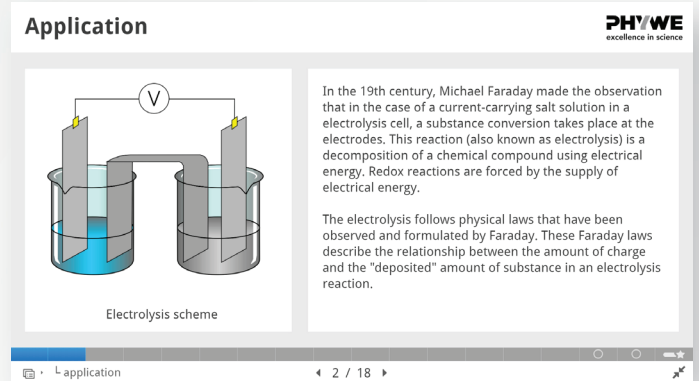
With the new teaching and learning platform curricuLAB® PHYWE offers a unique concept for your digital science education.



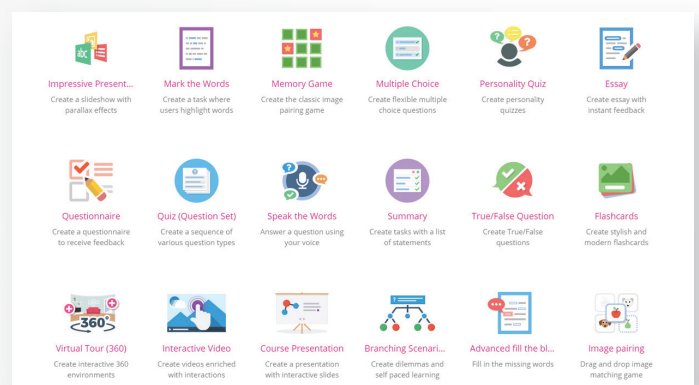
**Something for everyone** – More than 1000 didactically prepared descriptions for student and teacher experiments.



**It could hardly be easier** – The intuitive editor makes every change a breeze.



**Learning content that inspires** – Interactive and practical content motivates and makes you want more.



**No limits to creativity** – Choose from more than 40 highly interactive content types to create your own content.

## curricuLAB® makes you fit for the future (Education 4.0)

- **Self-directed learning** (students can decide where and when they learn)
- **Personalized learning** (learning content adapts to the individual abilities of the students)
- **Flexible learning** (learning with different devices and techniques - mobile learning / micro learning)
- **Practical learning** (interactive learning content supplements theoretical knowledge with practical action)
- **Supported learning** (continuous assessment of students for more support, guidance and opportunities for improvement during the learning process)
- **More efficient teaching** (for teachers, this means didactic and media versatility and thus motivation and variety as well as work facilitation and time saving)

### Products

curricuLAB® (online), site licence (available from 3rd quarter 2020)





### Item No.

14577-62

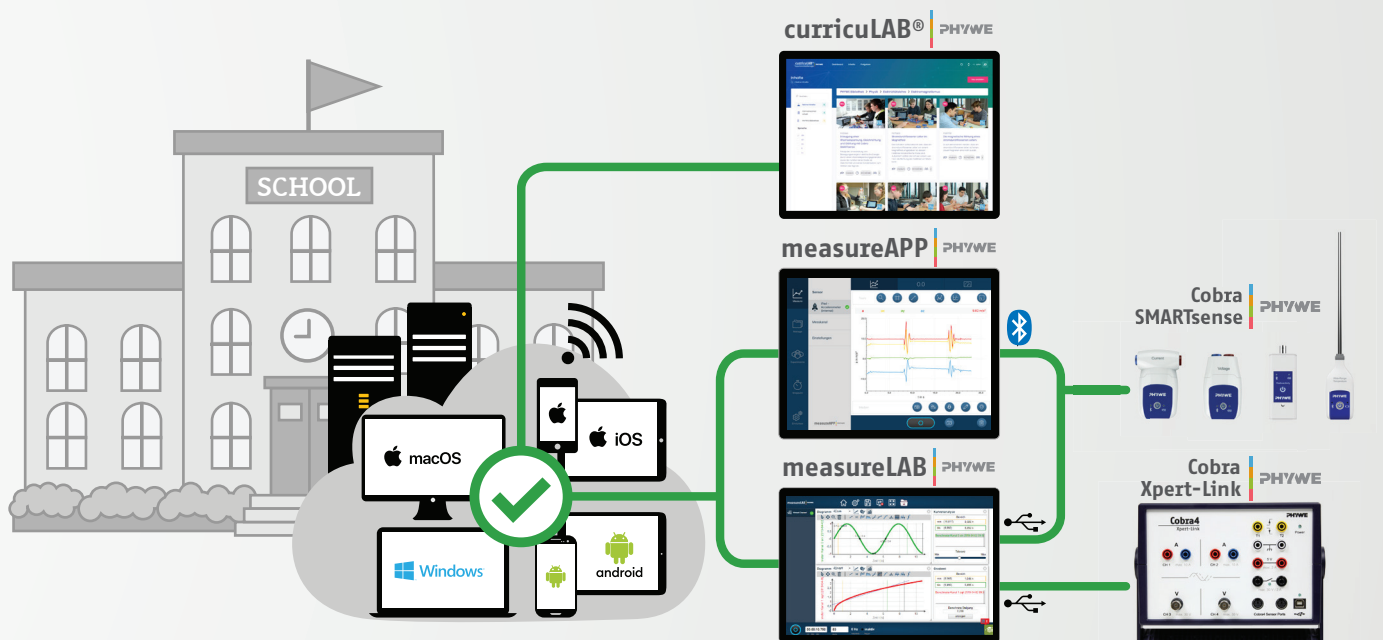


# Whatever IT infrastructure you have – We have the solution for your digital science education

Our solution for your digital science education fits your needs, independent of your use of

- WLAN , Bluetooth 4.0  or wired (LAN)
- Windows , macOS, iOS or Android 
- smartphone, tablet or desktop
- school cloud, learning platform or no digital solution at all

Our intuitiv and modern products help you to take the next step in the digitalization of your science education.



PHYWE has been your professional partner since more than 100 years. During the last 30 years we are even focussing on computer-assisted and digital education. Our curriculum-compliant concept transfers the entire PHYWE portfolio into the digital world. You can use this!

If you have any questions about digital science education, please contact us: [digital-education@phywe.de](mailto:digital-education@phywe.de).

Coming soon  
at PHYWE



## Cobra SMARTlink: Simple. Connect. Measuring.

The easy way to measure with Cobra SMARTsense

The ideal display unit for Cobra SMARTsense with integrated sensors  
(available from Q3 2020).



## All in one SMART Experiments – SMART and easy measurement

Get results in three easy steps.

1. Get SMART Experiment out of the cabinet
2. Insert Cobra SMARTsense sensor
3. Measure

The new 8 all in one SMART Experiments are:

- Archimedes' principle (Boyancy law)
- Mathematic pendulum
- Hooke's Law
- Newtons 3rd Law
- Square Distance Law (available from Q2 2020)
- Magnetic attraction (available from Q2 2020)
- Bergmann's Rule (available from Q2 2020)
- Variable g-pendulum (available from Q2 2020)



Hooke's Law



Archimedes' principle

# PHYWE

excellence in science

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