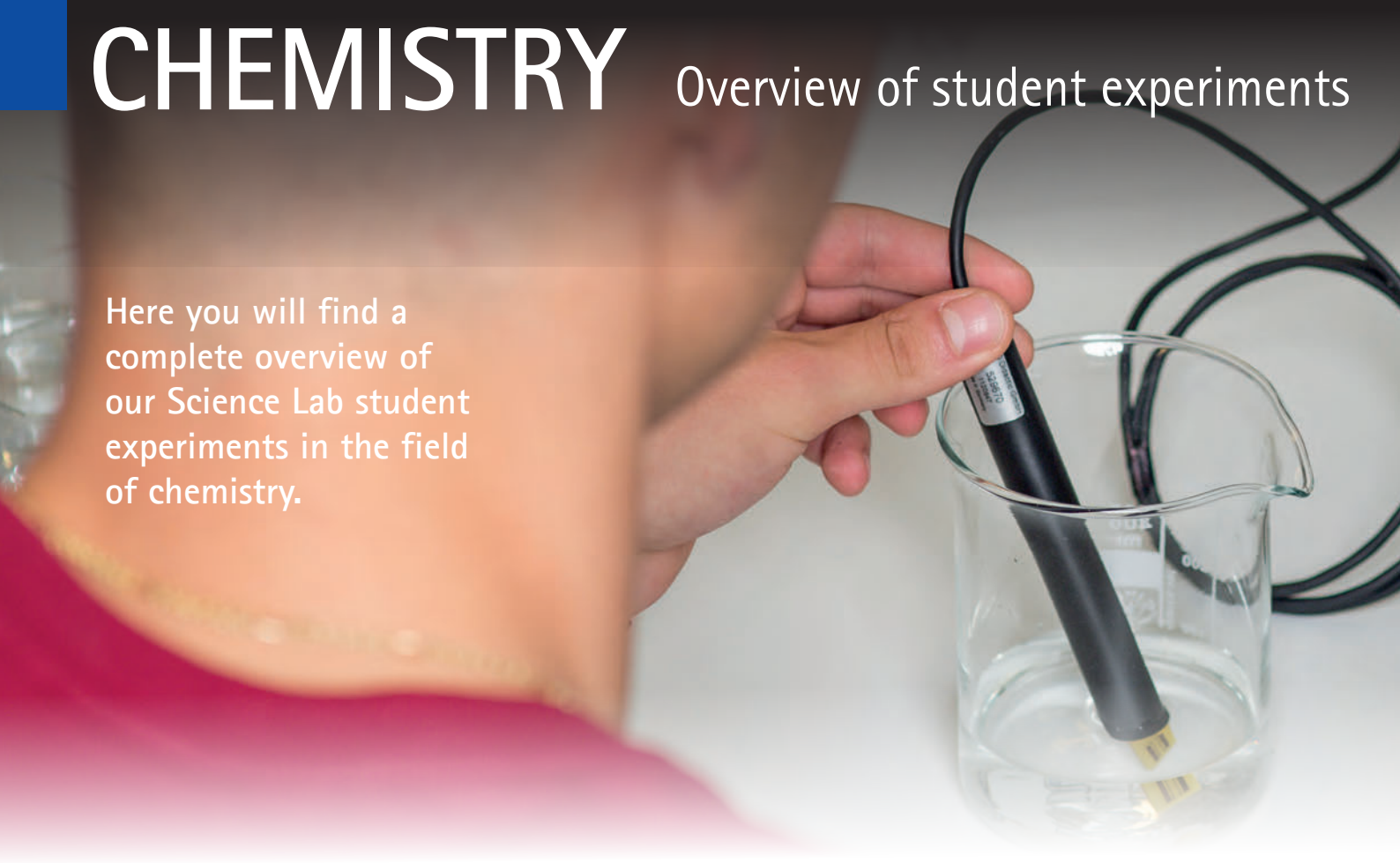
CHEMISTRY Overview of student experiments



Here you will find a complete overview of our Science Lab student experiments in the field of chemistry.

INORGANIC AND GENERAL CHEMISTRY

EXPERIMENT TOPICS		CURRICULUM TOPICS	NO. EXPERIMENTS	DETAILS FROM
LC1.1	GENERAL METHODS & SEPARATION METHODS	Properties of substances; Mixtures of substances; Separation of substances	93	PAGE 148
LC1.2	WATER	Water as a solvent; Analysis, synthesis and detection of water; Water treatment		
LC1.3	AIR, GASES AND THEIR PROPERTIES	Gases - synthesis, detection and properties; Air and combustion		
LC1.4	ACIDIC AND ALKALINE SOLUTIONS	Acidic and alkaline; Acids, Alkaline solutions; Protolysis equilibrium; Titrations; Neutralisation and salification		
LC1.5	SALTS	Ion detection; Utilising salts		
LC1.6	METALS	Properties of metals; Use of metals; Complex chemistry		
LC1.7	REDOX REACTIONS	Oxidation; Redox titration		
LC1.8	CHEMICAL REACTIONS	Characteristics of a chemical reaction; Chemical laws		
LC1.9	NEW FIELDS IN CHEMISTRY	Nanochemistry		

ORGANIC CHEMISTRY

EXPERIMENT TOPICS		CURRICULUM TOPICS	NO. EXPERIMENTS	DETAILS FROM
LC2.1	ORGANIC SUBSTANCES	Characteristics of organic substances; Elements in organic substances	53	PAGE 156
LC2.2	HYDROCARBONS	Saturated hydrocarbons; Unsaturated hydrocarbons; Petrochemistry		
LC2.3	ALCOHOLS, ALDEHYDES AND KETONES	Production of alcohols; Detection of alcohols; Properties and uses of alcohols; Aldehydes; Ketones		
LC2.4	CARBOXYLIC ACIDS AND ESTERS	Production of carboxylic acids; Properties and uses of carboxylit acids; Production and properties of esters		
LC2.5	REACTIONS IN ORGANIC CHEMISTRY	Addition reactions; Substitution reactions		
LC2.6	METHODS OF ORGANIC CHEMISTRY	Distillations		

more than 250 EXPERIMENTS IN TOTAL

PHYSICAL CHEMISTRY

EXPERIMENT TOPICS		CURRICULUM TOPICS	NO. EXPERIMENTS	DETAILS FROM
LC3.1	ELECTROCHEMISTRY	Electrial conductivity; Electrochemical potentials; Galvanic elements; Applied electrochemistry; Electrolysis	55	PAGE 164
LC3.2	PHYSICAL PROCESSES	Particle movement		
LC3.3	ENERGY IN CHEMICAL REACTIONS	Calorimetry; Reaction heat		
LC3.4	RATE OF REACTION	Course of a reaction; Influencing the rate of reaction		
LC3.5	CHEMICAL EQUILIBRIUM	Chemical equilibrium; Le Chatelier's priniciple; The law of mass action and its applications		

TECHNICAL CHEMISTRY

EXPERIMENT TOPICS		CURRICULUM TOPICS	NO. EXPERIMENTS	DETAILS FROM
LC4.1	BUILDING MATERIALS	Limestone and gypsum	24	PAGE 172
LC4.2	GLASS	Glass		
LC4.3	METALS	Extraction of metals; Alloys		
LC4.4	CHEMICAL APPLICATIONS	Fertilisers; Photography		
LC4.5	PRODUCTS OF THE ORGANIC INDUSTRY	Pigment and Dyestuffs; Plastics; Soaps		

BIOCHEMISTRY

EXPERIMENT TOPICS		CURRICULUM TOPICS	NO. EXPERIMENTS	DETAILS FROM
LC5.1	FATS	Properties of fats; Fatty foods; Analysing Fats	32	PAGE 172
LC5.2	CARBOHYDRATES	Properties of carbohydrates; Extraction of sugars; Detection of sugars; Starch and cellulose		
LC5.3	AMINO ACIDS AND PROTEINS	Properties of proteins; Detection of proteins		
LC5.4	FOOD	Preservatives; Additives		

Science Lab

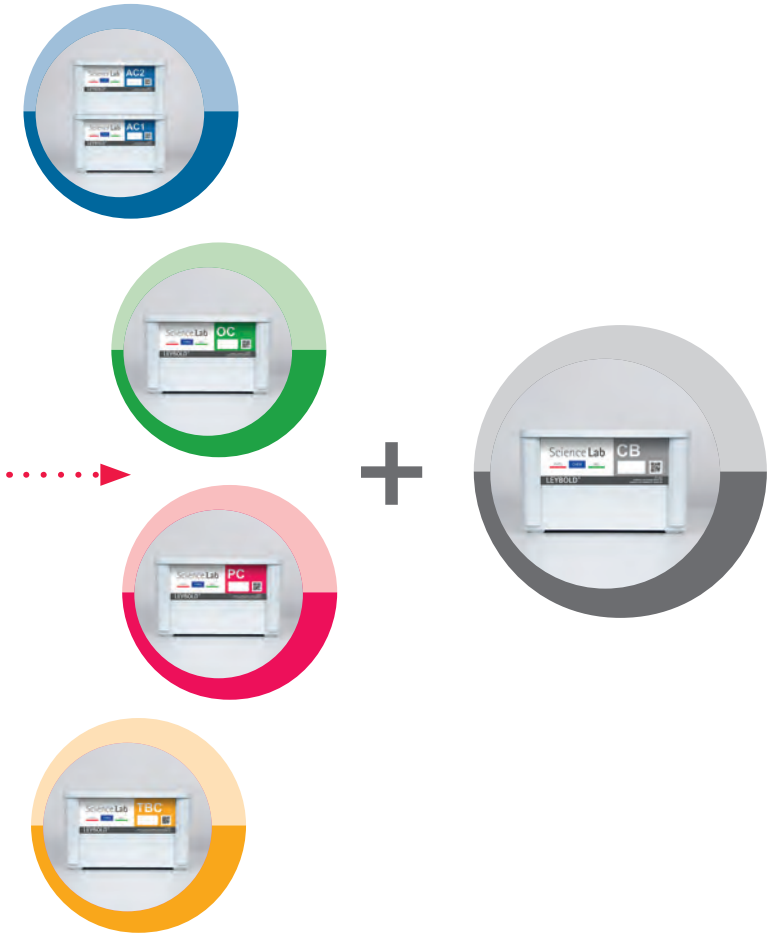
Chemistry Basic CB (207 200S)

BASIC SET FOR OUR INNOVATIVE STUDENT EXPERIMENT SYSTEM FOR CHEMISTRY

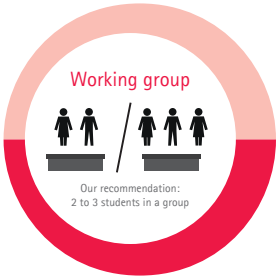
- This Basic Set contains **the basic devices** which are regularly needed for student experiments in chemistry.
- Each device has its own specified space in the pre-formed storage tray.
- With four **different thematic sets** more than **250** student experiments can be performed in chemistry.
- One Basic Set for all fields of chemistry and a maximum of two trays on the student workstation.

ADVANTAGES

- The Basic Set contains the material required for **one work group** - consisting of 2-3 students.
- Experiments from the Science Lab Chemistry can then be carried out with only one additional set, depending on the topic.
- Same devices = always the same handling: no need to re-learn devices for every topic.



Science Lab Chemistry Basic CB (Set)



Student experiment set of the student experiment system Science Lab in the field of chemistry. Basic equipment for experiments in inorganic and general chemistry, organic chemistry, physical chemistry, technical and biochemistry.
Set-up material for one working group in pre-formed tray. The individual trays are stackable and can optionally be closed with a lid (647 003).
The equipment set Science Lab Chemistry Basic CB, in combination with at least one of the following chemistry sets, enables the performance of experiments at school, college and university level for worldwide curriculums:

- Experiment set Science Lab Inorganic Chemistry AC (207 211S)
- Experiment set Science Lab Organic Chemistry OC (207 221S)
- Experiment set Science Lab Physical Chemistry PC (207 231S)
- Experiment set Science Lab Technical and Biochemistry TBC (207 241S)

Scope of delivery:

Count	Name
2	Bosshead S
2	Stand base MF
1	Stand feet, pair
3	Stand rod 40 cm, 10 mm Ø
1	Universal pencil
1	Thermometer, -10...+150 °C/1 K
1	Powder spatula, steel, 185 mm
1	Tray, high
1	Round filter, Type 595, 125 mm Ø, Set of 100
1	Boiling stones 100 g
5	Watch glass dish 80 mm Ø
3	Glass stirring rod 200 x 8 mm Ø
1	Measuring cylinder 100 ml, with plastic base
5	Dropping pipette 150 mm x 7 mm Ø
5	Rubber bulb
2	Graduated pipette 10 ml
1	Pipetting ball (Peleus ball)
2	Universal clamp 0...80 mm
1	Test tube brush with head bundle 20 mm Ø
1	Scissors 125 mm, round-ended
1	Laboratory knife
1	Tweezers, blunt, 130 mm
1	Test tube holder 20 mm Ø
1	Crucible tongs 200 mm
1	Test tube rack metal 20 mm Ø
1	Universal indicator paper pH 1...14, roll

207 200S	Science Lab Chemistry Basic CB (Set)

Additionally required:

Count	Cat.-No.	Name
1	207 211S	Science Lab Inorganic Chemistry AC (Set)
1	207 221S*	Science Lab Organic Chemistry OC (Set)
1	207 231S*	Science Lab Physical Chemistry PC (Set)
1	207 241S*	Science Lab Technical and Biochemistry TBC (Set)

* alternative

Additionally recommended:

Count	Cat.-No.	Name
1	647 003	Lid for tray

leylab.de/207200S

INORGANIC AND GENERAL CHEMISTRY

The Inorganic and General Chemistry experiment collection effortlessly arouses fascination towards chemistry: The Science Lab Set *Inorganic Chemistry* consists of *two* trays AC1 and AC2 and includes devices for both basic and advanced experiments, important for chemistry classes/lectures at school, college and university level.

Your students will use this set to carry out perceivable experiments, such as "Red cabbage as an indicator", as well as complex experiments such as conductivity titrations or redox titrations.

HIGHLIGHT

LC1.1.1.2C Boiling point

In this experiment, the boiling temperatures of water and methylated spirits are determined. For this purpose, the temperature of the respective liquid is measured at constant time intervals during the heating process with the help of the Mobile-CASSY 2 WiFi. The value pairs are then plotted on a graph to determine the boiling temperature from the curve. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Inorganic Chemistry AC (207 211S)**.

Overview of topics and sets

EXPERIMENT TOPICS		REQUIRED SETS	NO. EXPERIMENTS	DETAILS
LC1.1	GENERAL METHODS & SEPARATION METHODS	Chemisty Basic CB + Inorganic Chemistry AC	93	PAGE 148
LC1.2	WATER			
LC1.3	AIR, GASES AND THEIR PROPERTIES			
LC1.4	ACIDIC AND ALKALINE SOLUTIONS			
LC1.5	SALTS			
LC1.6	METALS			
LC1.7	REDOX REACTIONS			
LC1.8	CHEMICAL REACTIONS			
LC1.9	NEW FIELDS IN CHEMISTRY			

LC1.4.1.5C pH paper versus pH electrode

In this experiment, students will learn how to determine the pH values of solutions with pH paper and how to measure these with the Mobile-CASSY 2 WiFi and a pH probe. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Inorganic Chemistry AC (207 211S)**.

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

INORGANIC AND GENERAL CHEMISTRY – AC

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors		
	LC1.1	GENERAL METHODS & SEPARATION METHODS
	LC1.1.1	Properties of substances
	LC1.1.1.1	Density, solubility, magnetisability and colour
	LC1.1.1.2	Boiling point
	LC1.1.1.2C	Boiling point (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.1.1.3	Sublimation
	LC1.1.2	Mixtures of substances
	LC1.1.2.1	Heterogeneous mixtures
	LC1.1.2.2	Homogeneous mixtures
	LC1.1.2.3	Comparison of different solvents
	LC1.1.2.4	Solutions, colloids and suspensions
	LC1.1.3	Separation of substances
	LC1.1.3.1	Evaporation
	LC1.1.3.2	Elutriation and decanting
	LC1.1.3.3	Separation by melting and by magnets
	LC1.1.3.4	Purification of rock salt
	LC1.1.3.5	Separation of immiscible liquids
	LC1.1.3.6	Extraction
	LC1.1.3.7	Separation of substances by solvent extraction
	LC1.1.3.8	Chromatography

	LC1.2	WATER
	LC1.2.1	Water as a solvent
	LC1.2.1.1	Detection of dissolved solid substances in different water samples
	LC1.2.1.2	Detection of dissolved gases in drinking water
	LC1.2.1.3	Total hardness of water
	LC1.2.1.4C	Saturated solutions (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.2.1.5	Influencing the process of dissolution
	LC1.2.2	Analysis, synthesis and detection of water
	LC1.2.2.1	Water splitting and water synthesis
	LC1.2.2.2	Chemical testing for water
	LC1.2.3	Water treatment
	LC1.2.3.1	Filtering with gravel and activated charcoal filters
	LC1.2.3.2C	Oxygen content of water (with Mobile-CASSY 2 WiFi) DIGITAL

	LC1.3	AIR, GASES AND THEIR PROPERTIES
	LC1.3.2	Gases - synthesis, detection and properties
	LC1.3.2.1	Oxygen - synthesis, detection and properties
	LC1.3.2.2	Carbon dioxide - synthesis, detection and properties
	LC1.3.2.3	The carbon dioxide fire extinguisher
	LC1.3.2.4	Hydrogen - synthesis and properties
	LC1.3.3	Air and combustion
	LC1.3.3.1	Functionality of the burner
	LC1.3.3.2	Importance of air for combustion processes
	LC1.3.3.3	Oxygen content of air
	LC1.3.3.4	Production of charcoal

	LC1.4	ACIDIC AND ALKALINE SOLUTIONS
	LC1.4.1	Acidic and alkaline
	LC1.4.1.1	Preparing an indicator from red cabbage
	LC1.4.1.2	Effects of acids on indicators
	LC1.4.1.3	Effects of alkaline solutions on indicators
	LC1.4.1.4	The pH scale
●●	LC1.4.1.4C	The pH scale (with Mobile-CASSY 2 WiFi) DIGITAL
●●	LC1.4.1.5C	pH paper versus pH electrode (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.1.6	The pH value of everyday chemicals
●●	LC1.4.1.6C	The pH value of everyday chemicals (with Mobile-CASSY 2 WiFi) DIGITAL

	LC1.4.2	Acids
●●	LC1.4.2.1C	Conductivity of strong and weak acids (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.2.2	Sulphuric acid and its properties
	LC1.4.2.2C	Sulphuric acid and its properties (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.3	Alkaline solutions
	LC1.4.3.1	Using alkaline solutions in everyday life
	LC1.4.3.2	Reaction of hydroxides with water
	LC1.4.3.2C	Reaction of hydroxides with water (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.3.3	Reaction of alkali metals and alkaline earth metals with water
	LC1.4.3.4	Reaction of metal oxides with water
	LC1.4.3.5	Ammonia as an alkaline solution
	LC1.4.4	Protolysis equilibrium
●●	LC1.4.4.1C	Multi-step protolysis of phosphoric acid (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.4.2	Buffer solutions
●●	LC1.4.4.2C	Buffer solutions (with Mobile-CASSY 2 WiFi) DIGITAL
●●	LC1.4.4.3C	From the pH value to the pKa value (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.5	Titrations
	LC1.4.5.1	Titration of hydrochloric acid with sodium hydroxide solution
	LC1.4.5.2	Determining the acetic acid content in vinegar
	LC1.4.5.3	Recording a titration curve
●●	LC1.4.5.3C	Recording a titration curve (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.5.4	Selecting an indicator for titration
●●	LC1.4.5.4C	Selecting an indicator for titration (with Mobile-CASSY 2 WiFi) DIGITAL
●●	LC1.4.5.5C	Amino acids as dipolar ions (with Mobile-CASSY 2 WiFi) DIGITAL
●●	LC1.4.5.6C	Conductometric titration (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.4.6	Neutralisation and salification
	LC1.4.6.1	Neutralisation
	LC1.4.6.2	Reaction of metals with acids
	LC1.4.6.3	Reaction of metal oxides with acids

	LC1.5	SALTS
	LC1.5.2	Ion detection
	LC1.5.2.1	Detection of carbonate ions
	LC1.5.2.2	Detection of chloride ions
	LC1.5.2.3	Detection of sulphate ions
	LC1.5.2.4	Detection of iron ions
	LC1.5.2.5	Detection of copper ions
	LC1.5.3	Utilising salts
	LC1.5.3.1	Growing crystals
	LC1.5.3.1C	Growing crystals (with Mobile-CASSY 2 WiFi) DIGITAL
	LC1.5.3.2	Cold and heat mixtures
	LC1.5.3.2C	Cold and heat mixtures (with Mobile-CASSY 2 WiFi) DIGITAL

	LC1.6	METALS
	LC1.6.1	Properties of metals
	LC1.6.1.1	Heating metals
	LC1.6.1.2	The copper envelope
	LC1.6.1.3	Combustion of metals
	LC1.6.1.4	The rusting process
	LC1.6.1.5	Flame colouration
	LC1.6.2	Use of metals
	LC1.6.2.1	Rust protection by tin plating and galvanising
	LC1.6.2.2	Heat treatment of steel
	LC1.6.2.3	Silver mirror
	LC1.6.3	Complex chemistry
	LC1.6.3.1	Ligand exchange with copper complexes

	LC1.7	REDOX REACTIONS
	LC1.7.1	Oxidation
	LC1.7.1.1	Reaction of metals with air
	LC1.7.1.2	The reason for oxidation
	LC1.7.1.3	Combustion of metals
	LC1.7.2	Redox titration
	LC1.7.2.1	Redox titration

	LC1.8	CHEMICAL REACTIONS
	LC1.8.1	Characteristics of a chemical reaction
	LC1.8.1.1	Physical process or chemical reaction?
	LC1.8.1.2	The reaction of copper and iron with sulphur
	LC1.8.2	Chemical laws
	LC1.8.2.1	The law of conservation of mass
	LC1.8.2.2	The law of definite proportions

	LC1.9	NEW FIELDS IN CHEMISTRY
	LC1.9.1	Nanochemistry
	LC1.9.1.1	Solutions, colloids and suspensions
	LC1.9.1.2	Nanochemistry of carbon

93 EXPERIMENTS

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

- Conductivity sensor
- Conductivity adapter S
- pH sensor, BNC
- pH adapter S

LC1.6.1.1 Heating metals

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LC1.1 TO LC1.9 INORGANIC AND GENERAL CHEMISTRY

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE	CHEMICALS
Chemistry Basic CB	Inorganic Chemistry AC	Mobile-CASSY 2 WiFi	Science Lab Chemistry digital	Chemical Set AC

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

Science Lab Inorganic Chemistry AC (Set)

Student experiment set of the student experiment system Science Lab in the field of chemistry. Set-up material for one working group in pre-formed tray. With the equipment set AC, together with the Science Lab Chemistry Basic CB (207 200S), 93 experiments at school, college and university level for worldwide curriculums can be performed. The Science Lab Inorganic Chemistry AC contains two trays. The individual devices are assigned in such a way that the students have a maximum of 2 trays on the table for the experiments. The students deal with the topics general and inorganic chemistry. 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
8	Beaker Boro 3.3, 100 ml, squat
2	Tray, high
1	Microscope slides 76 mm x 26 mm x 1 mm, set of 50
1	Crucible porcelain 20 ml
16	Test tube Fiolax 16 mm x 160 mm
1	Test tube Supremax 20 mm x 180 mm
2	Beaker Boro 3.3, 400 ml, squat
1	Pneumatic Tank, Plastic
1	Erlenmeyer flask 250 ml, narrow neck, SB 29
1	Evaporating dish 60 mm Ø
2	Funnel PP 75 mm Ø
1	Dropper funnel, 75 ml, ST 29
1	Gas delivery tube, angled, 8 mm Ø
1	Angled tube 90°, 50/50 mm, 8 mm Ø
1	Angled tube 90°, 300/50 mm, 8 mm Ø

Count	Name
1	Glass nozzle 90°, 80 mm x 80 mm, 8 mm Ø
1	Burette filling funnel plastic, 35 mm Ø
1	Burette clear glass, 10 ml, side stopcock
1	Stand ring with stem 100 mm Ø
1	Wire gauze 160 mm x 160 mm
1	Wire triangle with clay sleeves 60 mm
1	Pestle 88 mm
1	Mortar porcelain 70 mm Ø
1	Rubber tubing 7 mm Ø, 1 m
14	Rubber stopper solid, 14...18 mm Ø
1	Rubber stopper solid, 25...31 mm Ø
1	Rubber stopper two 7 mm holes, 25...31 mm Ø
1	Silicone stopper, one 7 mm hole, 16...21 mm Ø
1	Stopwatch, digital
207 211S	Science Lab Inorganic Chemistry AC (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

leylabde/207211S

OVERVIEW OF ADVANTAGES

- Easy introduction to digital measurements and evaluation
- Includes the chemicals for at least 10 repetitions of all experiments
- Covers all requirement levels

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	207 200S	Science Lab Chemistry Basic CB (Set)	
1	661 243	Wash bottle PE 500 ml	
1	656 017	Teclu burner, universal	
1	607 020	Safety gas hose with clamp 0.5 m	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	529 670	Conductivity sensor	
1	524 0671	Conductivity adapter S	
1	529 672	pH sensor, BNC	
1	524 0672	pH adapter S	
1	666 194	Protective sleeves for temperature probe, set of 5	
1	ADACB501	Compact scale 500 g : 0.1 g	
1	667 609	Safety gloves, nitrile rubber, size 8	
1	607 105	Magnetic stirrer mini	
1	666 851	Stirring magnet 25 mm x 6 mm Ø, circular	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 72	LIT: LC Science Lab Chemistry, digital	
1	679 210	Chemicals Science Lab Inorganic Chemistry	
1	675 3410	Water, pure, 5 l	
1	MA91201	Test sticks total water hardness	
1	674 4640	Buffer solution pH 4.00, 250 ml	pH measurement experiments (LC1.4)
1	674 4670	Buffer solution pH 7.00, 250 ml	pH measurement experiments (LC1.4)
1	ADAHCB123	Compact Balance 120 g : 0.001 g	Titration experiment (LC1.4.5)

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

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

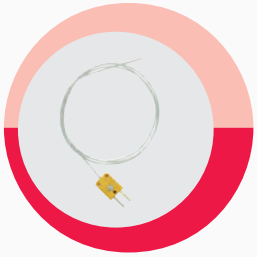
The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

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

SENSORS

INCLUDED IN SCOPE OF DELIVERY



Temperature probe NiCr-Ni, type K

Included with the purchase of the Mobile-CASSY 2 WiFi (524 005W).

SENSORS

Conductivity sensor ●

Conductivity sensor using four-wire technology with integrated Pt temperature sensor for use with chemistry box (524 067), conductivity adapter S (524 0671) and CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Open design for rapid response to changes in conductivity. When conducting measurements a minimum distance of 1 cm from the side of the, as well as a minimum immersion depth of 2 cm are to be maintained.

529 670	Conductivity sensor	

Conductivity adapter S ●

Used in conjunction with the conductivity sensor (529 670), this adapter enables conductivity and temperature to be measured with CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836).

524 0671	Conductivity adapter S	

pH sensor, BNC ●

pH glass electrode in plastic shaft and BNC plug for use with the chemistry box (524 067), pH adapter S (524 0672) and CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Low-maintenance pH electrode with solid electrolyte made of a conductive gel-like polymer.

529 672	pH sensor, BNC	

For storage 3 M Potassium chloride sol. is recommended (672 5250).

pH adapter S ●

Enables a pH electrode to be connected to CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Moreover, the voltage at the BNC socket can be measured at a very high resistance, e.g. for measuring electrochemical potentials.

524 0672	pH adapter S	

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

CHEMICALS

Chemicals Science Lab Inorganic Chemistry

Chemicals for carrying out student experiments in Science Lab Inorganic Chemistry. The chemical set contains 87 different chemicals which can be used to perform every experiment at least 10 times.

679 210	Chemicals Science Lab Inorganic Chemistry	

The individual chemicals from this set can be found in the chemicals overview which starts from page 220. There you will also find the relevant hazard symbols and classes as well as hazard warnings and safety instructions.

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
SUBJECT AREA

LIT: LC1 Inorganic and general chemistry

Printed version available in ring file of ONE subject area

Detailed experiment instructions relating to Science Lab Set AC (207 211S) and Science Lab Set Chemistry Basic CB (207 200S). Describes 93 experiments from the field of general and inorganic chemistry.

Topics:
General methods & separation methods; Water; Air, gases and their properties; Acidic and alkaline solutions; Salts; Metals; Redox reactions; Chemical reactions, New fields of chemistry

520 7211EN	LIT: LC1 Inorganic and general chemistry

SUBJECT

LIT: LC Science Lab Chemistry, digital

includes ALL subject areas

Comprehensive chemistry experiment instructions for the Science Lab.
Contains 257 experiments in the fields of inorganic chemistry, organic chemistry, physical chemistry, technical chemistry and biochemistry.

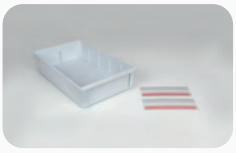
Includes all interactive experiment instructions (Lab Docs) as html file.

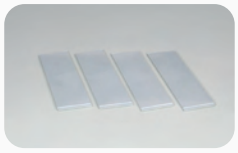
520 72	LIT: LC Science Lab Chemistry, digital

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.

ORGANIC CHEMISTRY

The Science Lab Set *Organic Chemistry* is the optimal collection of devices for teaching all topics relevant to organic chemistry.

Take advantage of the intelligent set-up system: Instead of using ground joint instruments, your students can implement complex set-ups themselves simply with GL screw joints. Thereby you can successfully conduct the experiment in just one class/lecture. This provides a large variety, from basic experiments on the properties of organic substances to insights into the petrochemical industry.

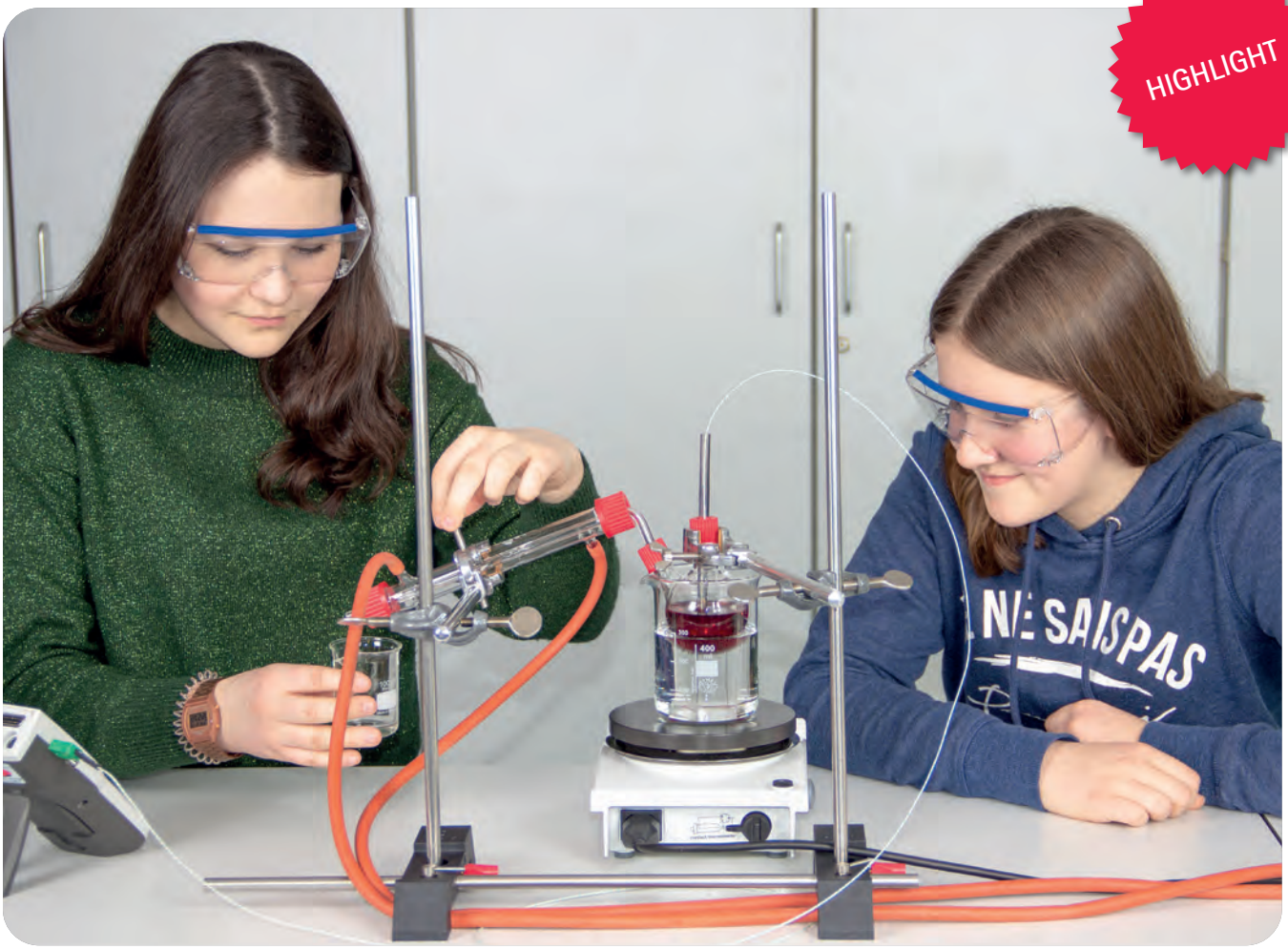
HIGHLIGHT

LC2.1.2.1 Detection of hydrogen and carbon

In this experiment, students will prove that organic matter consists of carbon and hydrogen. To do this, urea is heated together with copper oxide as an example of an organic substance. In doing so, the copper oxide reacts to the copper. The escaping gases are detected in a calcium hydroxide solution as CO_2. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Organic Chemistry OC (207 221S)**.

Overview of topics and sets

EXPERIMENT TOPICS		REQUIRED SETS		NO. EXPERIMENTS	DETAILS
LC2.1	ORGANIC SUBSTANCES	Chemistry Basic CB	Organic Chemistry OC	53	PAGE 156
LC2.2	HYDROCARBONS				
LC2.3	ALCOHOLS, ALDEHYDES AND KETONES				
LC2.4	CARBOXYLIC ACIDS AND ESTERS				
LC2.5	REACTIONS IN ORGANIC CHEMISTRY				
LC2.6	METHODS OF ORGANIC CHEMISTRY	207 200S	207 221S		



LC2.3.1.3C Distillation of wine

Distillation is a classic chemical process. In this experiment, pure alcohol is isolated from wine through distillation. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Organic Chemistry OC (207 221S)**.

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

ORGANIC CHEMISTRY – OC

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LC2.1	ORGANIC SUBSTANCES
	LC2.1.1	Characteristics of organic substances
	LC2.1.1.1	Characteristics of organic substances
	LC2.1.1.2	Combustion gas of organic substances
	LC2.1.2	Elements in organic substances
	LC2.1.2.1	Detection of hydrogen and carbon
	LC2.1.2.2	Detection of oxygen

	LC2.2	HYDROCARBONS
	LC2.2.1	Saturated hydrocarbons
	LC2.2.1.1	Dry distillation of coal
	LC2.2.1.2	Properties of propane
	LC2.2.1.3	Properties of some alkanes
	LC2.2.1.4	The melting point of paraffin
	LC2.2.2	Unsaturated hydrocarbons
	LC2.2.2.1	Detection of multiple bonds
	LC2.2.2.2	Properties of ethyne
	LC2.2.3	Petrochemistry
	LC2.2.3.1	Properties of some crude oil fractions
	LC2.2.3.2	Petrol as a solvent
	LC2.2.3.3	Catalytic cracking
	LC2.2.3.4	Analysis of crack products
	LC2.2.3.5	Production of biodiesel
	LC2.2.3.5C	Production of biodiesel (with Mobile-CASSY 2 WiFi) DIGITAL

	LC2.3	ALCOHOLS, ALDEHYDES AND KETONES
	LC2.3.1	Production of alcohols
	LC2.3.1.1	Production of "wood alcohol"
	LC2.3.1.2	Alcoholic fermentation
	LC2.3.1.3	Distillation of wine
	LC2.3.1.3C	Distillation of wine (with Mobile-CASSY 2 WiFi) DIGITAL
	LC2.3.2	Detection of alcohols
	LC2.3.2.1	Differentiation of methanol and ethanol
	LC2.3.2.2	Iodoform test
	LC2.3.2.3	Detection of multivalent alkanols
	LC2.3.3	Properties and uses of alcohols
	LC2.3.3.1	Ethanol as a solvent
	LC2.3.3.2	Flammability of an ethanol-water mixture
	LC2.3.3.3	Water-solubility of different alkanols
	LC2.3.3.4	Isomeric alkanols and their boiling points
	LC2.3.3.4C	Isomeric alkanols and their boiling points (with Mobile-CASSY 2 WiFi) DIGITAL
	LC2.3.3.5	Oxidation of alcohols
	LC2.3.4	Aldehydes
	LC2.3.4.1	The Tollens reaction
	LC2.3.4.2	Synthesis and detection of ethanal
	LC2.3.5	Ketones
	LC2.3.5.1	Synthesis of alkanons
	LC2.3.5.2	Properties and uses of acetone

	LC2.4	CARBOXYLIC ACIDS AND ESTERS
	LC2.4.1	Production of carboxylic acids
	LC2.4.1.1	Synthesis of acetic acid by oxidation
	LC2.4.1.2	Synthesis of wine vinegar
	LC2.4.2	Properties & uses of carboxylic acids
	LC2.4.2.1	Formic acid as a preservative
	LC2.4.2.2	Properties of formic acid and acetic acid
	LC2.4.2.3	Properties and uses of wine vinegar
	LC2.4.3	Production and properties of esters
	LC2.4.3.1	Esters of acetic acid
	LC2.4.3.2	Esters of propane acid
	LC2.4.3.3	Esters of benzoic acid
	LC2.4.3.4	Ester synthesis as an equilibrium reaction
	LC2.4.3.5	Alkaline ester hydrolysis
●●	LC2.4.3.5C	Alkaline ester hydrolysis (with Mobile-CASSY 2 WiFi) DIGITAL

	LC2.5	REACTIONS IN ORGANIC CHEMISTRY
	LC2.5.1	Addition reactions
	LC2.5.1.1	Electrophilic addition reaction
	LC2.5.1.2	Nucleophilic addition to the carbonyl group
	LC2.5.2	Substitution reactions
	LC2.5.2.1	Nucleophilic substitution reaction
	LC2.5.2.2	Radical substitution reaction
●●	LC2.5.2.2C	Radical substitution reaction (with Mobile-CASSY 2 WiFi) DIGITAL

	LC2.6	METHODS OF ORGANIC CHEMISTRY
	LC2.6.1	Distillations
	LC2.6.1.1	Distillation of cola
	LC2.6.1.1C	Distillation of cola (with Mobile-CASSY 2 WiFi) DIGITAL
	LC2.6.1.2	Steam distillation for the extraction of fragrances
	LC2.6.1.2C	Steam distillation for the extraction of fragrances (with Mobile-CASSY 2 WiFi) DIGITAL

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

- Conductivity sensor
- Conductivity adapter S
- pH sensor, BNC
- pH adapter S

53 EXPERIMENTS

LC2.2.1.4 The melting point of paraffin

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LC2.1 TO LC2.6 ORGANIC CHEMISTRY

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE	CHEMICALS
Chemistry Basic CB	Organic Chemistry OC	Mobile-CASSY 2 WiFi	Science Lab Chemistry digital	Chemical Set OC

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

Science Lab Organic Chemistry OC (Set)

Student experiment set of the student experiment system Science Lab in the field of chemistry. Set-up material for one working group in pre-formed tray. With the equipment set OC, together with the Science Lab Chemistry Basic CB (207 200S), 53 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topics organic chemistry. 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	Beaker Boro 3.3, 100 ml, squat
1	Syringe 50 ml
1	Luer Combi Stopper red
1	Two-neck round bottom flask Boro 3.3, 100 ml, GL 18
1	Cooling jacket
1	Tray, high
6	Test tube Fiolax 16 mm x 160 mm
1	Test tube Supremax 20 mm x 180 mm
1	Test tube with side arm, Boro 3.3, 20 x 180 mm
1	Copper wire gauze roll 80 x 7.5 mm Ø
2	Beaker Boro 3.3, 400 ml, squat
1	Petri dish, 100 x 20 mm, glass
1	Erlenmeyer flask 250 ml, narrow neck, SB 29
2	Evaporating dish 60 mm Ø

Count	Name
1	Gas delivery tube, angled, 8 mm Ø
1	Angled tube 90°, 300/50 mm, 8 mm Ø
1	Glass nozzle 90°, 80 mm x 80 mm, 8 mm Ø
1	Fermentation tube 200 mm x 8 mm Ø
1	Pestle 88 mm
1	Mortar porcelain 70 mm Ø
2	Rubber tubing 7 mm Ø, 1 m
5	Rubber stopper solid, 14...18 mm Ø
1	Rubber stopper, one 7-mm hole, 14...18 mm Ø
1	Rubber stopper, one 7-mm hole, 16...21 mm Ø
1	Rubber stopper, one 7-mm hole, 25...31 mm Ø
1	Silicone stopper, one 7-mm hole, 16...21 mm Ø
1	Screw cap GL 18, solid

207 221S	Science Lab Organic Chemistry OC (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

leylab.de/207221S

OVERVIEW OF ADVANTAGES

- GL screw joints instead of ground joints
- Includes chemicals for at least 10 repetitions of all experiments
- Wide range of experiments: basic and advanced level

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	207 200S	Science Lab Chemistry Basic CB (Set)	
1	661 243	Wash bottle PE 500 ml	
1	656 017	Teclu burner, universal	
1	607 020	Safety gas hose with clamp 0.5 m	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	529 670	Conductivity sensor	
1	524 0671	Conductivity adapter S	
1	529 672	pH sensor, BNC	
1	524 0672	pH adapter S	
1	666 194	Protective sleeves for temperature probe, set of 5	
1	ADACB501	Compact scale 500 g : 0.1 g	
1	667 609	Safety gloves, nitrile rubber, size 8	
1	666 839	Magnetic stirrer with hot plate	for several experiments
1	666 851	Stirring magnet 25 mm x 6 mm Ø, circular	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 72	LIT: LC Science Lab Chemistry, digital	
1	679 220	Chemicals Science Lab Organic Chemistry	
1	675 3410	Water, pure, 5 l	
1	674 4640	Buffer solution pH 4.00, 250 ml	Substitution reaction experiment (LC2.5.2)
1	674 4670	Buffer solution pH 7.00, 250 ml	Substitution reaction experiment (LC2.5.2)
1	674 9340	Anthracite coal, pieces, 100 g	

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

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

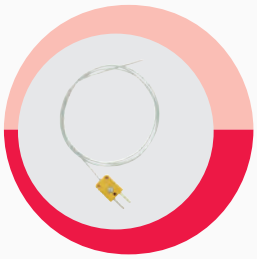
The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

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

SENSORS

INCLUDED IN SCOPE OF DELIVERY



Temperature probe NiCr-Ni, type K

Included with the purchase of the Mobile-CASSY 2 WiFi (524 005W).

SENSORS

Conductivity sensor

Conductivity sensor using four-wire technology with integrated Pt temperature sensor for use with chemistry box (524 067), conductivity adapter S (524 0671) and CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Open design for rapid response to changes in conductivity.
When conducting measurements a minimum distance of 1 cm from the side of the, as well as a minimum immersion depth of 2 cm are to be maintained.

529 670	Conductivity sensor	

Conductivity adapter S

Used in conjunction with the conductivity sensor (529 670), this adapter enables conductivity and temperature to be measured with CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836).

524 0671	Conductivity adapter S	

pH sensor, BNC

pH glass electrode in plastic shaft and BNC plug for use with the chemistry box (524 067), pH adapter S (524 0672) and CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Low-maintenance pH electrode with solid electrolyte made of a conductive gel-like polymer.

529 672	pH sensor, BNC	

For storage 3 M Potassium chloride sol. is recommended (672 5250).

pH adapter S

Enables a pH electrode to be connected to CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Moreover, the voltage at the BNC socket can be measured at a very high resistance, e.g. for measuring electrochemical potentials.

524 0672	pH adapter S	

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

CHEMICALS

Chemicals Science Lab Organic Chemistry

Chemicals for carrying out student experiments in Science Lab Organic Chemistry. The chemical set contains 68 different chemicals which can be used to perform every experiment at least 10 times.

679 220	Chemicals Science Lab Organic Chemistry	

The individual chemicals from this set can be found in the chemicals overview which starts from page 220. There you will also find the relevant hazard symbols and classes as well as hazard warnings and safety instructions.

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
SUBJECT AREA

LIT: LC2 Organic Chemistry

Printed version available in ring file of ONE subject area

Detailed experiment instructions relating to Science Lab Set OC (207 221S) and Science Lab Set Chemistry Basic CB (207 200S). Describes 53 experiments from the field of organic chemistry.

Topics:
Organic substances; Hydrocarbons; Alcohols, aldehydes and ketones; Carboxylic acids and esters; Reactions in organic chemistry; Methods of organic chemistry

520 7221EN	LIT: LC1 Organic chemistry

SUBJECT

LIT: LC Science Lab Chemistry, digital

includes ALL subject areas

Comprehensive chemistry experiment instructions for the Science Lab.
Contains 257 experiments in the fields of inorganic chemistry, organic chemistry, physical chemistry, technical chemistry and biochemistry.

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

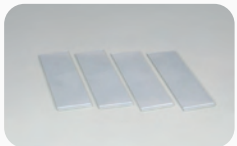
520 72	LIT: LC Science Lab Chemistry, digital

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.

PHYSICAL CHEMISTRY

With the Science Lab Set *Physical Chemistry*, you will inspire your students with basic, chemistry-related phenomena. With this selection of experiments students do not only gain a deep understanding of electrochemistry, but also of basic concepts such as reaction rate, the energy of chemical reactions or equilibrium concentrations.

Our long established devices, such as our cell batteries for the construction of electrochemical elements, can still be used hereby alongside with our Mobile-CASSY 2 WiFi with its state-of-the-art measuring technology.

HIGHLIGHT

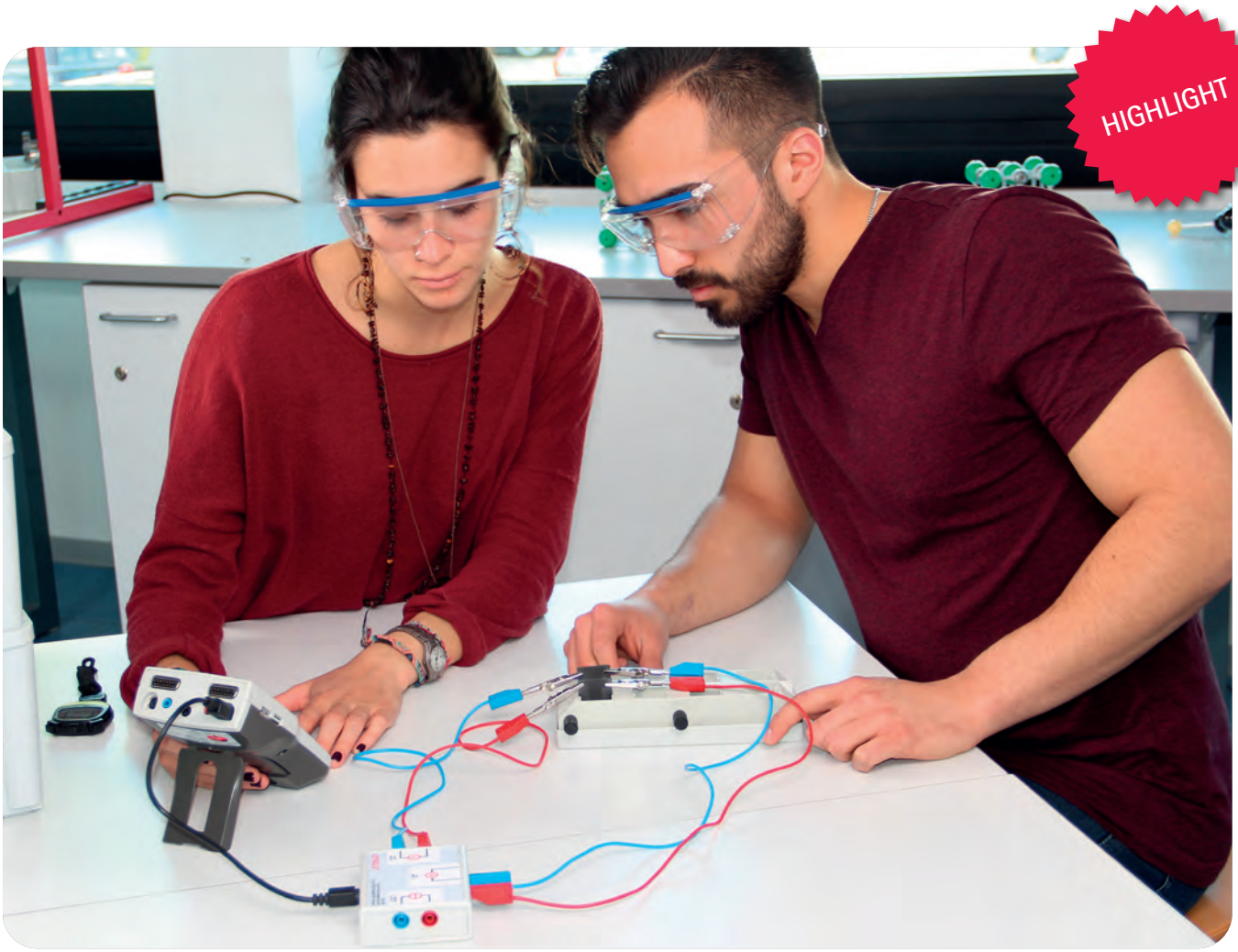
LC3.3.1.1C The water equivalent of a calorimeter

In this experiment, the students will build a simple calorimeter and use a water mixture to calculate the thermal capacity of their calorimeter. This forms a foundation for later calorimetry experiments. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Physical Chemistry PC (207 231S).**

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

EXPERIMENT TOPICS		REQUIRED SETS		NO. EXPERIMENTS	DETAILS
LC3.1	ELECTROCHEMISTRY	Chemisty Basic CB	Physical Chemistry PC	55	PAGE 164
LC3.2	PHYSICAL PROCESSES				
LC3.3	ENERGY IN CHEMICAL REACTIONS				
LC3.4	RATE OF REACTION				
LC3.5	CHEMICAL EQUILIBRIUM	207 200S	207 231S		



LC3.1.3.4C The zinc iodide battery

For this experiment, students will construct a zinc iodide battery and charge it using electrolysis in the first part of the experiment. This process is especially easy to observe, as iodine is formed in one half cell and zinc is deposited on the carbon electrode in the other half cell. Then, the battery discharge is examined by measuring the cell voltage and the short-circuit current with the Mobile-CASSY 2 WiFi. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Physical Chemistry PC (207 231S).**

PHYSICAL CHEMISTRY – PC

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LC3.1	ELECTROCHEMISTRY	
	LC3.1.1	Electrical conductivity	
●	LC3.1.1.1	Conductors and non-conductors	
●	LC3.1.1.2	The conductivity of liquids and solutions	
●	LC3.1.1.3	Ionic migration	
	LC3.1.2	Electrochemical potentials	
	LC3.1.2.1	The redox series of metals	
●	LC3.1.2.2C	Creation of an electrochemical series (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.2.3C	Expansion of an electrochemical series (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.2.4C	The standard potentials of metals (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.2.5C	The standard potentials of non-metals (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.2.6C	The NERNST equation part I - Fundamentals (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.2.7C	The NERNST equation part II - Structure (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.2.8C	Influences on the voltage of concentration cells (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.1.3	Galvanic elements	
●	LC3.1.3.1C	The Voltaic element (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.3.2C	The DANIELL element (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.3.3C	The DANIELL element (series connection) (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.3.4C	The zinc iodide battery (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.3.5C	The functionality of a fuel cell (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.1.4	Applied electrochemistry	
	LC3.1.4.1	The corrosion of iron	
	LC3.1.4.2	Corrosion protection of iron	
●	LC3.1.4.3C	Galvanisation (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.4.4	Electrolytic refining of copper	
●	LC3.1.4.5	Anodic oxidation	
●	LC3.1.4.6C	The solubility product (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.4.7C	The dissociation constant (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.4.8C	The silver/silver chloride electrode (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.1.5	Electrolysis	
●	LC3.1.5.1	Electrolysis of water	
●	LC3.1.5.2	Electrolysis of metal halide solutions	
●	LC3.1.5.3C	Faraday's first law with the electrolyser (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.5.4C	Faraday's second law with the electrolyser (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.1.5.5C	Determination of the Faraday efficiency of an electrolyser (with Mobile-CASSY 2 WiFi)	DIGITAL

	LC3.2	PHYSICAL PROCESSES	
	LC3.2.1	Particle movement	
	LC3.2.1.1	Diffusion	

	LC3.3	ENERGY IN CHEMICAL REACTIONS	
	LC3.3.1	Calorimetry	
	LC3.3.1.1C	The water equivalent of a calorimeter (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.1.2C	Neutralisation enthalpy (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.1.3C	Solution enthalpy of salts (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.1.4C	Reaction enthalpy of a redox reaction (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.2	Reaction heat	
	LC3.3.2.1C	The exothermic reaction (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.2.2C	The endothermic reaction (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.2.3C	Hess's law (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.3.2.4C	A spontaneous endothermic reaction (with Mobile-CASSY 2 WiFi)	DIGITAL

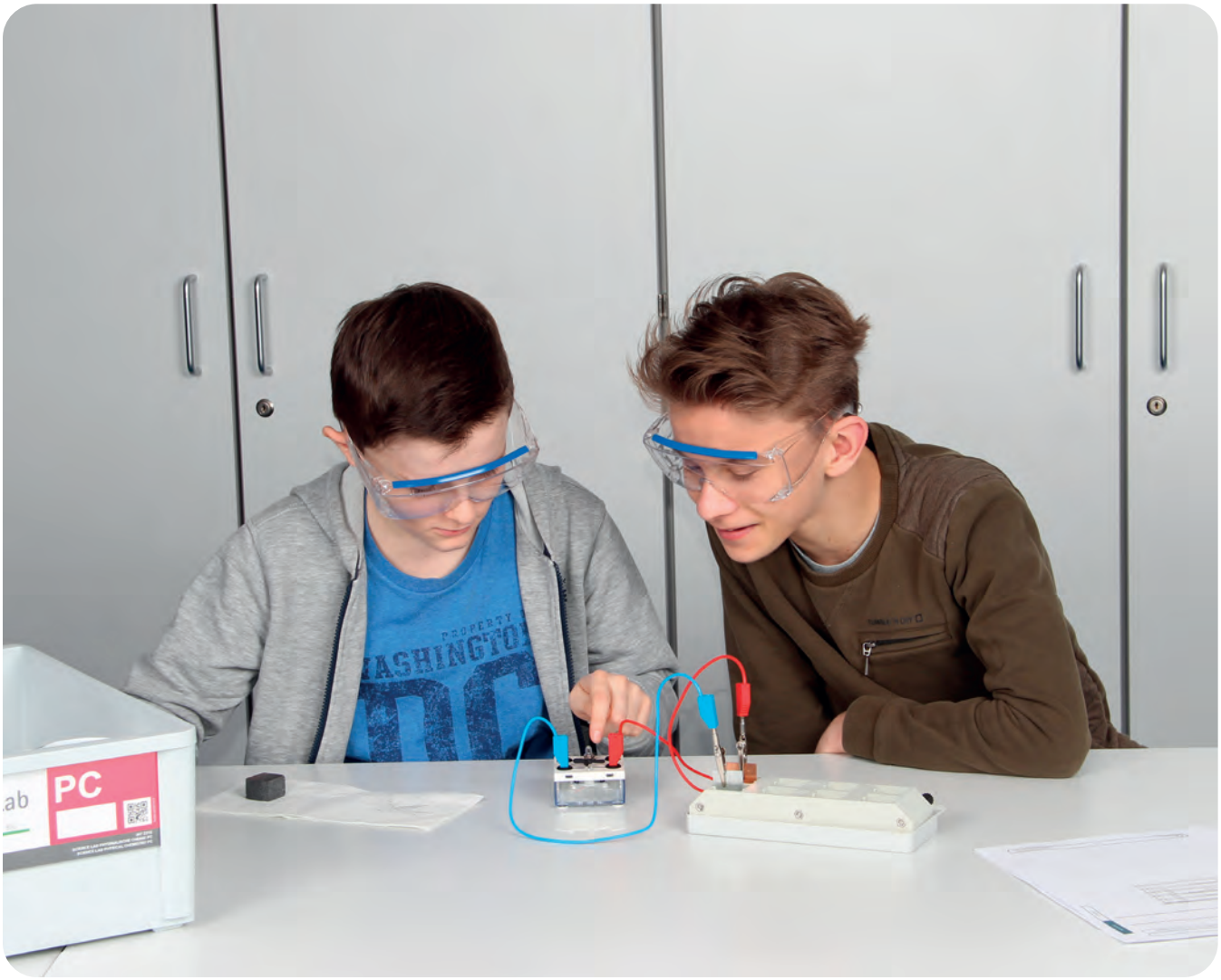
	LC3.4	RATE OF REACTION	
	LC3.4.1	Course of a reaction	
● ●	LC3.4.1.1C	Hydrolysis of esters (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.4.1.2	Activation energy	
	LC3.4.2	Influencing the rate of reaction	
	LC3.4.2.1	Temperature dependence	
	LC3.4.2.2	Concentration dependence	
	LC3.4.2.3	Degree of fragmentation	
	LC3.4.2.4	A catalytic reaction	
	LC3.4.2.5	Inorganic and organic catalysts	
	LC3.4.2.6	Analysis of enzyme activity	

	LC3.5	CHEMICAL EQUILIBRIUM	
	LC3.5.1	Chemical equilibrium	
	LC3.5.1.1	Chemical equilibrium	
	LC3.5.1.2	Ligand exchange with copper complexes	
	LC3.5.2	Le Chatelier's principle	
● ●	LC3.5.2.1C	Influence of a change in temperature (with Mobile-CASSY 2 WiFi)	DIGITAL
	LC3.5.2.2	Influence of a change in concentration	
	LC3.5.2.3	Influence of a change in pressure	
	LC3.5.3	The law of mass action and its applications	
	LC3.5.3.1	Law of mass action	
● ●	LC3.5.3.2C	Determination of the equilibrium constant (with Mobile-CASSY 2 WiFi)	DIGITAL
●	LC3.5.3.3	The solubility product	
●	LC3.5.3.4C	The dissociation constant (with Mobile-CASSY 2 WiFi)	DIGITAL

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

- Conductivity sensor
- Conductivity adapter S
- pH sensor, BNC
- pH adapter S
- Electrochemistry box M

55 EXPERIMENTS



LC3.1.3.2C The DANIELL element

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LC3.1 TO LC3.5 PHYSICAL CHEMISTRY

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE	CHEMICALS
Chemistry Basic CB	Physical Chemistry PC	Mobile-CASSY 2 WiFi	Science Lab Chemistry digital	Chemical Set PC
				

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

Science Lab Physical Chemistry PC (Set)

Student experiment set of the student experiment system Science Lab in the field of chemistry. Set-up material for one working group in pre-formed tray. With the equipment set PC, together with the Science Lab Chemistry Basic CB (207 200S), 55 experiments at school, college and university level for worldwide curriculums can be performed. The students deal with the topics physical chemistry 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	Connecting lead 19 A, 50 cm, red/blue, pair
6	Crocodile clip, polished
4	Beaker Boro 3.3, 100 ml, squat
1	Syringe 50 ml
1	Luer Combi Stopper red
4	Plastic cup
1	Tray, high
5	Test tube Fiolax 16 mm x 160 mm
2	Beaker Boro 3.3, 400 ml, squat
2	Petri dish, 100 x 20 mm, glass
1	Plastic plate for magnesium electrode
4	Plate electrode copper 43 x 28 mm
2	Plate electrode zinc 43 x 28 mm

Count	Name
2	Plate electrode iron 43 x 28 mm
3	Plate electrode carbon 43 x 28 mm
2	Plate electrode silver 43 x 28 mm
1	Mesh electrode platinum 43 x 28 mm
1	Grindstone
1	Spare Diaphragms, 100 sheets
1	Angled tube 90°, 250/50 mm, 8 mm Ø
1	Electrical loads Electrochemistry
1	Cell batteries, pair
1	Stopwatch, digital
207 231S	Science Lab Physical Chemistry PC (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

leylab.de/20723 1S

OVERVIEW OF ADVANTAGES

- Electrochemistry with the reliable cell battery: low amounts of chemicals needed and simultaneous measurements in the separate compartments possible
- Digital measurements (temperature, voltage, current, conductivity)
- Experiments with the multifunctional electrochemistry box M, no separate power supply required
- Quantitative experiments for advanced chemistry lessons/classes
- Includes enough chemicals for at least 10 repetitions of all experiments

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	207 200S	Science Lab Chemistry Basic CB (Set)	
1	661 243	Wash bottle PE 500 ml	
1	656 017	Teclu burner, universal	
1	607 020	Safety gas hose with clamp 0.5 m	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	529 670	Conductivity sensor	
1	524 0671	Conductivity adapter S	
1	529 672	pH sensor, BNC	
1	524 0672	pH adapter S	
1	524 450	Electrochemistry box M	
1	666 194	Protective sleeves for temperature probe, set of 5	
1	ADACB501	Compact scale 500 g : 0.1 g	
1	667 609	Safety gloves, nitrile rubber, size 8	
1	607 105	Magnetic stirrer mini	
1	666 839	Magnetic stirrer with hot plate	Le Chatelier's principle experiment (LC3.5.2)
1	666 851	Stirring magnet 25 mm x 6 mm Ø, circular	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 72	LIT: LC Science Lab Chemistry, digital	
1	679 230	Chemicals Science Lab Physical Chemistry	
1	675 3410	Water, pure, 5 l	
1	ADAHCB123	Compact Balance 120 g : 0.001 g	
1	674 4640	Buffer solution pH 4.00, 250 ml	Le Chatelier's principle experiment (LC3.5.2)
1	674 4670	Buffer solution pH 7.00, 250 ml	Le Chatelier's principle experiment (LC3.5.2)

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

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

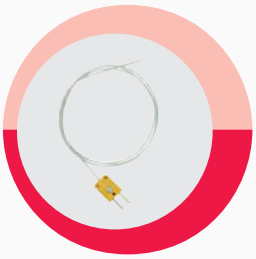
The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

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

SENSORS

INCLUDED IN SCOPE OF DELIVERY



Temperature probe NiCr-Ni, type K

Included with the purchase of the Mobile-CASSY 2 WiFi (524 005W).

SENSORS

Conductivity sensor

Conductivity sensor using four-wire technology with integrated Pt temperature sensor for use with chemistry box (524 067), conductivity adapter S (524 0671) and CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Open design for rapid response to changes in conductivity. When conducting measurements a minimum distance of 1 cm from the side of the, as well as a minimum immersion depth of 2 cm are to be maintained.

529 670	Conductivity sensor	

Conductivity adapter S

Used in conjunction with the conductivity sensor (529 670), this adapter enables conductivity and temperature to be measured with CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836).

524 0671	Conductivity adapter S	

pH sensor, BNC

pH glass electrode in plastic shaft and BNC plug for use with the chemistry box (524 067), pH adapter S (524 0672) and CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Low-maintenance pH electrode with solid electrolyte made of a conductive gel-like polymer.

529 672	pH sensor, BNC	

For storage 3 M Potassium chloride sol. is recommended (672 5250).

pH adapter S

Enables a pH electrode to be connected to CASSY (524 013, 524 006, 524 005W, 524 018) or the universal chemistry measuring instrument (531 836). Moreover, the voltage at the BNC socket can be measured at a very high resistance, e.g. for measuring electrochemical potentials.

524 0672	pH adapter S	

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

SENSORS

Electrochemistry box M

Mobile power supply for experiments as well as voltage and current measuring device in conjunction with Mobile-CASSY 2 WiFi (524 005W). For power supply up to 300 mA as well as the intuitive, parallel measurement of voltage up to ±20 V and current up to ±2 A.

524 450	Electrochemistry box M	

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

CHEMICALS

Chemicals Science Lab Physical Chemistry

Chemicals for carrying out student experiments in Science Lab topic Physical Chemistry and Electrochemistry.
The chemical set contains 57 different chemicals which can be used to perform every experiment at least 10 times.

679 230	Chemicals Science Lab Physical Chemistry	

The individual chemicals from this set can be found in the chemicals overview which starts from page 220. There you will also find the relevant hazard symbols and classes as well as hazard warnings and safety instructions.

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
SUBJECT AREA

LIT: LC3 Physical Chemistry

Printed version available in ring file of ONE subject area

Detailed experiment instructions relating to Science Lab Set PC (207 231S) and Science Lab Set Chemistry Basic CB (207 200S). Describes 55 experiments from the field of physical chemistry.

Topics:
Electrochemistry; Physical processes; Energy in chemical reactions; Rate of reaction; Chemical equilibrium

520 7231EN	LIT: LC3 Physical chemistry

SUBJECT

LIT: LC Science Lab Chemistry, digital

includes ALL subject areas

Comprehensive chemistry experiment instructions for the Science Lab.
Contains 257 experiments in the fields of inorganic chemistry, organic chemistry, physical chemistry, technical chemistry and biochemistry.

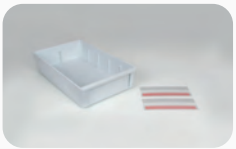
Includes all interactive experiment instructions (Lab Docs) as html file.

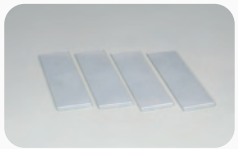
520 72	LIT: LC Science Lab Chemistry, digital

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.

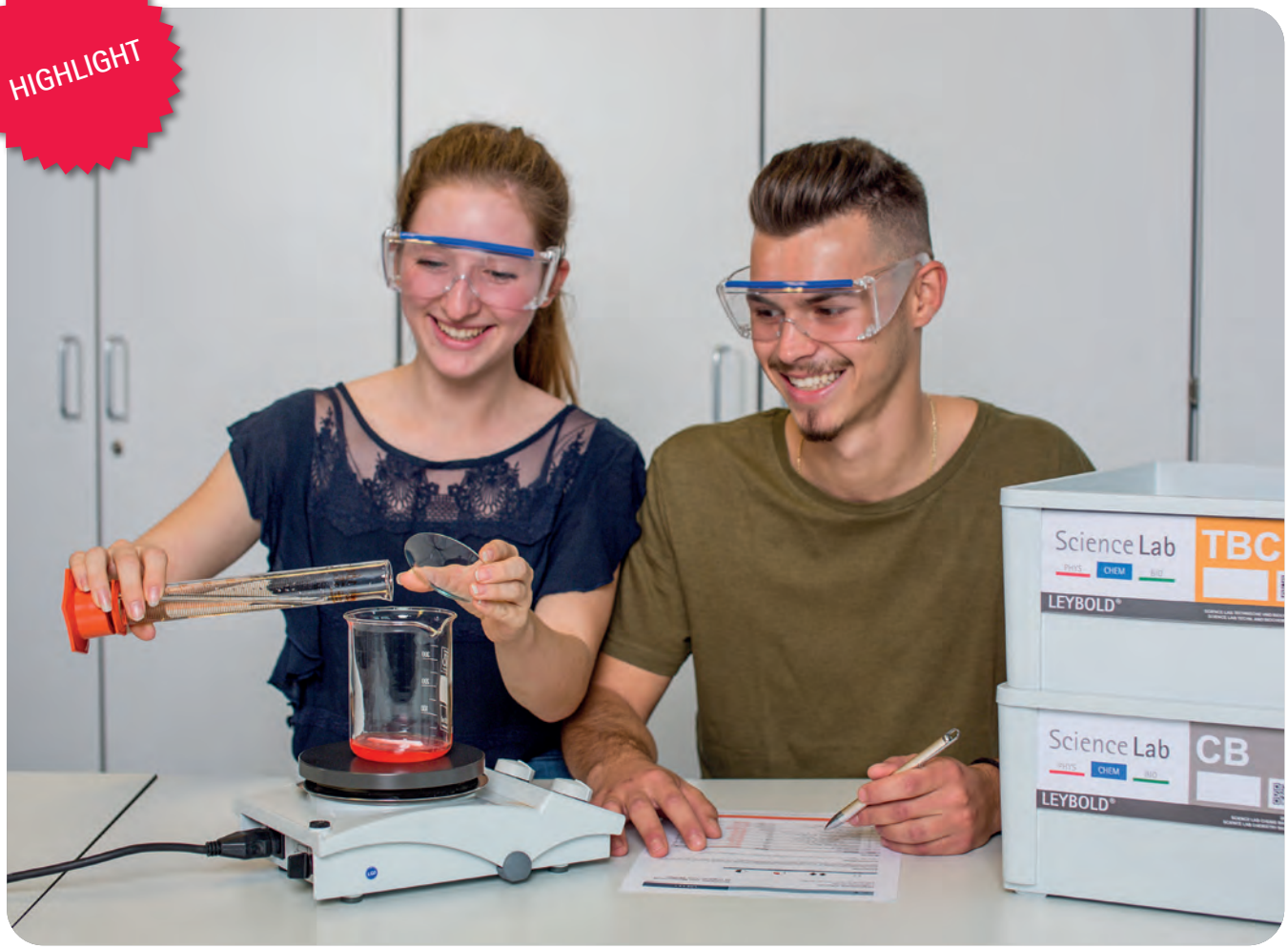
TECHNICAL CHEMISTRY AND BIOCHEMISTRY

With the experiments from the Science Lab Set Technical Chemistry, your students can apply their basic knowledge to their everyday lives. For example, they can apply the principles of chemical equilibrium to the topic of lime and gypsum, or they can use the fundamentals of organic chemistry when it comes to dyes. The topics of metals, plastics and soaps also have relevance to everyday life.

Biochemistry, as an interdisciplinary subject between chemistry and biology, is a captivating topic for many students. With the Science Lab Set Technical Chemistry and Biochemistry, you will look at fats, carbohydrates and proteins as well as their properties and applicable chemical detection reactions. Additionally, you can perform experiments on the chemistry of food and therefore practice applying chemical knowledge to everyday topics.

The Technical Chemistry and Biochemistry Set contains experiments in *Technical Chemistry* and *Biochemistry* that can be individually selected.

HIGHLIGHT

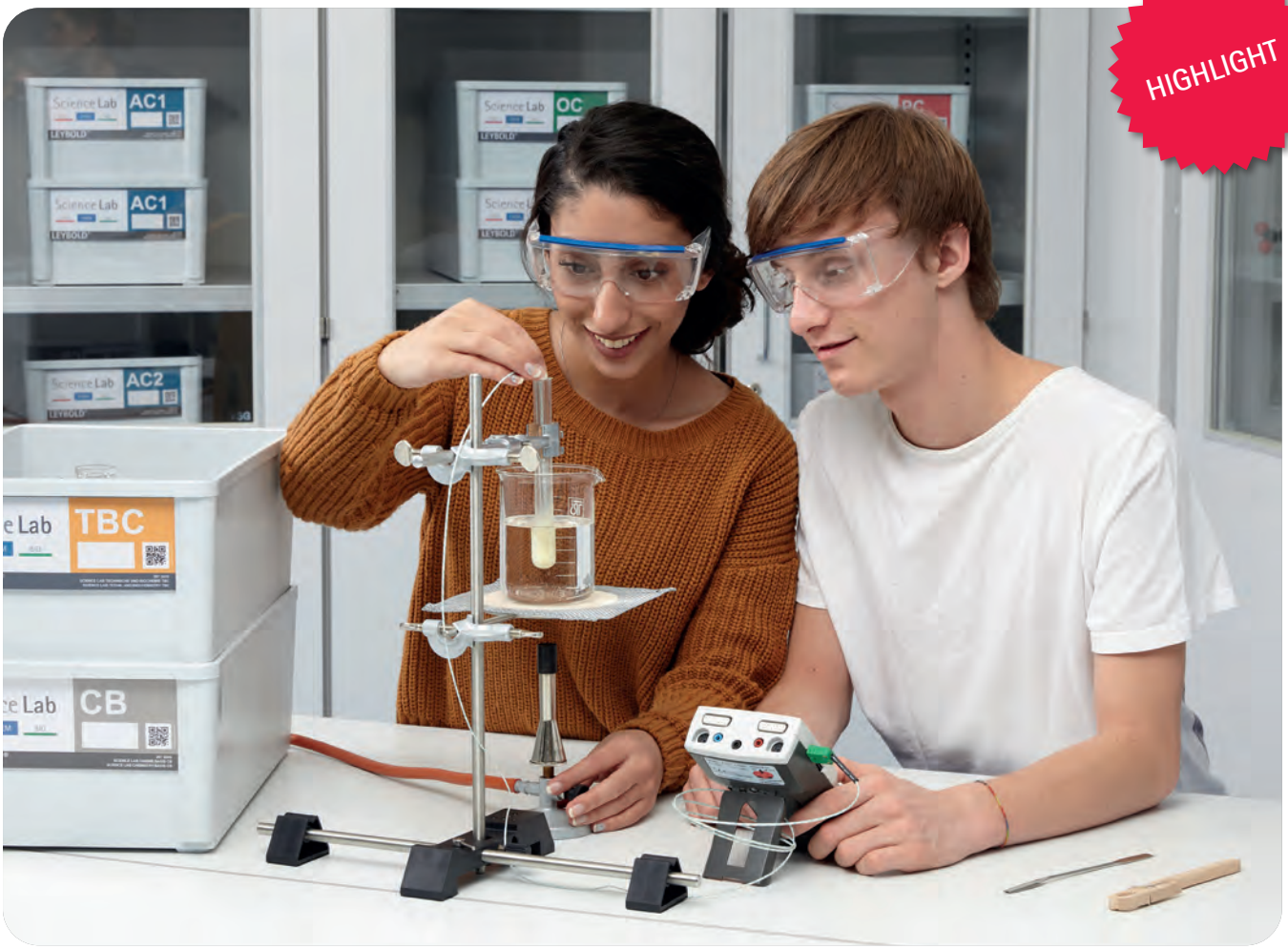


LC4.5.2.3 Influencing the properties of plastics

Plasticisers can change the properties of a plastic. In this experiment, two sheets of starch are prepared, one with added glycerine as plasticiser. Both sheets are compared with each other. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Technical Chemistry and Biochemistry TBC (207 241S)**.

Overview of topics and sets

EXPERIMENT TOPICS TECHNICAL CHEMISTRY		REQUIRED SETS		NO. EXPERIMENTS	DETAILS
LC4.1	BUILDING MATERIALS	Chemistry Basic CB	Technical & Biochemistry TBC	24	PAGE 172
LC4.2	GLASS				
LC4.3	METALS				
LC4.4	CHEMICAL APPLICATIONS				
LC4.5	PRODUCTS OF THE ORGANIC INDUSTRY				
EXPERIMENT TOPICS BIOCHEMISTRY				NO. EXPERIMENTS	DETAILS
LC5.1	FATS	207 200S	207 241S	32	PAGE 172
LC5.2	CARBOHYDRATES				
LC5.3	AMINO ACIDS AND PROTEINS				
LC5.4	FOOD				



LC5.1.1.2C Melting and solidification point

Fats are always mixtures of several triglycerides. The melting point or melting range gives information about the composition of a fat. For this experiment you will need the sets **Science Lab Chemistry Basic CB (207 200S)** and **Science Lab Technical Chemistry and Biochemistry TBC (207 241S)**.

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

TECHNICAL CHEMISTRY AND BIOCHEMISTRY

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

TECHNICAL CHEMISTRY

LC4.1	BUILDING MATERIAL	
LC4.1.1	Limestone and gypsum	
LC4.1.1.1	Calcination of limestone	
LC4.1.1.2	Slaking of limestone	
LC4.1.1.3	Setting of limestone	
LC4.1.1.4	Setting of gypsum	
LC4.1.1.4C	Setting of gypsum (with Mobile-CASSY 2 WiFi)	DIGITAL

LC4.2	GLASS
LC4.2.1	Glass
LC4.2.1.1	Production of soda-lime glass

LC4.3	METALS
LC4.3.1	Extraction of metals
LC4.3.1.1	The smelting of oxidic ores
LC4.3.2	Alloys
LC4.3.2.1	Production of bronze
LC4.3.2.2	Production of brass

LC4.4	CHEMICAL APPLICATIONS
LC4.4.1	Fertilisers
LC4.4.1.1	Production of ammonium sulphate
LC4.4.2	Photography
LC4.4.2.1	The photochemical reaction

LC4.5	PRODUCTS OF THE ORGANIC INDUSTRY
LC4.5.1	Pigments and dyestuffs
LC4.5.1.1	Molecular structure and colour
LC4.5.1.2	Synthesis of orange II
LC4.5.1.3	Extraction of food colourings
LC4.5.1.4	Synthesis of indigo and vat dyeing
LC4.5.1.5	The phenomenon of fluorescence
LC4.5.2	Plastics
LC4.5.2.1	The characteristics of different plastics
LC4.5.2.2	Polycondensation in the production of plastics
LC4.5.2.3	Influencing the properties of plastics
LC4.5.2.4	Recycling via pyrolysis
LC4.5.2.5	Silicons and carbon fibres as modern materials
LC4.5.3	Soaps
LC4.5.3.1	Production via alkaline saponification
LC4.5.3.2	Production using the carbonate process
LC4.5.3.3	Soap as an emulsifier

24 EXPERIMENTS

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

BIOCHEMISTRY

LC5.1	FATS	
LC5.1.1	Properties of fats	
LC5.1.1.1	Solubility	
LC5.1.1.2	Melting and solidification point	
LC5.1.1.2C	Melting and solidification point (with Mobile-CASSY 2 WiFi)	DIGITAL
LC5.1.1.3	Boiling point	
LC5.1.1.3C	Boiling point (with Mobile-CASSY 2 WiFi)	DIGITAL
LC5.1.2	Fatty foods	
LC5.1.2.1	Rendering animal fats	
LC5.1.2.2	Extracting vegetable fats	
LC5.1.2.2C	Extracting vegetable fats (with Mobile-CASSY 2 WiFi)	DIGITAL
LC5.1.3	Analysing fats	
LC5.1.3.1	Detection of fats	
LC5.1.3.2	Detection of unsaturated fatty acids	
LC5.1.3.2C	Detection of unsaturated fatty acids (with Mobile-CASSY 2 WiFi)	DIGITAL

LC5.2	CARBOHYDRATES	
LC5.2.1	Properties of carbohydrates	
LC5.2.1.1	Components of carbohydrates	
LC5.2.1.2	Solubility of carbohydrates	
LC5.2.1.2C	Solubility of carbohydrates (with Mobile-CASSY 2 WiFi)	DIGITAL
LC5.2.2	Extraction of sugars	
LC5.2.2.1	Isolation and detection of lactose	
LC5.2.3	Detection of sugars	
LC5.2.3.1	Detection of glucose and fructose	
LC5.2.3.3	Seliwanoff's test	
LC5.2.3.4	Blue bottle experiment	
LC5.2.3.5	Components of sucrose	
LC5.2.4	Starch and cellulose	
LC5.2.4.1	Components of starch	
LC5.2.4.2	Starch test	
LC5.2.4.3	Cellulose test	

LC5.3	AMINO ACIDS AND PROTEINS
LC5.3.1	Properties of proteins
LC5.3.1.1	Preparing an egg white solution
LC5.3.1.2	Properties of proteins
LC5.3.1.3	The composition of proteins
LC5.3.1.5	The isoelectric point of amino acids
LC5.3.2	Detection of proteins
LC5.3.2.1	The Biuret test
LC5.3.2.2	Detection with test sticks

LC5.4	FOOD
LC5.4.1	Preservatives
LC5.4.1.1	Detection of vitamin C
LC5.4.1.2	Preservation with benzoic acid and sorbic acid
LC5.4.2	Additives
LC5.4.2.1	Extraction of food colourings
LC5.4.2.2	Composition of baking powder

32 EXPERIMENTS

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

LC4.5.1.4 Synthesis of indigo and vat dyeing

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LC4.1 TO LC5.4 TECHNICAL AND BIOCHEMISTRY

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE	CHEMICALS
Chemistry Basic CB	Technical & Biochemistry TBC	Mobile-CASSY 2 WiFi	Science Lab Chemistry digital	Chemical Sets TBC

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

Science Lab Technical and Biochemistry TBC (Set)

Student experiment set of the student experiment system Science Lab in the field of chemistry. Set-up material for one working group in pre-formed tray. With the equipment set TBC, together with the Science Lab Chemistry Basic CB (207 200S), 56 experiments at school, college and university level for worldwide curriculums can be performed. The students deal with the topics technical chemistry and/or biochemistry. 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
3	Beaker Boro 3.3, 100 ml, squat
4	Plastic cup
1	Tray, high
1	Crucible porcelain 20 ml
6	Test tube Fiolax 16 mm x 160 mm
1	Test tube Supremax 20 mm x 180 mm
2	Beaker Boro 3.3, 400 ml, squat
2	Petri dish, 100 x 20 mm, glass
1	Erlenmeyer flask 250 ml, narrow neck, SB 29
1	Grindstone
2	Evaporating dish 60 mm Ø

Count	Name
1	Funnel PP 75 mm Ø
1	Angled tube 90°, 300/50 mm, 8 mm Ø
1	Stand ring with stem 100 mm Ø
1	Wire gauze 160 mm x 160 mm
1	Pestle 88 mm
1	Mortar porcelain 70 mm Ø
4	Rubber stopper solid, 14...18 mm Ø
1	Rubber stopper solid, 25...31 mm Ø
1	Silicone stopper, one 7-mm hole, 16...21 mm Ø

207 241S	Science Lab Technical and Biochemistry TBC (Set)

leylab.de/207241S

LC5.3.1.3 The composition of proteins

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

OVERVIEW OF ADVANTAGES

- 1 experiment set plus Basic Set provides 24 experiments in technical chemistry and 32 experiments in biochemistry
- Everyday topics also suitable for project work and elective courses
- Includes enough chemicals for at least 10 repetitions of all experiments

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	207 200S	Science Lab Chemistry Basic CB (Set)	
1	656 017	Teclu burner, universal	
1	607 020	Safety gas hose with clamp 0.5 m	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	666 194	Protective sleeves for temperature probe, set of 5	
1	ADACB501	Compact scale 500 g : 0.1 g	
1	667 609	Safety gloves, nitrile rubber, size 8	
1	666 839	Magnetic stirrer with hot plate	Pigments & dyestuffs, plastics, starch & cellulose experiments (LC4.5.1, LC4.5.2, LC5.2.4)
1	666 851	Stirring magnet 25 mm x 6 mm Ø, circular	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 72	LIT: LC Science Lab Chemistry, digital	
1	679 240	Chemicals Science Lab Technical Chemistry	
1	679 250	Chemicals Science Lab Biochemistry	
1	675 3410	Water, pure, 5 l	
1	661 080	Cobalt chloride test paper 2 x 7 cm, 100 strips	
1	670 2230	Albustix test sticks, 50 pcs	
1	670 9430	Lead(II) acetate paper, 1 package	
1	672 1150	Glucose-test stripes, 50 pcs	
1	MA91314	Test sticks Ascorbic acid	
1	665 6351	Analysis lamp (UV)	

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

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

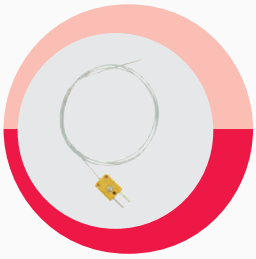
The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

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

SENSORS

INCLUDED IN SCOPE OF DELIVERY



Temperature probe NiCr-Ni, type K

Included with the purchase of the Mobile-CASSY 2 WiFi (524 005W).

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.

CHEMICALS

Chemicals Science Lab Technical Chemistry

Chemicals for carrying out student experiments in Science Lab topic Technical Chemistry. The chemical set contains 40 different chemicals which can be used to perform every experiment at least 10 times.

679 240	Chemicals Science Lab Technical Chemistry	

Chemicals Science Lab Biochemistry

Chemicals for carrying out student experiments in Science Lab topic Biochemistry. The chemical set contains 37 different chemicals which can be used to perform every experiment at least 10 times.

679 250	Chemicals Science Lab Biochemistry	

The individual chemicals from this set can be found in the chemicals overview which starts from page 220. There you will also find the relevant hazard symbols and classes as well as hazard warnings and safety instructions.

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
SUBJECT AREA

LIT: LC4 Technical Chemistry

Printed version available in ring file of ONE subject area

Detailed experiment instructions relating to Science Lab Set TBC (207 241S) and Science Lab Set Chemistry Basic CB (207 200S). Describes 24 experiments from the field of technical chemistry.

Topics:
Building material; Glass; Metals; Chemical applications; Products of the organic industry

520 7241EN	LIT: LC4 Technical Chemistry	

LIT: LC5 Biochemistry

Printed version available in ring file of ONE subject area

Detailed experiment instructions relating to Science Lab Set TBC (207 241S) and Science Lab Set Chemistry Basic CB (207 200S). Describes 32 experiments from the field of biochemistry.

Topics:
Fats; Carbohydrates; Amino acids and proteins; Food

520 7251EN	LIT: LC5 Biochemistry	

SUBJECT

LIT: LC Science Lab Chemistry, digital

includes ALL subject areas

Comprehensive chemistry experiment instructions for the Science Lab.
Contains 257 experiments in the fields of inorganic chemistry, organic chemistry, physical chemistry, technical chemistry and biochemistry.

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

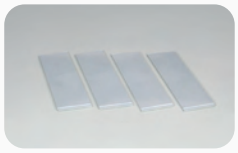
520 72	LIT: LC Science Lab Chemistry, digital

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.