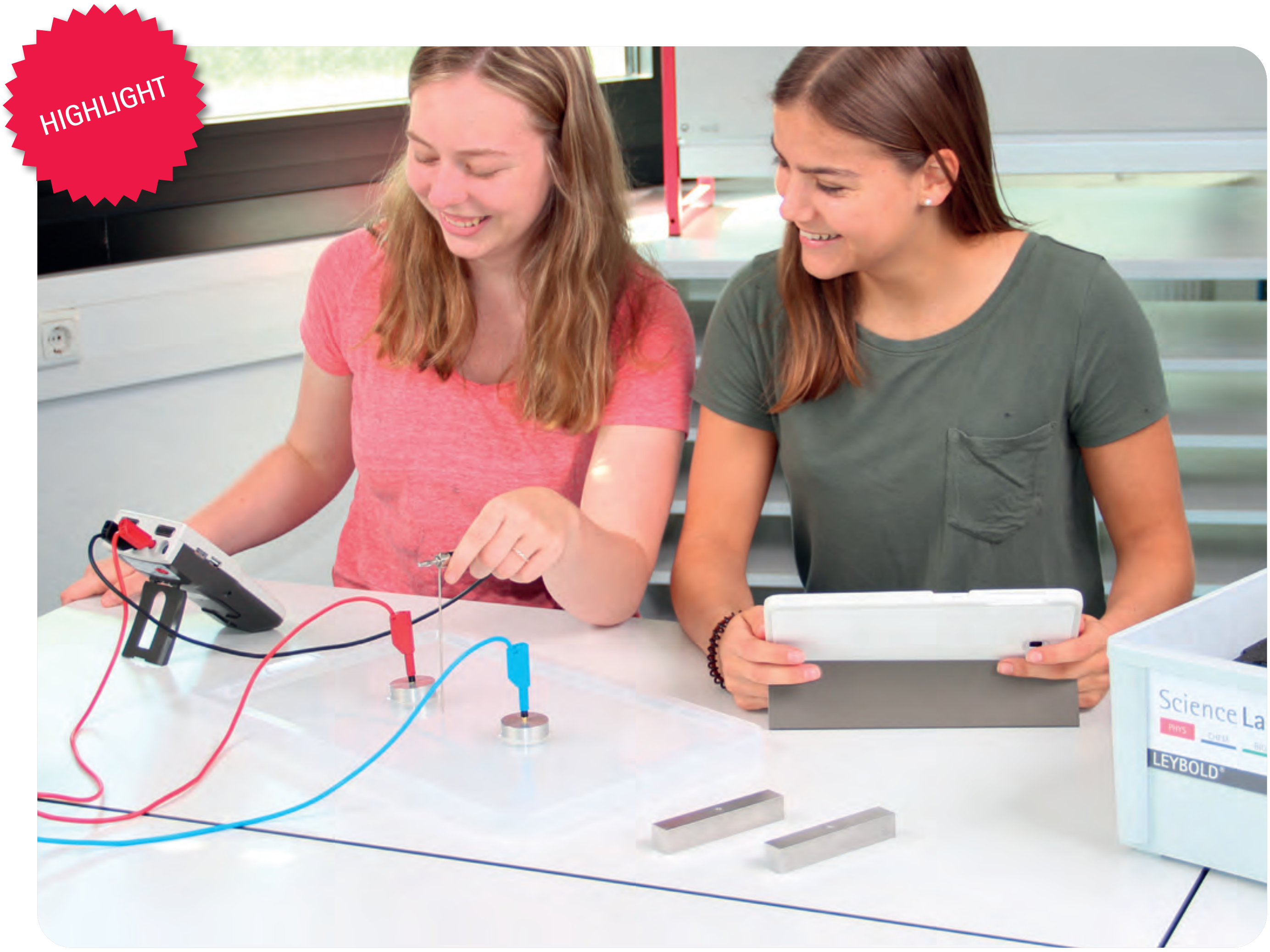
ELECTRICITY/ELECTRONICS

The introduction to *Electricity/Electronics* for the students usually begins with experiments such as the simple electric circuit. They learn the basic principles that are essential for understanding the experiments based on them.

The use of the innovative, modular plug-in board makes it particularly easy to reduce the experiments to a minimum. The safety sockets on the plug-in board enable the use of safety connecting leads. *Five* Electrics Sets provide six topic areas with 154 experiments.

The measurements of current and voltage can be carried out both with the Mobile-CASSY 2 WiFi and with multimeters.



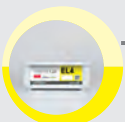
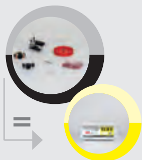
LP3.1.7.1C Equipotential lines between identically shaped electrodes

In this experiment, students record the equipotential lines between two identically shaped electrodes by searching for the points of equal potential difference between the 0 V electrode and the steel needle with the Mobile-CASSY 2 WiFi and depict these points on a graph. For this experiment you will need the set **Science Lab Electrics EL1 (207 131S)**.

Further information about our curriculum-compliant topics and student experiments as well as the corresponding sets can be found on the following pages.

Overview of topics and sets

ELECTRICITY

EXPERIMENT TOPICS		REQUIRED SETS	NO. EXPERIMENTS	DETAILS
LP3.1	ELECTROSTATICS			
LP3.1.1	CONTACT ELECTRICITY	Electrics EL1  207 131S	25	PAGE 72
LP3.1.2	FORCES ACTING BETWEEN CHARGES			
LP3.1.3	ELECTROSTATIC INDUCTION			
LP3.1.4	CHARGE STORAGE			
LP3.1.5	ELECTROSTATIC INTERACTION			
LP3.1.6	INSULATORS AND CONDUCTORS			
LP3.1.7	EQUIPOTENTIAL LINES			
LP3.1.8	PLATE CAPACITOR			
LP3.2	MAGNETISM			
LP3.2.1	MAGNETIC FORCES AND FIELDS	Electrics EL2  207 132S	12	PAGE 78
LP3.2.2	MAGNETIC INDUCTION			
LP3.2.3	MAGNETIC FIELDS			
LP3.3	BASIC ELECTRICAL CIRCUITS AND ELECTROCHEMISTRY			
LP3.3.1	ELECTRICAL CIRCUITS AND SWITCHES	Electrics EL3  207 133S	40	PAGE 84
LP3.3.2	ELECTRICAL MEASUREMENT METHODS			
LP3.3.3	OHMIC RESISTANCE			
LP3.3.4	SPECIAL RESISTORS			
LP3.3.5	VOLTAGE SOURCES			
LP3.3.6	ELECTRICAL APPLICATION CIRCUITS			
LP3.3.7	ELECTROCHEMISTRY			
LP3.4	ELECTROMAGNETISM AND INDUCTION			
LP3.4.1	ELECTROMAGNETISM	Electrics EL3  207 133S + Electrics EL4  207 134S	21	PAGE 90
LP3.4.2	ELECTROMAGNETIC APPLICATIONS			
LP3.4.3	INDUCTION			
LP3.4.4	TRANSFORMERS			
LP3.4.5	APPLICATIONS OF INDUCTION			
LP3.4.6	COILS IN DIRECT AND ALTERNATING CURRENT CIRUITS			
LP3.5	MOTORS AND GENERATORS			
LP3.5.1	GENERATORS	Electrics EL3  207 133S + Electrics EL4  207 134S + Electrics EL5  207 135S	14	PAGE 96
LP3.5.2	ELECTRIC MOTORS			

ELECTRONICS

EXPERIMENT TOPICS		REQUIRED SETS	NO. EXPERIMENTS	DETAILS
LP4.1	BASIC ELECTRONIC CIRCUITS			
LP4.1.1	CAPACITORS	Electrics EL3  207 133S + Electrics EL6  207 136S	42	PAGE 102
LP4.1.2	RELAY CIRCUITS			
LP4.1.3	DIODES			
LP4.1.4	TRANSISTORS			
LP4.1.5	DIODE CIRCUITS			
LP4.1.6	FLIP-FLOPS			
LP4.1.7	AMPLIFIER CIRCUITS			
LP4.1.8	SOLAR CELLS			

ELECTRICS – EL1

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

LP3.1	ELECTROSTATICS	
LP3.1.1	Contact electricity	
LP3.1.1.1	Proof of charge types on friction rods with a glow lamp	
LP3.1.1.2	Proof of charge types on foils and sheets with a glow lamp	
LP3.1.1.3	Contact electricity generated by friction	
LP3.1.2	Forces acting between charges	
LP3.1.2.1	Forces acting between charges on friction rods	
LP3.1.2.2	Forces acting on a charged pendulum pair	
LP3.1.2.3	Operating principle of an electroscope	
LP3.1.3	Electrostatic induction	
LP3.1.3.1	Induction phenomena with conductors and non-conductors	
LP3.1.3.2	Induction phenomena of a pointer	
LP3.1.3.3	Electric induction on a pair of pendulums	
LP3.1.3.4	Induction phenomena on an electroscope caused by friction rods	
LP3.1.4	Charge storage	
LP3.1.4.1	Conductive bodies as charge storage devices	
LP3.1.4.2	Proof of charges on a Faraday cup	
LP3.1.5	Electrostatic interaction	
LP3.1.5.1	Electrostatic forces between friction rod and pendulum	
LP3.1.5.2	Charge transfer through a pendulum	
LP3.1.6	Insulators and conductors	
LP3.1.6.1	Charges on insulators	
LP3.1.6.2	Proof of conductivity with an electroscope	
LP3.1.6.3	Point discharge	
LP3.1.7	Equipotential lines	
LP3.1.7.1	Equipotential lines between identically shaped electrodes	
LP3.1.7.1C	Equipotential lines between identically shaped electrodes (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.1.7.2	Equipotential lines between non-identically shaped electrodes	
LP3.1.7.2C	Equipotential lines between non-identically shaped electrodes (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.1.7.3	Distortion of equipotential lines	
LP3.1.7.3C	Distortion of equipotential lines (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.1.8	Plate capacitor	
LP3.1.8.1	The electric field in a plate capacitor	
LP3.1.8.1C	The electric field in a plate capacitor (with Mobile-CASSY 2 WiFi)	DIGITAL

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi.

25 EXPERIMENTS

HIGHLIGHT

LP3.1.4.2 Proof of charges on a Faraday cup

Students will show that the two different charges can be retained on a Faraday cup and detected with the glow lamp.
For this experiment you will need the set **Science Lab Electrics EL1 (207 131S)**.

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP3.1 ELECTROSTATICS

TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Electrics EL1	Mobile-CASSY 2 WiFi	Science Lab Electricity digital
 +	 +	

Detailed information on the above listed and **additionally required products** are available on the following pages.

Science Lab Electrics EL1 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray. With the equipment set EL1 (207 131S), 25 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topics electrostatics and electric fields. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
2	Safety connecting lead 50 cm, red
2	Safety connecting lead 50 cm, blue
3	Adapter 4-mm plug/4-mm socket
1	Crocodile clip, polished
1	Glow lamp, tubular 90 V
1	Electroscope
2	Friction rods, PVC and acrylic
1	Induction plate 8 cm x 4 cm
1	Bar electrodes for 54509, set 2
1	Set of 3 round electrodes for 54509
1	Faraday's cup

Count	Name
1	Clamping plug
1	Tray, high
1	Lid for tray
1	Cord
1	Plastic clips, pair
1	Electrostatic pendulums, pair
1	Microfibre cloth
1	Steel needle
5 out of	Acetate foils 300 x 300 x 0.1 mm, set of 10
207 131S	Science Lab Electrics EL1 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	521 487	AC/DC Power supply PRO 0...12 V/3 A	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	531 120	Multimeter LDanalog 20	alternative for analog measurements

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 713	LIT: LP3 Science Lab Electricity, digital	
1	675 3410	Water, pure, 5 l	Equipotential lines & plate capacitor experiments (LP3.1.7, LP3.1.8)

leylab.de/207131S

OVERVIEW OF ADVANTAGES

- Students build their "own" electroscope and learn about its function
- Straightforward experiments for the detection and storage of different charges and electric fields
- All electric and electronic components are in transparent housings for a safe and long term use and labelled with the same electronic symbols as real life devices
- Acquired skills: Design and function of electrical measuring instruments

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

MOBILE-CASSY 2 WIFI

With the Mobile-CASSY 2 WiFi, voltage *(U)*, current *(I)*, power *(P)* and energy *(E)* can be measured via 4 mm safety sockets.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP3.1 Electrostatics

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set EL1 (207 131S). Describes 25 experiments from the field of electrostatics.

Topics:
Contact electricity; Force acting between charges; Electrostatic induction; Charge storage; Electrostatic interaction; Insulators and conductors; Equipotential lines; Plate capacitor

520 7131EN	LIT: LP3.1 Electrostatics	

SUBJECT AREA

LIT: LP3 Science Lab Electricity, digital

includes only **ONE** subject area

Comprehensive physics experiment instructions in the field of electricity for the Science Lab.
Contains 154 experiments on electrostatics, magnetism, basic electrical circuits and electrochemistry, electromagnetism and induction, motors and generators and electronics.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 713	LIT: LP3 Science Lab Electricity, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes **ALL** subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

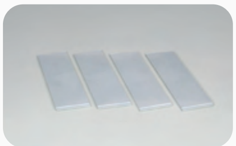
Includes all interactive experiment instructions (Lab Docs) as html file.

520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES

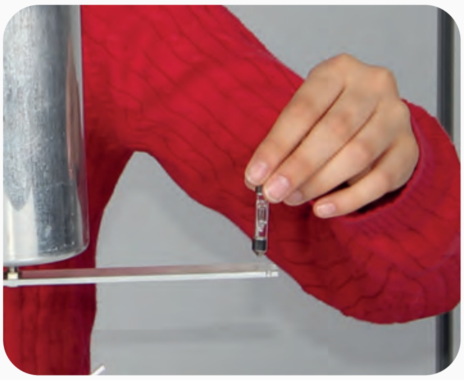


You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

Experiment and research – Discover electrostatic phenomena with fun

Even though the names of the experiments may not sound like fun to students first, the electrostatics experiments vividly illustrate many everyday life experiences.



SOME EXAMPLES OF STUDENT QUESTIONS THAT WILL BE ANSWERED:

- Why do I get an electric shock if I touch a metal door after I have walked on carpet with shoes on?
- Why does that seem to be worse with certain shoes than with others?
- Why does hair stick to a balloon if I rub the balloon on my t-shirt first?

ELECTRICS – EL2

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

LP3.2	MAGNETISM
LP3.2.1	Magnetic forces and fields
LP3.2.1.1	Magnetic and non-magnetic materials
LP3.2.1.2	Position of the magnetic poles on a bar magnet
LP3.2.1.3	Polarity of magnets
LP3.2.2	Magnetic induction
LP3.2.2.1	Magnetisation
LP3.2.2.2	Disassembling magnets
LP3.2.2.3	Combining magnets
LP3.2.3	Magnetic fields
LP3.2.3.1	Demonstration of a magnetic field with iron powder
LP3.2.3.2	Field lines of a bar magnet
LP3.2.3.3	Model experiment on the earth's magnetic field
LP3.2.3.4	Field lines of a horseshoe magnet
LP3.2.3.5	Field lines of attracting magnetic poles
LP3.2.3.6	Field lines of repelling magnetic poles

12 EXPERIMENTS

LP3.2.1.1 Magnetic and non-magnetic materials

LP3.2.3.1 Demonstration of a magnetic field with iron powder

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP3.2 MAGNETISM

TOPIC SET		DIGITAL MEASURING DEVICE		LITERATURE
Electrics EL2		Mobile-CASSY 2 WiFi		Science Lab Electricity digital
	+		+	

Detailed information on the above listed and **additionally required products** are available on the following pages.

Science Lab Electrics EL2 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray.
With the equipment set EL2, 12 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topic magnetism. While working out the curriculum required topics, they are also trained in communication and assessment skills.
In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
2	Bar magnet
2	Plotting compass
1	Magnetizable rods, set of 4
1	Hemisphere for earth's magnetism
1	Magnetism experimental field
1	Iron yokes, pair
1	Pocket compass
1	Magnetic field indicator
1	Shaker for iron filings
1	Tray, low
1	Iron powder, reduced, 50 g
1	Cord

207 132S	Science Lab Electrics EL2 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	510 55	Direction-finding compass	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 713	LIT: LP3 Science Lab Electricity, digital	

leylab.de/207132S

OVERVIEW OF ADVANTAGES

- Understandable experiments to distinguish between attracting and repelling magnetic forces which can be visualised with the help of the magnetism experimental field and iron powder
- Investigation of the Earth's magnetic field in a simple model
- Acquired skills: Explanation of everyday phenomena using simple models

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP3.2 Magnetism

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set EL2 (207 132S). Describes 12 experiments from the field of magnetism.

Topics:
Magnetic forces and fields; Magnetic induction; Magnetic fields

520 7132EN	LIT: LP3.2 Magnetism	

SUBJECT AREA

LIT: LP3 Science Lab Electricity, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of electricity for the Science Lab. Contains 154 experiments on electrostatics, magnetism, basic electrical circuits and electrochemistry, electromagnetism and induction, motors and generators and electronics.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 713	LIT: LP3 Science Lab Electricity, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

Includes all interactive experiment instructions (Lab Docs) as html file.

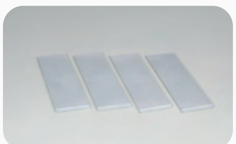
520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES




You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

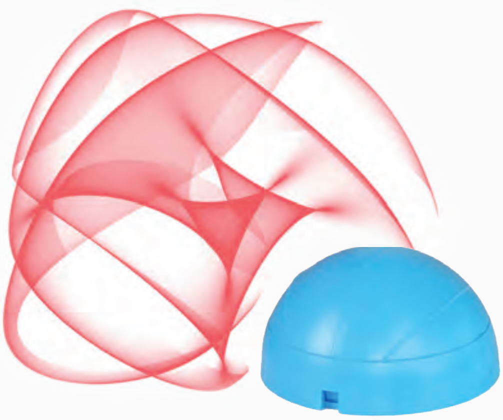
Discover and experience magnetism by yourself

MAKING MAGNETIC FIELDS VISIBLE

DESCRIBING FIELD LINES AND INTERPRETING THE BEHAVIOUR OF MAGNETS

DRAWING CONCLUSIONS ABOUT THE EARTH'S MAGNETIC FIELD

UNDERSTANDING THE FUNCTIONS OF A COMPASS



USING THE HEMISPHERE TO UNDERSTAND THAT THE EARTH IS A DIPOLE

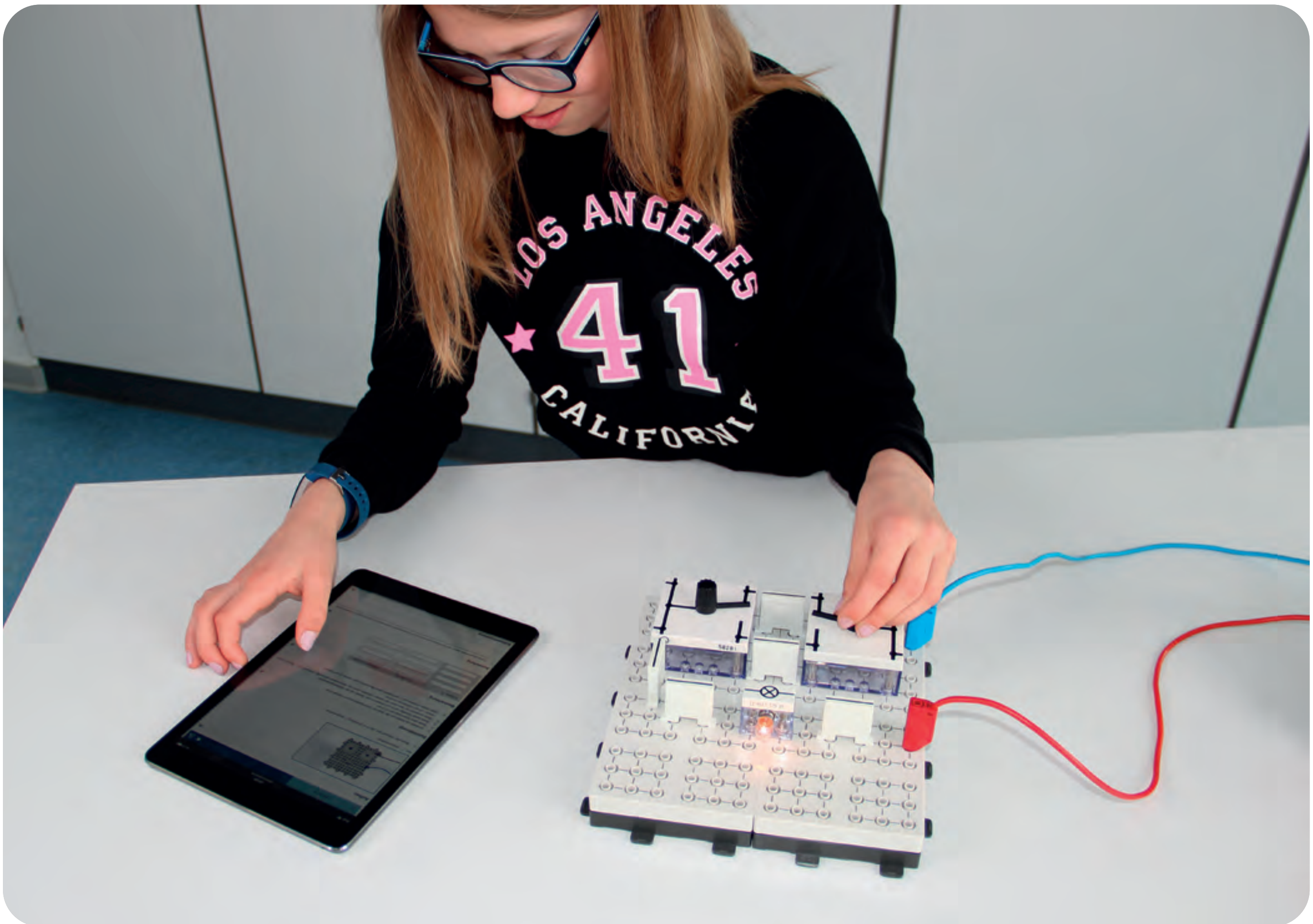
ELECTRICS – EL3

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

LP3.3	BASIC ELECTRICAL CIRCUITS AND ELECTROCHEMISTRY	
LP3.3.1	Electrical circuits and switches	
LP3.3.1.1	The simple circuit	
LP3.3.1.2	Conductors and non-conductors (insulators)	
LP3.3.1.3	Switching over	
LP3.3.1.4	Two-way switches	
LP3.3.1.5	AND gate, OR gate	
LP3.3.2	Electrical measurement methods	
LP3.3.2.1	Measuring current intensity in a simple circuit	
LP3.3.2.1C	Measuring current intensity in a simple circuit (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.2.2	Measuring voltage in a simple circuit	
LP3.3.2.2C	Measuring voltage in a simple circuit (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.3	Ohmic resistance	
LP3.3.3.1	Ohm's law	
LP3.3.3.1C	Ohm's law (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.3.2	How a wire's resistance depends on its material, length and cross-section	
LP3.3.3.2C	How a wire's resistance depends on its material, length and cross-section (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.3.3	Voltage distribution in a current-carrying wire (potentiometer)	
LP3.3.3.3C	Voltage distribution in a current-carrying wire (potentiometer) (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.3.4	Resistors in series	
LP3.3.3.4C	Resistors in series (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.3.5	Resistors in parallel	
LP3.3.3.5C	Resistors in parallel (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.4	Special capacitors	
LP3.3.4.1	Temperature-dependent resistors (NTC)	
LP3.3.4.1C	Temperature-dependent resistors (NTC) (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.4.2	Light-dependent resistors LDR (photo-conductive cell)	
LP3.3.4.2C	Light-dependent resistors LDR (photo-conductive cell) (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.5	Voltage sources	
LP3.3.5.1	Parallel and series connection of monocells	
LP3.3.5.1C	Parallel and series connection of monocells (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.5.2	Terminal voltage and internal resistance of a voltage source	
LP3.3.5.2C	Terminal voltage and internal resistance of a voltage source (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.6	Electrical application circuits	
LP3.3.6.1	Self-heating and temperature sensitivity in wire-wound resistors	
LP3.3.6.1C	Self-heating and temperature sensitivity in wire-wound resistors (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.6.2	Model of a fuse	
LP3.3.6.3	Bimetal switch (model of a fire alarm)	
LP3.3.6.4	Power and work of an electrical current	
LP3.3.6.4C	Power and work of an electrical current (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.7	Electrochemistry	
LP3.3.7.1	Conductivity of aqueous solutions (electrolytes)	
LP3.3.7.1C	Conductivity of aqueous solutions (electrolytes) (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.7.2	Relation between current and voltage in an electrolyte	
LP3.3.7.2C	Relation between current and voltage in an electrolyte (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.3.7.3	Galvanising	
LP3.3.7.4	Galvanic cells	
LP3.3.7.4C	Galvanic cells (with Mobile-CASSY 2 WiFi)	DIGITAL

40 EXPERIMENTS

For experiments marked with „C“, the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi.



LP3.3.1.4 Two-way switches

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP3.3 BASIC ELECTRICAL CIRCUITS AND ELECTROCHEMISTRY

TOPIC SET		DIGITAL MEASURING DEVICE		LITERATURE
Electrics EL3		Mobile-CASSY 2 WiFi		Science Lab Electricity digital
	+		+	

Detailed information on the above listed and **additionally required products** are available on the following pages.

Science Lab Electrics EL3 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray. With the equipment set EL3, 40 experiments at school, college and university level for worldwide curriculums can be performed. The students deal with the topics electrical basic circuits and electrochemistry. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
2	Coupling plug 4 mm
1	Bimetallic strip
2	Safety connecting lead 50 cm, red
2	Safety connecting lead 50 cm, blue
1	Safety connecting lead 50 cm, black
1	Bridging plugs STE 2/19, set of 10
1	Adapter 4-mm plug/4-mm socket
2	Crocodile clip, polished
1	Conductors/insulators, set of 6
1	Wrapping plate for wires
2	Plug-in board safety socket, 20/10
2	Monocell holder STE 2/50
1	Resistor 47 Ohm, STE 2/19
2	Resistor 100 Ohm, STE 2/19
1	Resistor 1 kOhm, STE 2/19
1	Resistor 10 kOhm, STE 2/19

Count	Name
1	Variable resistor 47 kOhm, STE 2/19
1	Photoresistor LDR 05, STE 2/19
1	NTC resistor 2.2 kOhm, STE 2/19
1	PTC resistor 100 Ohm, STE 2/19
2	Lamp holder E10, lateral, STE 2/19
1	Toggle switch STE 2/19
2	Plug-in holder STE
1	Contact strip
2	Change-over switch STE 4/50
1	Flat trough/electrolysis cell
2	Plate electrode copper 76 x 40 mm
1	Plate electrode zinc 76 x 40 mm
1	Plate electrode iron 76 x 40 mm
1	Tray, high
1	Grindstone

207 133S	Science Lab Electrics EL3 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

leylab.de/207133S

OVERVIEW OF ADVANTAGES

- The plug-in system enables even larger circuits to be mounted on the plug-in boards
- Variable plug-in board with safety sockets for 4 mm plugs
- Set up experiments in L- or T-shape with the plug-in board
- Easily expandable for more complex circuits by plugging several boards together
- Wrapping plate for wires allows easy experimentation on the resistance of wires while using less resources

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per student

Count	Cat.-No.	Name	Description
1	610 010	Laboratory safety goggles, Focomax	

Additionally required per working group

Count	Cat.-No.	Name	Description
1	505 07	Bulbs, 4 V/0,16 W, E10, Set of 10	
1	505 08	Bulbs, 12 V/3 W, E10, Set of 10	
2	505 11	Bulbs, 2.5 V/0,25 W, E10, Set of 10	
1	521 487	AC/DC Power supply PRO 0...12 V/3 A	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
2	531 120	Multimeter LDanalog 20	alternative for analog measurements
2	685 48	Mono cell 1.5 V (IEC R20)	Voltage sources experiments (LP3.3.5)

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 713	LIT: LP3 Science Lab Electrics, digital	
1	550 42	Constantan resistance wire, 0.35 mm diameter, 100 m	Ohmic resistance experiments (LP3.3.3)
1	550 46	Chrome-nickel resistance wire, 0.25 mm diameter, 100 m	Wire's resistance experiments (LP3.3.3)
1	550 47	Chrome-nickel resistance wire, 0.35 mm diameter, 100 m	Wire's resistance experiments (LP3.3.3)
1	550 51	Iron resistance wire, 0.2 mm diameter, 100 m	Wire's resistance experiments (LP3.3.3)
1	672 9650	Copper (II) sulfate solution 1%, 50 ml	Electrochemistry experiments (LP3.3.7)
1	673 5700	Sodium chloride 250 g	Electrochemistry experiments (LP3.3.7)
1	674 7960	Sulfuric acid, diluted, 0.05 mol/l, 2 l	Electrochemistry experiments (LP3.3.7)
1	675 3400	Water, pure, 1 l	Electrochemistry experiments (LP3.3.7)

Detailed information on **Mobile-CASSY 2 WiFi**, **sensors**, **literature packages** and **chemical sets** are available on the following pages.

MOBILE-CASSY 2 WIFI

With the Mobile-CASSY 2 WiFi, voltage *(U)*, current *(I)*, power *(P)* and energy *(E)* can be measured via 4 mm safety sockets.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP3.3 Electrical basic circuits and electrochemistry

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set EL3 (207 133S).
Describes 40 experiments from the field of basic electrical circuits and electrochemistry.

Topics:
Electrical circuits and switches; Electrical measurement methods; Ohmic resistance; Special resistors; Voltage sources; Electrical application circuits; Electrochemistry

520 7133EN	LIT: LP3.3 Electrical basic circuits and electrochemistry	

SUBJECT AREA

LIT: LP3 Science Lab Electricity, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of electricity for the Science Lab.
Contains 154 experiments on electrostatics, magnetism, basic electrical circuits and electrochemistry, electromagnetism and induction, motors and generators and electronics.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 713	LIT: LP3 Science Lab Electricity, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

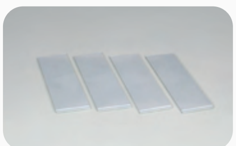
Includes all interactive experiment instructions (Lab Docs) as html file.

520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

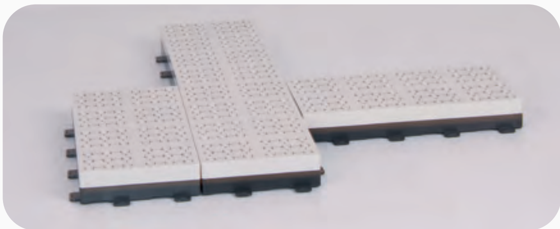
ADDITIONAL STORAGE ACCESSORIES

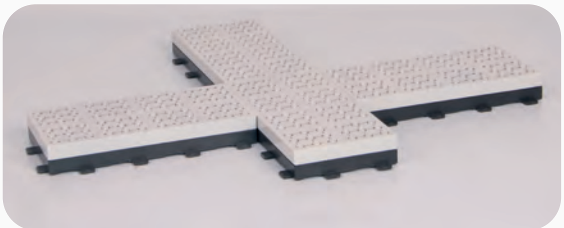


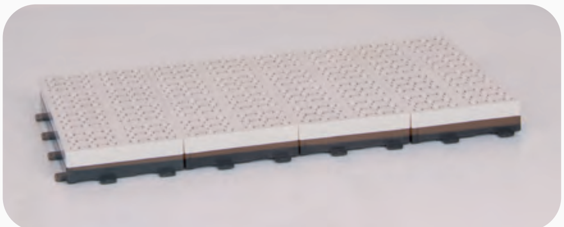
You can find detailed information on additional storage accessories from page 228.

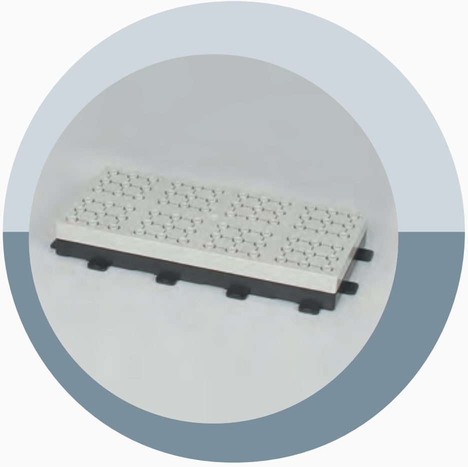
INTRODUCING THE TOPIC

The possibilities of the plug-in board - changeable and adaptable





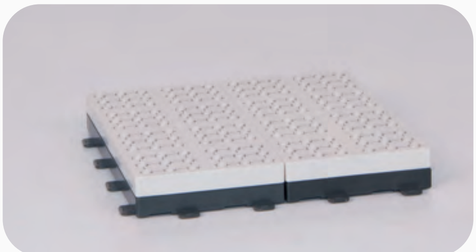




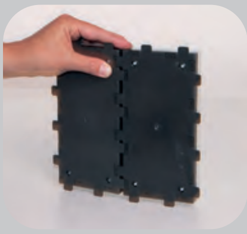
FLEXIBLE AND MODULAR

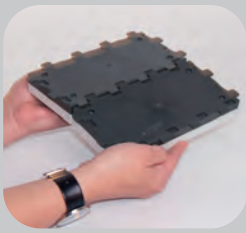
- Facilitates the use of safety wires in experiments
- Experiment set-up in T and L shapes
- Sturdy
- Minimal space required

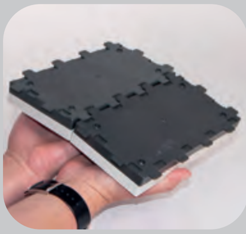
FOR SIMPLE ELECTRICAL EXPERIMENTS TO COMPLEX ELECTRONICS CIRCUITS



EASY TO SET UP AND DISASSEMBLE







The sturdy plug-in boards can be clicked together easily.

PHYSICS

ELECTRICS – EL4

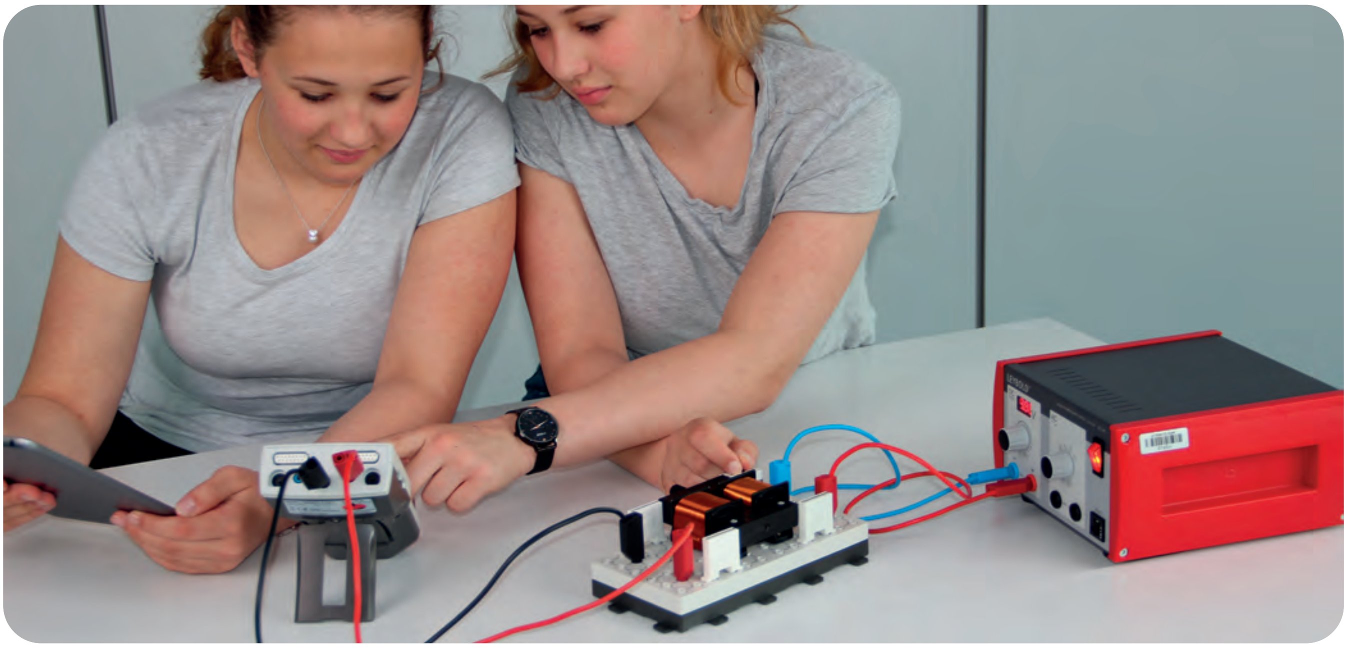
OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LP3.4	ELECTROMAGNETISM AND INDUCTION	
	LP3.4.1	**Electromagnetism**	
	LP3.4.1.1	Magnetic effect of electric current	
	LP3.4.1.2	Current-carrying conductor in a magnetic field	
	LP3.4.1.3	Magnetic field of a coil	
●	LP3.4.1.3C	Magnetic field of a coil (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP3.4.2	**Electromagnetic applications**	
	LP3.4.2.1	Electromagnet	
	LP3.4.2.2	Electromagnetic relays	
	LP3.4.2.3	The electric bell	
	LP3.4.3	**Induction**	
	LP3.4.3.1	Electromagnetic induction with bar magnet and a coil	
	LP3.4.3.1C	Electromagnetic induction with bar magnet and a coil (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP3.4.3.2	Electromagnetic induction with two coils	
	LP3.4.3.2C	Electromagnetic induction with two coils (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP3.4.4	**Transformers**	
	LP3.4.4.1	Voltage transformation	
●	LP3.4.4.1C	Voltage transformation (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP3.4.4.2	Current transformation	
	LP3.4.4.2C	Current transformation (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP3.4.5	**Applications of induction**	
	LP3.4.5.1	Self-induction of a coil (model of an induction coil)	
	LP3.4.5.2	Model of an alternating current generator	
	LP3.4.5.2C	Model of an alternating current generator (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP3.4.6	**Coils in direct and alternating current circuits**	
	LP3.4.6.1	DC and AC resistance of a coil I (observation experiment)	
	LP3.4.6.2	DC and AC resistance of a coil II (measuring experiment)	
	LP3.4.6.2C	DC and AC resistance of a coil II (measuring experiment) (with Mobile-CASSY 2 WiFi)	DIGITAL

21 EXPERIMENTS

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi.

● Voltage sensor M, ±30 V ● Magnetic field sensor M, ±100 mT



LP3.4.3.2C Electromagnetic induction with two coils

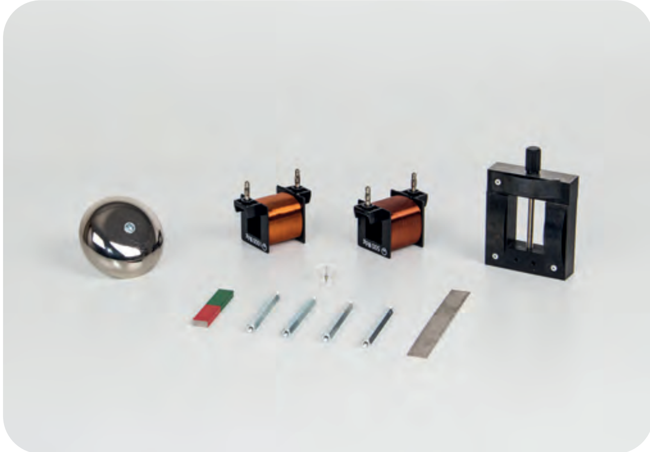
LP3.4.3.1C Electromagnetic induction with bar magnet and a coil

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP3.4 ELECTROMAGNETISM AND INDUCTION

BASIC SET		TOPIC SET		DIGITAL MEASURING DEVICE		LITERATURE
Electrics EL3		Electrics EL4		Mobile-CASSY 2 WiFi		Science Lab Electricity digital
	+		+		+	

Detailed information on the above listed and **additionally required equipment** is available on the following pages.



Science Lab Electrics EL4 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray. With the equipment set EL4, together with the Science Lab Electrics EL3 (207 133S), 21 experiments at school, college and university level for worldwide curriculums can be performed.

The students deal with the topic electromagnetism. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
1	Bar magnet
1	Plotting compass
1	Magnetizable rods, set of 4
1	Bell dome
1	Leaf spring

Count	Name
1	Coil 500 turns STE 2/50
1	Coil 1000 turns STE 2/50
1	Transformer core, demountable
1	Tray, low
207 134S	Science Lab Electrics EL4 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	207 133S	Science Lab Electrics EL3 (Set)	
1	521 487	AC/DC Power supply PRO 0...12 V/3 A	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	524 436	Magnetic field sensor M, ±100 mT	
1	524 438	Voltage sensor M, ±30 V	
1	500 622	Safety connecting lead 50 cm, blue	Transformation experiment (LP3.4.4)
2	531 120	Multimeter LDanalog 20	alternative for analog measurements

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 713	LIT: LP3 Science Lab Electricity, digital	

leylab.de/207134S

OVERVIEW OF ADVANTAGES

- With EL 4, students understand the link between electricity and magnetism - for example through induction experiments
- The demountable transformer core is easy to use so the transformation of voltages can be worked on quickly and comprehensibly
- Acquired skills: Understanding the connections between magnetic and electrical phenomena

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

SENSORS

Magnetic field sensor M, ±100 mT ●

For measuring the tangential or axial magnetic flux density up to ±100 mT with Mobile-CASSY 2 WiFi (524 005W).

524 436	Magnetic field sensor M, ±100 mT	

Voltage sensor M, ±30 V ●

For measuring the electrical voltage up to ±30 V with Mobile-CASSY 2 (524 005W). In connection with the integrated voltage input, Mobile-CASSY 2 WiFi (524 005W) can become a two channel storage oscilloscope.

524 438	Voltage sensor M, ±30 V	

You can find detailed information on these and other sensors from page 229.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP3.4 Electromagnetism and Induction

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set EL4 (207 134S) in conjunction with Science Lab Set EL3 (207 133S). Describes 21 experiments from the fields of electromagnetism and induction.

Topics:
Electromagnetism; Electromagnetic applications; Induction; Transformers; Applications of induction; Coils in direct and alternating current circuits

520 7134EN	LIT: LP3.4 Electromagnetism and Induction	

SUBJECT AREA

LIT: LP3 Science Lab Electricity, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of electricity for the Science Lab.
Contains more than 154 experiments on electrostatics, magnetism, basic electrical circuits and electrochemistry, electromagnetism and induction, motors and generators and electronics.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 713	LIT: LP3 Science Lab Electricity, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains about 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

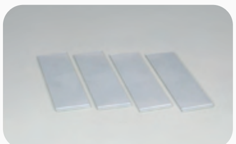
Includes all interactive experiment instructions (Lab Docs) as html file.

520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  – PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  – PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES



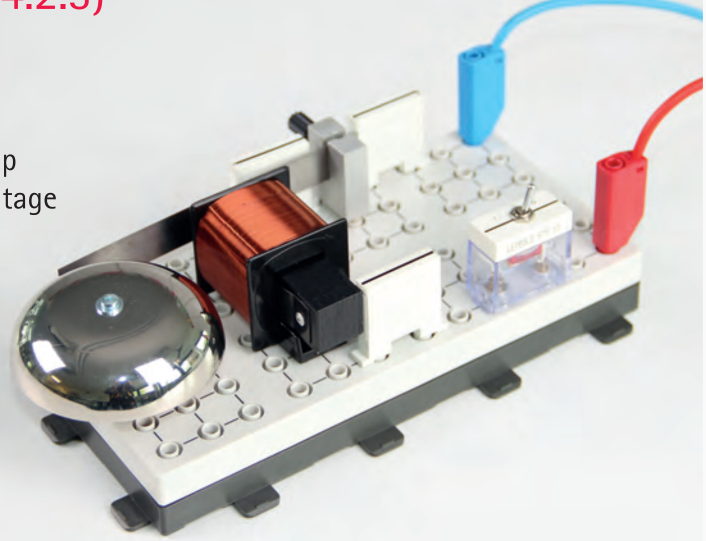
You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

Generate sounds with electromagnetism

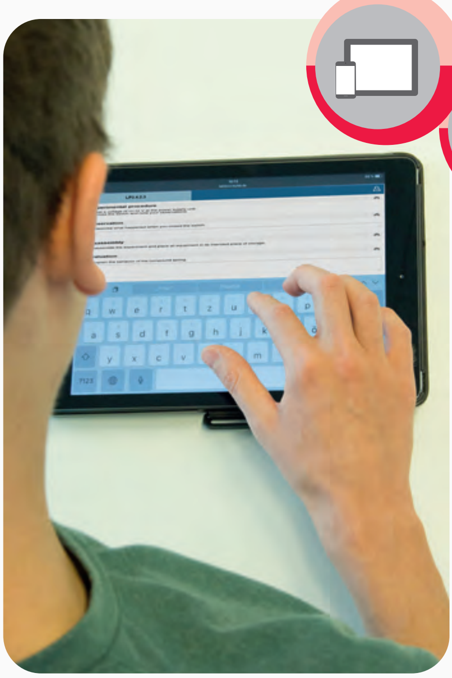
THE ELECTRIC BELL (LP3.4.2.3)

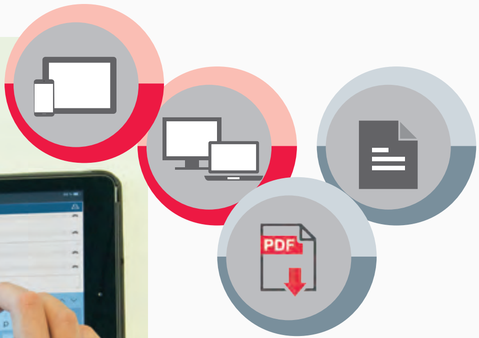
- Investigating the function of an electric bell
- The materials can be used to set up a bell that is operated with AC voltage



EVERYDAY EXPERIENCE – What happens if I press a bell button?
+ GAIN KNOWLEDGE ABOUT MAGNETISM
+ UNDERSTAND ELECTRICAL PHENOMENA

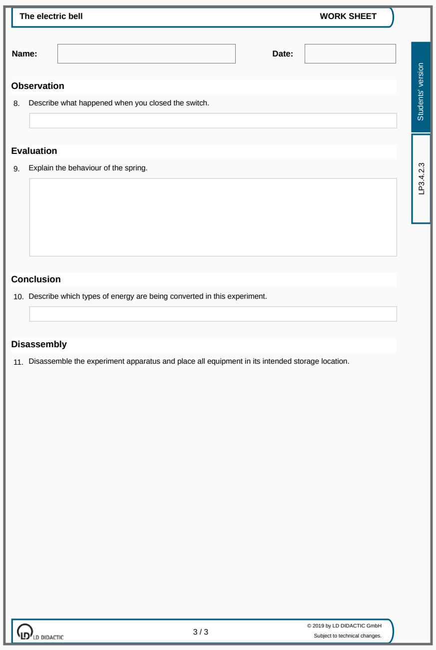
INTERESTING AND EASY-TO-UNDERSTAND EXPERIMENT INSTRUCTIONS
DIGITAL OR IN HARD COPY





Lab Docs are responsive. They adapt the layout to the screen size.

From the smallest smartphone, tablet or laptop to a projector.



The electric bell WORK SHEET

Students' version

LP3.4.2.3

Name: **Date:**

Observation

8. Describe what happened when you closed the switch.

Evaluation

9. Explain the behaviour of the spring.

Conclusion

10. Describe which types of energy are being converted in this experiment.

Disassembly

11. Disassemble the experiment apparatus and place all equipment in its intended storage location.

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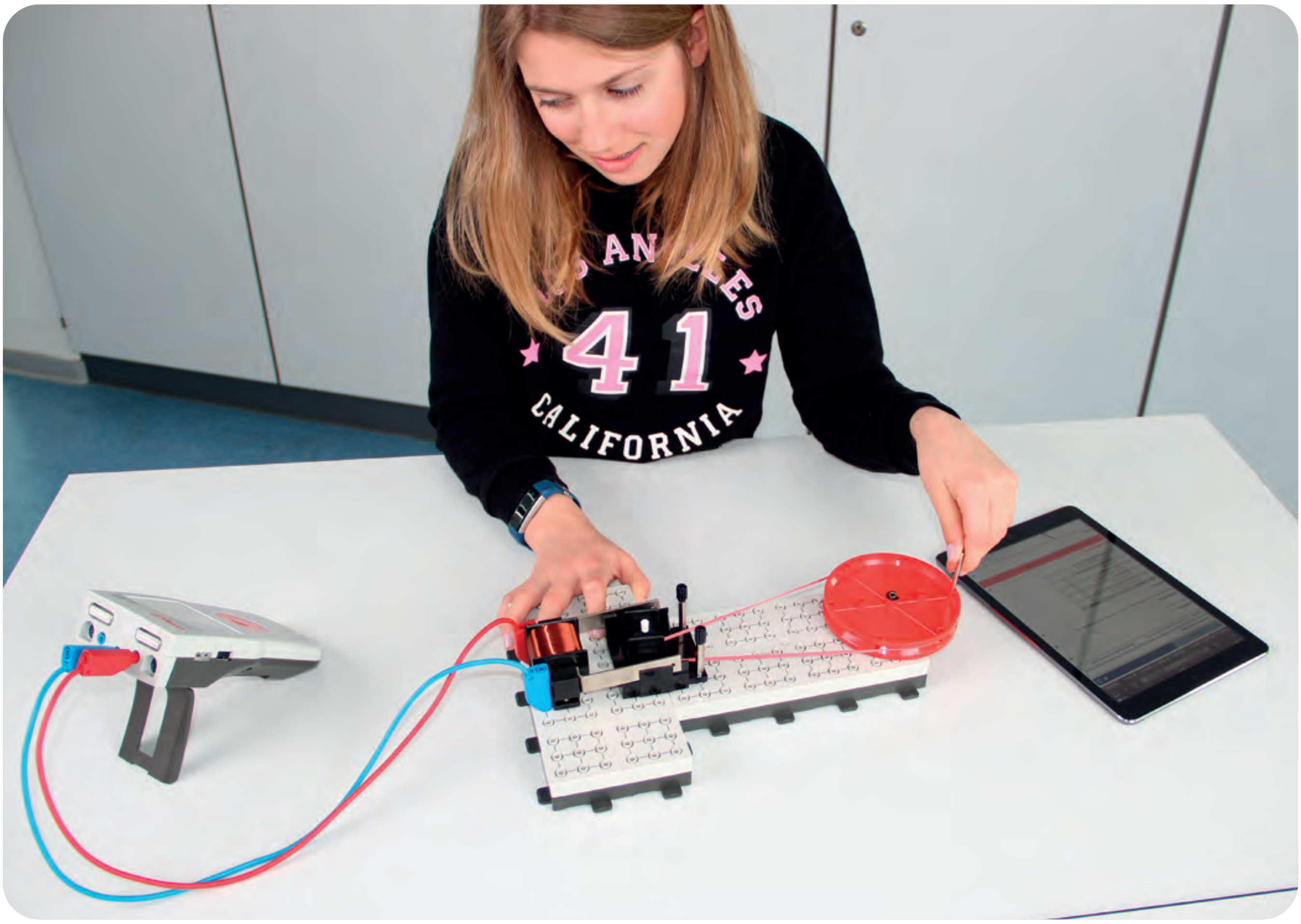
ELECTRICS – EL5

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

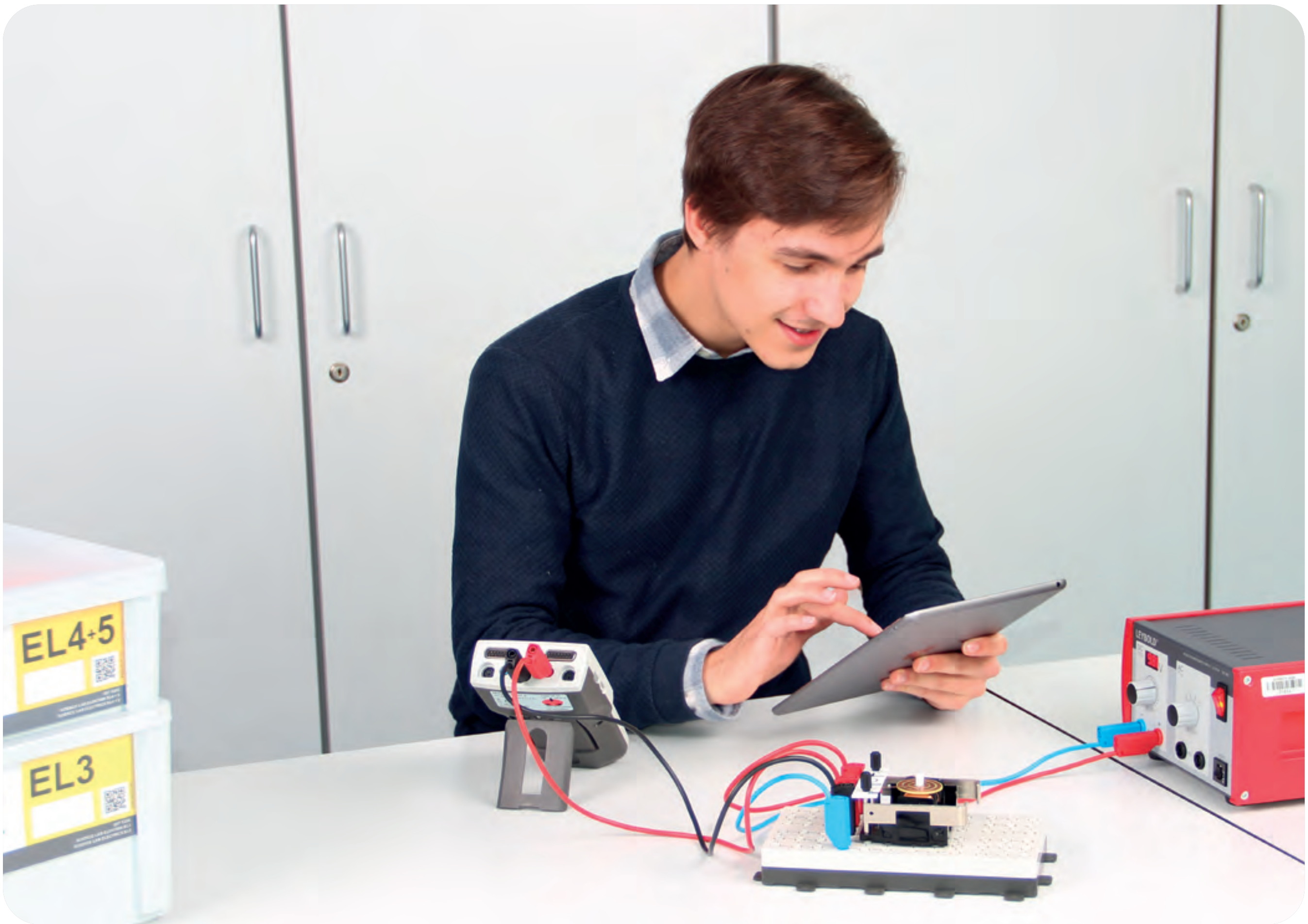
LP3.5	MOTORS AND GENERATORS	
LP3.5.1	**Generators**	
LP3.5.1.1	Dynamo	
LP3.5.1.1C	Dynamo (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.5.1.2	Universal generator – functional principle	
LP3.5.1.2C	Universal generator – functional principle (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.5.1.3	Power plant generator	
LP3.5.1.3C	Power plant generator (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.5.1.4	AC/DC generator with electromagnetic stator	
LP3.5.1.4C	AC/DC generator with electromagnetic stator (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.5.2	**Electric motors**	
LP3.5.2.1	DC motor – functional principle	
LP3.5.2.1C	DC motor – functional principle (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.5.2.2	Universal shunt-wound motor	
LP3.5.2.2C	Universal shunt-wound motor (with Mobile-CASSY 2 WiFi)	DIGITAL
LP3.5.2.3	Universal series-wound motor – functional principle	
LP3.5.2.3C	Universal series-wound motor – functional principle (with Mobile-CASSY 2 WiFi)	DIGITAL

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi.

14 EXPERIMENTS



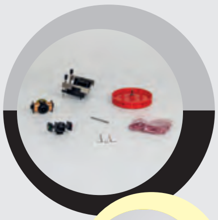
LP3.5.1.1C Dynamo



LP3.5.2.1C DC motor – functional principle

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP3.5 MOTORS AND GENERATORS

BASIC SET	TOPIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Electrics EL3	Electrics EL4	Electrics EL5	Mobile-CASSY 2 WiFi	Science Lab Electricity digital
 +	 +	 + = 	 +	

Detailed information on the above listed and **additionally required products** are available on the following pages.

Science Lab Electrics EL5 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group. The equipment is stored in Science Lab Electrics EL4 (207 134S). With the supplementary equipment set EL5, together with the Science Lab Electrics EL3 (207 133S) and EL4 (207 134S), 14 experiments at school, college and university level for worldwide curriculums can be performed.

The students deal with the topics motors and generators. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
1	Plug-in axle
1	Rubber rings, set of 8
1	Pulley Ø 100 mm, plug-in
1	Stator STE 4/50

Count	Name
1	Coil rotor STE
1	Brush yoke STE
1	Magneto inductor STE

207 135S	Science Lab Electrics EL5 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	207 133S	Science Lab Electrics EL3 (Set)	
1	207 134S	Science Lab Electrics EL4 (Set)	
1	521 487	AC/DC Power supply PRO 0...12 V/3 A	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
2	531 120	Multimeter LDanalog 20	alternative for analog measurements

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 713	LIT: LP3 Science Lab Electricity, digital	

leylab.de/207135S

OVERVIEW OF ADVANTAGES

- Everyday relevance: Further insights into electromagnetism through experiments with simple motors and generators
- Engine and generator models are quickly assembled and functionally reliable
- Acquired skills: understanding different drive technologies (relevant for the debate on electromobility)

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

MOBILE-CASSY 2 WIFI

With the Mobile-CASSY 2 WiFi, voltage *(U)*, current *(I)*, power *(P)* and energy *(E)* can be measured via 4 mm safety sockets.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP3.5 Motors and Generators

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set EL5 (207 135S) in conjunction with Science Lab Set EL3 (207 133S) and EL4 (207 134S). Describes 14 experiments from the field of motors and generators.

Topics:
Generators; Electric motors

520 7135EN	LIT: LP3.5 Motors and Generators	

SUBJECT AREA

LIT: LP3 Science Lab Electricity, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of electricity for the Science Lab.
Contains 154 experiments on electrostatics, magnetism, basic electrical circuits and electrochemistry, electromagnetism and induction, motors and generators and electronics.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 713	LIT: LP3 Science Lab Electricity, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

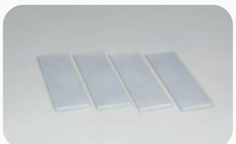
Includes all interactive experiment instructions (Lab Docs) as html file.

520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

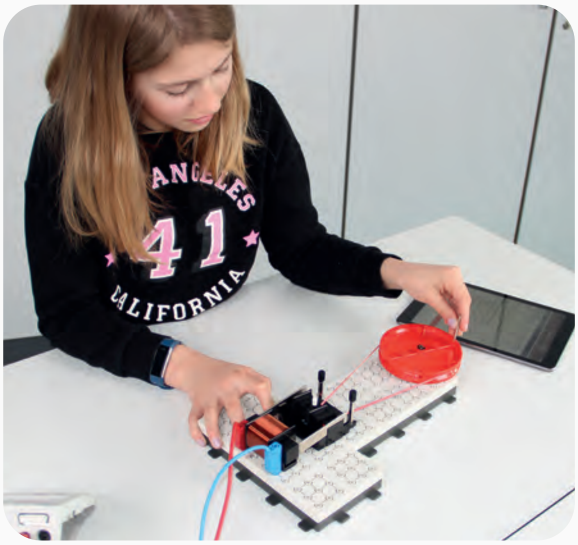
ADDITIONAL STORAGE ACCESSORIES



You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

Electromobility – the e-bike trend



CLASSIC: BICYCLE LIGHT WITH DYNAMO

- As with every trend, it's all about gaining basic knowledge
- By spinning the drive roller, the voltage can be measured or visualised using a light bulb
- General understanding of generators
- Transferable to wind energy

INNOVATIVE: ELECTRIC DRIVES

- The DC motor is comparable with an e-bike motor
- By assembling and operating different motors, the students gain knowledge of the respective functions
- Through this investigation and further experiments with electric motors, students get their first insight into the topic of electromobility

ELECTRONICS – EL6

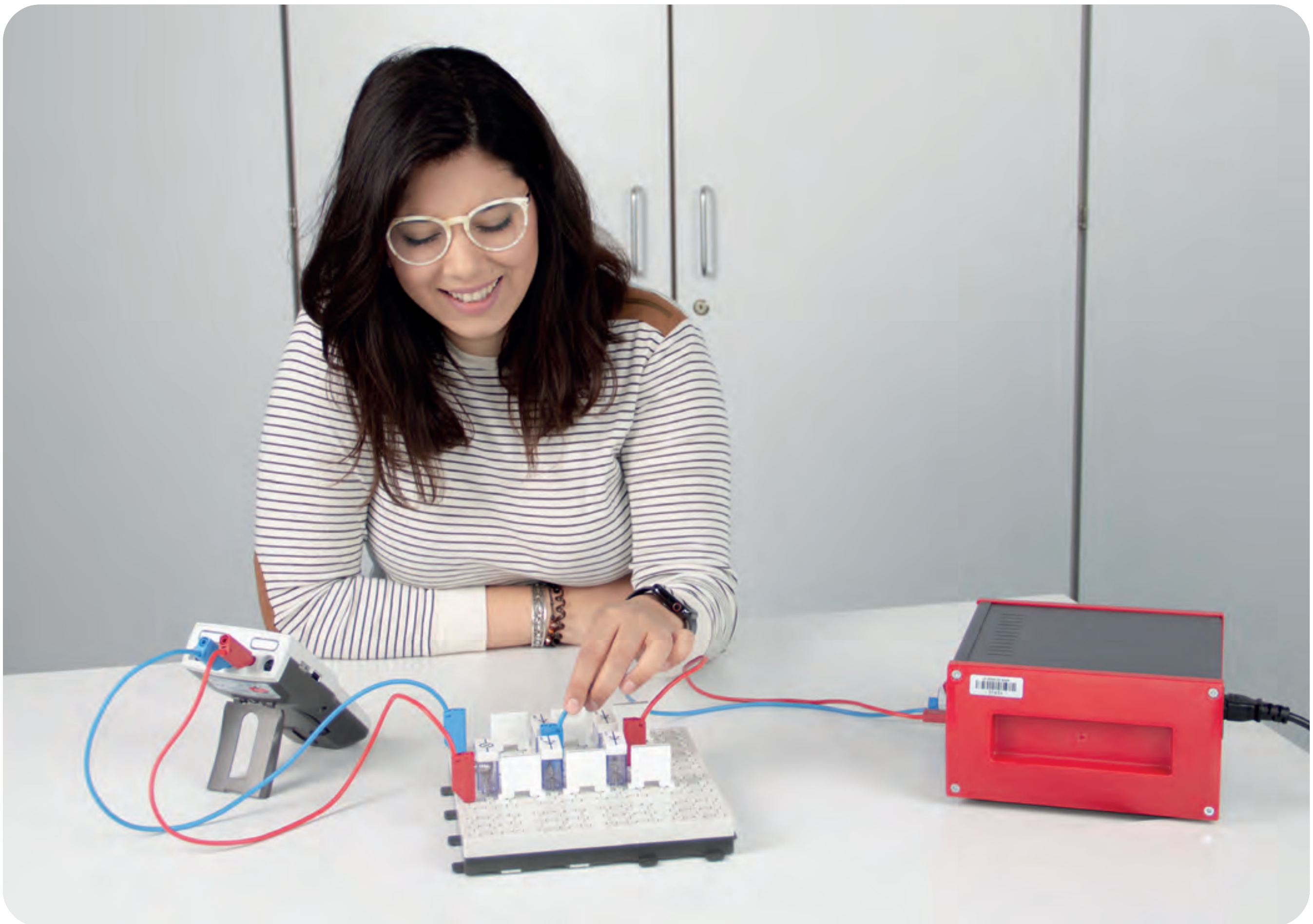
OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LP4.1	BASIC ELECTRONIC CIRCUITS	
	LP4.1.1	**Capacitors**	
	LP4.1.1.1	Capacitors in a DC circuit	
	LP4.1.1.1C	Capacitors in a DC circuit (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.1.2	Capacitors in an AC circuit	
	LP4.1.1.2C	Capacitors in an AC circuit (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.2	**Relay circuits**	
	LP4.1.2.1	Light-controlled relays	
	LP4.1.2.1C	Light-controlled relays (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3	**Diodes**	
	LP4.1.3.1	Characteristic curve of a diode	
	LP4.1.3.1C	Characteristic curve of a diode (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3.2	Half-wave rectification	
	LP4.1.3.2C	Half-wave rectification (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3.3	Full-wave rectification	
	LP4.1.3.3C	Full-wave rectification (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3.4	Light-emitting diodes	
	LP4.1.3.4C	Light-emitting diodes (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3.5	Polarity tester with diodes	
	LP4.1.3.5C	Polarity tester with diodes (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3.6	Characteristic curve of a Z diode	
	LP4.1.3.6C	Characteristic curve of a Z diode (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.3.7	Overvoltage protection using a Z diode	
●	LP4.1.3.7C	Overvoltage protection using a Z diode (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.4	**Transistors**	
	LP4.1.4.1	Diode junctions on transistors, test circuit with light-emitting diodes	
	LP4.1.4.2	Transfer characteristic of a transistor	
	LP4.1.4.2C	Transfer characteristic of a transistor (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.4.3	Transistor circuit I, voltage control	
	LP4.1.4.3C	Transistor circuit I, voltage control (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.4.4	Light-controlled transistor I, light barrier	
	LP4.1.4.5	Delay switch	
	LP4.1.4.5C	Delay switch (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.5	**Diode circuits**	
	LP4.1.5.1	Overvoltage and reverse polarity protection using diodes	
	LP4.1.5.1C	Overvoltage and reverse polarity protection using diodes (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.5.2	Smoothing pulsating DC voltages with capacitors	
	LP4.1.5.2C	Smoothing pulsating DC voltages with capacitors (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.6	**Flip-flops**	
	LP4.1.6.1	Basic experiments with flip-flops	
	LP4.1.6.1C	Basic experiments with flip-flops (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.7	**Amplifier circuits**	
	LP4.1.7.2	Touch-sensitive switches, humidity and fill level indicators	
	LP4.1.7.2C	Touch-sensitive switches, humidity and fill level indicators (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.8	**Solar cells**	
	LP4.1.8.1	Forward and reverse direction of a solar cell	
	LP4.1.8.1C	Forward and reverse direction of a solar cell (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.8.2	Output and power characteristics of a solar cell	
	LP4.1.8.2C	Output and power characteristics of a solar cell (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP4.1.8.3	No-load voltage of a solar cell	
	LP4.1.8.3C	No-load voltage of a solar cell (with Mobile-CASSY 2 WiFi)	DIGITAL

42 EXPERIMENTS

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi.

● Voltage sensor M, ±30 V



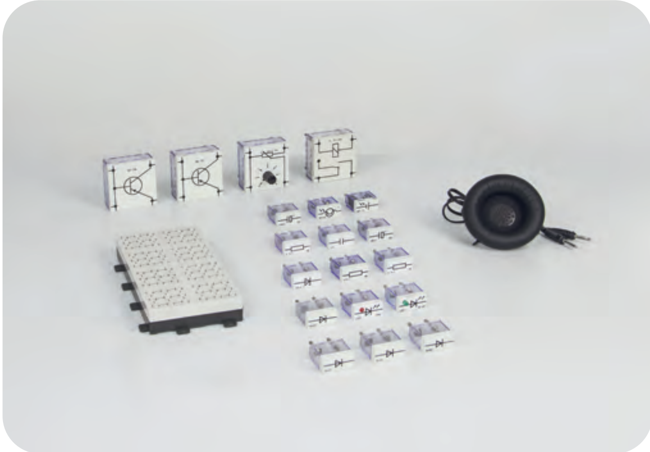
LP4.1.3.3C Full-wave rectification

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP4.1 BASIC ELECTRONIC CIRCUITS

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Electrics EL3	Electrics EL6	Mobile-CASSY 2 WiFi	Science Lab Electricity digital
 +	 +	 +	

Detailed information on the above listed and **additionally required equipment** is available on the following pages.



Science Lab Electrics EL6 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray. With the equipment set EL6, together with the Science Lab Electrics EL3 (207 133S), 42 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topics basic electronic circuits and transistor electronics. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
1	Plug-in board safety socket, 20/10
1	Resistor 470 Ohm, STE 2/19
1	Resistor 4.7 kOhm, STE 2/19
1	Potentiometer 220 Ohm, STE 4/50
1	Capacitor, 1 µF, STE 2/19
1	Capacitor (electrolytic) 100 µF, STE 2/19
1	Capacitor (electrolytic) 470 µF, STE 2/19
1	Light emitting diode red, STE 2/19
4	Diode 1N 4007, STE 2/19
1	Zener diode 6.2, STE 2/19
1	Light emitting diode green, STE 2/19
1	Photodiode, lateral
1	Solar cell, STE 2/19
1	Transistor BD 137, NPN, e.b., STE 4/50
1	Transistor BD 138, PNP, e.b., STE 4/50
1	Relay with change-over switch STE 4/50
1	Earphone
1	Tray, low

207 136S	Science Lab Electrics EL6 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	207 133S	Science Lab Electrics EL3 (Set)	
1	521 487	AC/DC Power supply PRO 0...12 V/3 A	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	524 438	Voltage sensor M, ±30 V	
1	500 622	Safety connecting lead 50 cm, blue	Overvoltage protection experiment (LP4.1.3)
2	531 120	Multimeter LDanalog 20	alternative for analog measurements

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 713	LIT: LP3 Science Lab Electricity, digital	

leylab.de/207136S

OVERVIEW OF ADVANTAGES

- Students learn to understand more complex structures, such as diode and transistor circuits, through the structured experiment instructions
- Similarities to the use of printed circuit boards in electronic components become visible
- Acquired skills: understanding the functions of electronic components in modern technical devices

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

SENSORS

Voltage sensor M, ±30 V

For measuring the electrical voltage up to ±30 V with Mobile-CASSY 2 WiFi (524 005W). In connection with the integrated voltage input, Mobile-CASSY 2 WiFi (524 005W) can become a 2 channel storage oscilloscope.

524 438	Voltage sensor M, ±30 V	

You can find detailed information on this and other sensors from page 229.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP4.1 Electronics

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set EL6 (207 136S) in conjunction with Science Lab Set EL3 (207 133S). Describes 42 experiments from the field of electronics.

Topics:
Capacitors; Relay circuits; Diodes; Transistors; Diode circuits; Flip-flops; Amplifier circuits; Solar cells

520 7136EN	LIT: LP4.1 Electronics	

SUBJECT AREA

LIT: LP3 Science Lab Electricity, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of electricity for the Science Lab.
Contains 154 experiments on electrostatics, magnetism, basic electrical circuits and electrochemistry, electromagnetism and induction, motors and generators and electronics.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 713	LIT: LP3 Science Lab Electricity, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

Includes all interactive experiment instructions (Lab Docs) as html file.

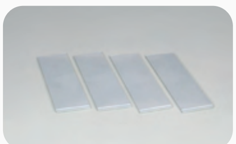
520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES

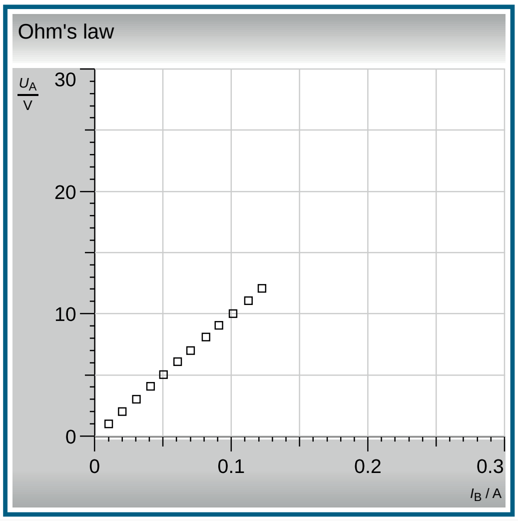



You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

Ohm's Law as a diagram with the Mobile-CASSY 2 WiFi



Current and voltage measurement on a resistor

MEASURE SEVERAL PHYSICAL VARIABLES AT THE SAME TIME

- With the Mobile-CASSY 2 WiFi, two or more measuring quantities can be measured against each other and simultaneously recorded, such as:
  - Current and voltage
  - Temperature and voltage
- Dependencies between measuring quantities can be illustrated exceptionally well in diagrams
- This allows students to gain a deeper understanding of the basic principles of electronics
- Simple measuring of characteristic curves is only possible with digital measuring technology

DIRECT DISPLAY OF CHARACTERISTIC CURVES IN THE DIAGRAMS IN THE DIGITAL EXPERIMENT LITERATURE

With interactivity between the Mobile-CASSY 2 WiFi and Lab Docs, the measured values are transferred in real time and the characteristic curves are displayed directly in the diagrams.

The Lab Doc with the recorded characteristic curve can also be saved as a digital protocol and then shared with the teacher.

With the Lab Docs Editor, the diagrams (among other features) can be adjusted.