

C100 MSL Chemistry

Mobile Science Laboratory

A fully featured Mobile Sciences Laboratory (MSL) for the discipline of Chemistry to be operated by the teacher. It's designed for the **demonstrations, experiments and laboratory work** in the secondary level Chemistry curriculum topics. The complex includes laboratory equipment, instruments, digital instrumentation, interactive learning resources, multimedia and test materials, interrelated and complementary to each other for the experiments and observations on the program.

The C100 complex consists of:

- 1) The Universal Mobile cart base
- 2) The experimental kits for the teacher and

- 3) The Didactic application PCB102

The C100 is supplied with special didactic software application that allows training in the disciplines of Biology in the respective training programs by using **modern technology, interactive teaching tools** and **STEM methodology**.

The **PCB102 application** is based in Hypertext HTML form and includes at minimum the methods and facilities covered in the specifications of PCB 102 Index, listed further in this document.

The Chemistry Modules of the C100 mobile laboratory are driven by PCB 102 application which is divided into topics, each topic is divided into sections and each section to subsection. In each subsection you can find the **Presentations**, the relevant **Multimedia or Video** support content and the **Simulations**. Furthermore, lab work is divided to the **Demonstrations** for the teacher and the **Activities** for the students. This distinction is due to the different materials used in the experiments. Different kits for Teacher (**CT** series) and Student (**CS** series) are provided. The cart can incorporate the teacher set and up to 5 student sets of kits. Ideally, 4 students can work per each set.

Inside the PCB 102 application you can find different support modules such as:



The **Inventory** which contains all the materials from the specific kits that are used in each lesson divided.

The **Glossary** which contains an alphabetical keyboard and by pressing each letter you can find words-meanings and terminology.

The **Application** which has two subunits: the **Simulators** (you can find simulations of specific experiments using the exact B100 equipment or generic lab simulations related to the sub topic) and the **Multimedia** presentations (showing a relevant phenomenon in some topics).

The **Science Support** module which is also divided in two subunits: the **Curriculum** (an index and search utility to find all the demonstrations and the activities numbered with links that take you to the experiment and is also mentioned the section or subsection to which it belongs) and the electronic **Manuals**, including Safety guides, Operational Videos etc and all the sub applications needed by the teacher (i.e. Data Acquisition application, Classroom management applications, Student response application).

The provided kits and the facilities of the Mobile Science Cart offer all the equipment and support to implement the pedagogical processes in the subject of Chemistry. Analytically, the Chemistry topics, sections and subsections supported by the MSL kits and the PCB 102 application are presented below.

PCB 102 INDEX

General Chemistry Process

Evaporation - Purification - Distillation - Enthalpy - Electrochemical conductivity - Electrochemistry

Chemical Structure

Atomic Structure - Determining Ion Concentration - Chemical Bonding

Chemical Reactions

Reactivity - Decomposition - Acid and Bases - Salts - Principles of Stoichiometry - Stoichiometry in Chemical Equations - Oxidation and Reduction Redox Reactions

Organic Chemistry - Introduction to Organic Chemistry - Hydrocarbons - Organic Compounds



CHEMISTRY MSL KITS *	
CT3001 Chemistry Teacher Mini Lab	1
CT3003 Teacher Support equipment	1
CT3010 Set of Molecule Models	1
CT3011 Acids and Bases	1
CS3001 Chemistry Student Mini lab	5
DLC100 Digital laboratory set	5

* Note: Quantity of sets per MSL cart

The **Didactic Application** also comes with **new add-on modules** such as:

1. **Classroom management system.**
2. **Student response system** which supports Android Pad and Smartphone user interface.
3. **Classroom Performance** Evaluation and Statistics.
4. **Teacher add-on content Link Interface.**
5. **Voice file add-on Annotation** utility.

All experiments are conducted either with the conventional measuring devices or with the use of data acquisition system which includes a variety of sensors and a state of the art datalogger. There is a variety of sensors provided with the MSL kits in order for the students to enter in the Digital Laboratory Technology. Pressure, temperature, voltage, current and pH are some of the sensors provided to the students to conduct their experiments. More than 40 teacher and student activities are provided.

Every subsection of the C100 application covers a variety of subjects with relevant experiments, some to be conducted by the Teacher (demonstrations) and others by the Student (activities) as well as theoretical presentations for each concerned subject. All the required equipment for the experiments are granted by the Chemistry MSL kits.

Analytically:

- ◆The **Evaporation** subsection covers: Demonstrations: Evaporation factors
Activities: Evaporation factors, Saline Evaporation.
- ◆The **Purification** subsection covers:
Demonstrations: Rock Salt Purification.
Activities: Separating a sand and salt mixture.
- ◆The **Distillation** subsection covers: Demonstrations: Distilled water.
- ◆The **Enthalpy** subsection covers: Demonstrations: Enthalpy Changes in A Series Changes, Heat of Neutralization, Hess's law.
- ◆The **Electrochemical Conductivity** subsection covers:
Demonstrations: Electrolysis of Water.
Activities: Electrolysis of Water.
- ◆The **Atomic Structure** subsection covers:
Demonstrations: Halide Ion Identification.
Activities: Cation/Anion Displacement.
- ◆The **Determining Ion**

Concentration subsection covers:

Demonstrations: Titration.
Activities: Acid Base Titration, Determining molarity in a solution.

◆The **Chemical Bond** subsection covers:

Activities: Introduction to Chemical Models Kits.

◆The **Reactivity** subsection covers: Demonstration: Reactivity and the Periodic Table, Silver Mirror.

Activities: Reactivity Series of Metals, Reactivity and Enthalpy Changes.

◆The **Decomposition** subsection covers:

Demonstrations: Combustion with a candle, Electrolytic chemical decomposition reaction.

Activities: Catalytic chemical decomposition reaction, Thermal chemical decomposition reaction, Catalytic Decomposition of H_2O_2 by combustion.

◆The **Acid and Bases** subsection covers:

Demonstrations: Interaction of Marble with Acid.

Activities: Acid or Base, pH Measurement.

◆The **Salts** subsection covers:

Activities: How to make salt, Electrolysis of Salt Water.

◆The **Principles of Stoichiometry** subsection covers:

Activities: Stoichiometry Ratio in Redox Displacement reaction, Stoichiometric Ratio, Calculating the volume of volatile gases.

◆The **Stoichiometry in Chemical Reactions** subsection covers:

Activities: Stoichiometry ratio by sediment weighting, Stoichiometry ratio of neutralization reaction.

◆The **Oxidation And Reduction** subsection covers:

Activities: Oxidation States of Oxygen Atoms, Oxidation States of Transition Metal Ions.

◆The **REDOX Reactions** subsection covers:

Activities: Redox states of Transition electron, Redox of Metals.

◆The **Introduction to Organic Chemistry** subsection covers:

Activities: Saponification

◆The **Organic Compound** subsection covers:

Activities: Halogen addition to Unsaturated Hydrocarbon.

The C100 interconnects the Teacher with the Students in a uniform platform.

Theory presentations with interfaces to any Student **Response system or Interactive board**, Teacher **Demonstrations**, **Lab Simulations**, **Virtual measurement simulations**, **Data acquisition** applications, **Multimedia** presentations, Student **experiments**, Student **activities** and student **quizzes and tests** jointly provide the most modern platform in Science teaching. The C100 application includes also various utilities as Glossary, Instructions for different devices in the mobile cart, the inventory of the Mobile lab, the software applications which are used during the teaching process.

As mentioned before the cart provides besides the Teacher set of kits, space of 5 student sets of kits. In case more sets are required, these are provided in a student trolley, the ST100. Each trolley can fit 3 student sets.

