

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.) | |
|----------------------------|---|---|--------------------------|----------------------------|--------------------------|---|-----------------------------------|-----------|
| SCIENCE | 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 | |
| PHYSICS | MECHA- NICS | 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 | |
| | THERMO- DYNAMICS | 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 | |
| | ELECTRI- CITY | 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 | |
| OPTICS | Electrics on the board: electrochemistry, electro mag., ... | 15291-88 | 33 | | | 12901-01, 12902-01 | | |
| | 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 | | |
| RADIO- ACTIVITY | Optics / Atomic physics | 15350-88 | 16 | | | 12901-01, 12902-01 | 15350-88D | |
| | Radioactivity | | | 15590-88 | 15 | 12937-00 (included) | 25261-88 | |
| CHEMISTRY | 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 | |
| BIOLOGY | 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 ₂ | Spizometer | Heart Rate | Oxygen | Blood pressure | Skin resistance | Ethanol vapor | Weather station |
|----------------|---|---|---|---|---|---|---|---|---|---|
| Figure |  |  |  |  |  |  |  |  |  |  |
| Measured value | humidity | voltage | CO ₂ concentration | volume flow | heart rate | O ₂ -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 ₂ | Humidity |
| Figure | | | | | | | |
| Measured value | voltage | current | temperature | force | brightness | CO ₂ 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



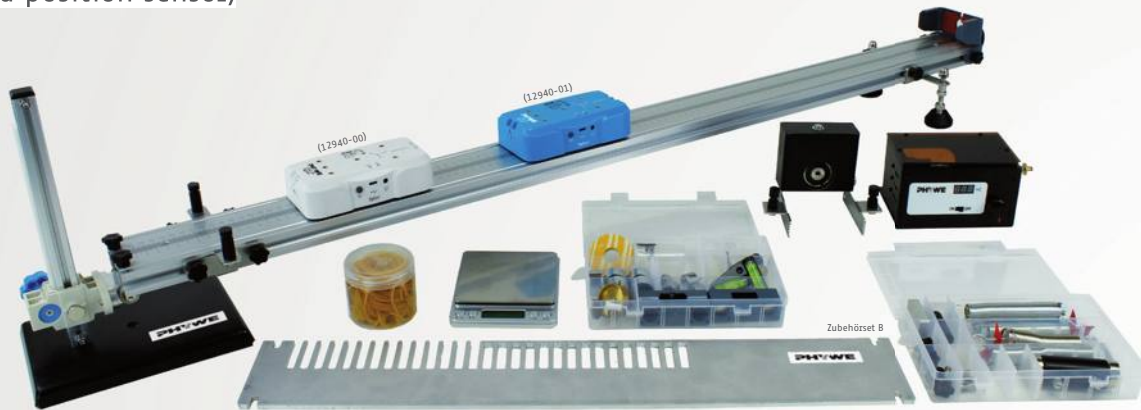
| Products | Item number |
|-----------------------------------|-------------|
| USB fast charger with 5 USB ports | 07934-99 |
| measureAPP | 14581-61 |

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. |
|--|----------|
| DigiCart Expert Set 2 DigiCarts (white and blue) and track with complete accessories, for 12 experiments | |
| DigiCart Expert Set | 12940-88 |
| DigiCart Basic Set 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:

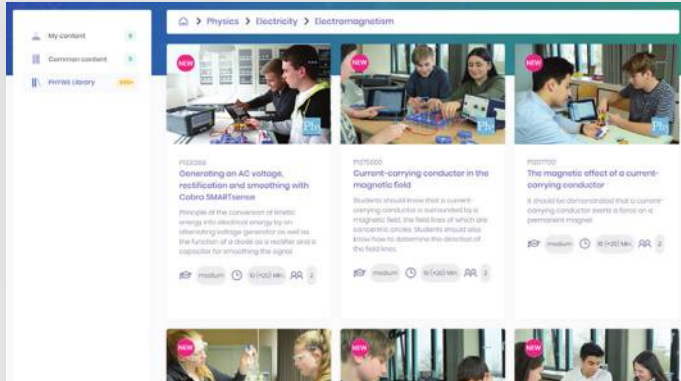


| Products | Item No. |
|-------------------|----------|
| Cobra4 Xpert-Link | 12625-99 |
| measureLAB | 14580-61 |

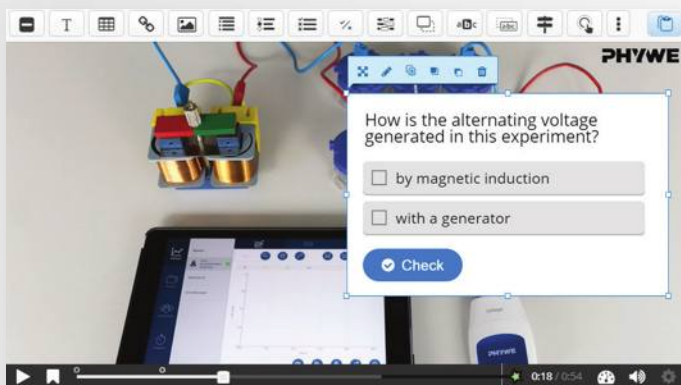
curricuLAB®: Simple. Perfect. Teaching.

The digital teaching and learning platform for science

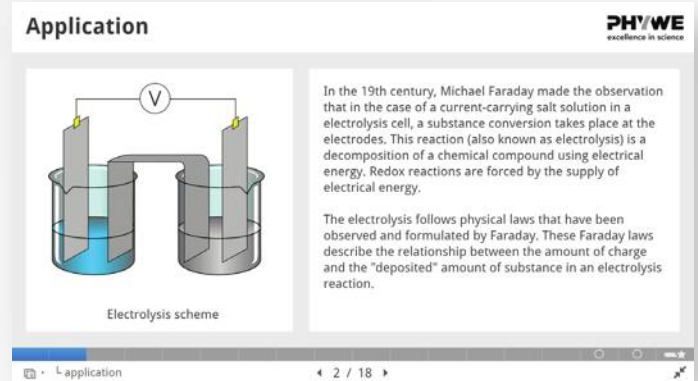
With the new teaching and learning platform curricuLAB® PHYWE offers a unique concept for your digital science education.



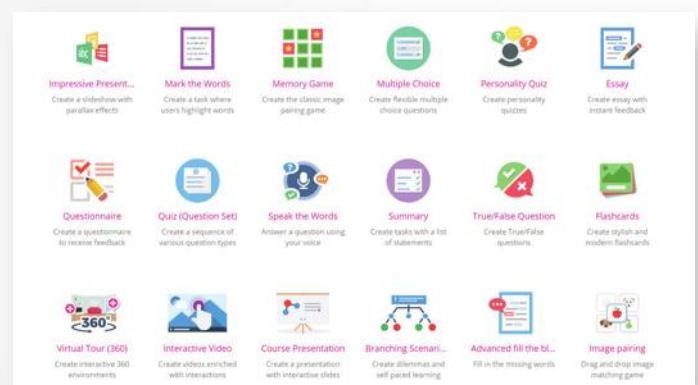
Something for everyone – More than 1000 didactically prepared descriptions for student and teacher experiments.



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.

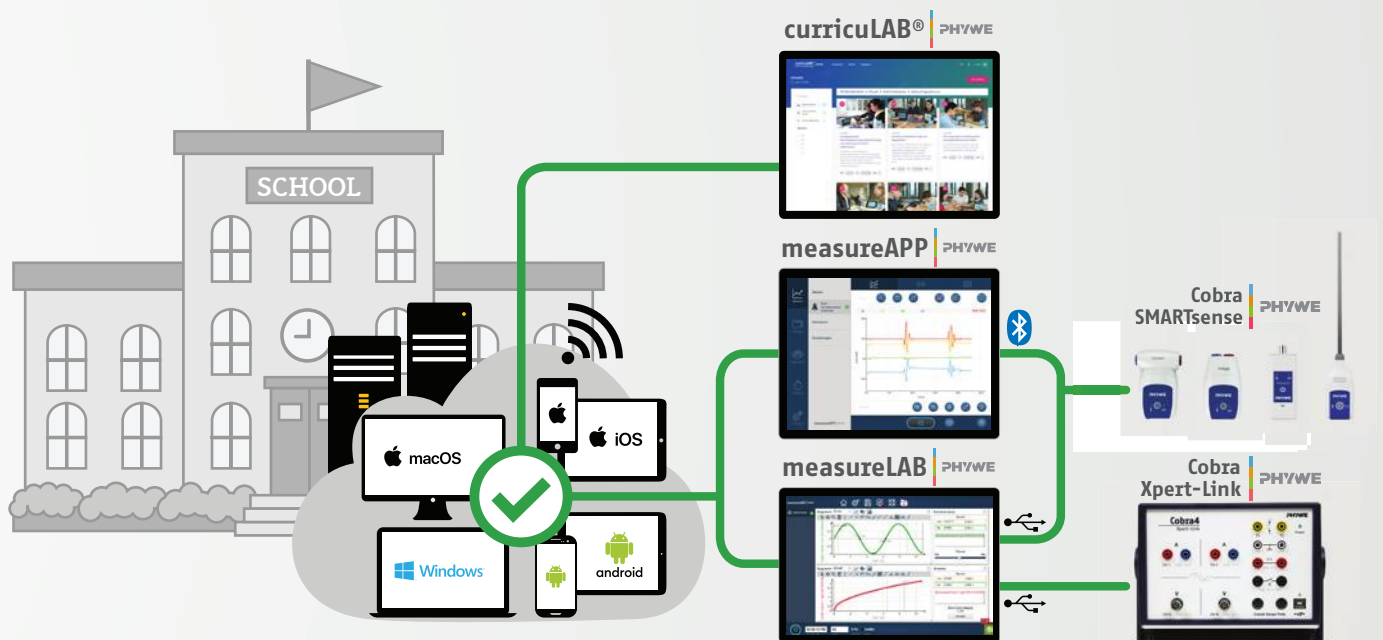
14577-62

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.

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

PHYWE Systeme GmbH & Co. KG
Robert-Bosch-Breite 10
37079 Göttingen / Germany

P. +49 (0) 551 604 - 0
F. +49 (0) 551 604 - 115

info@phywe.com