Liquid Mass Transfer and Diffusion Unit

QDTL

Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION
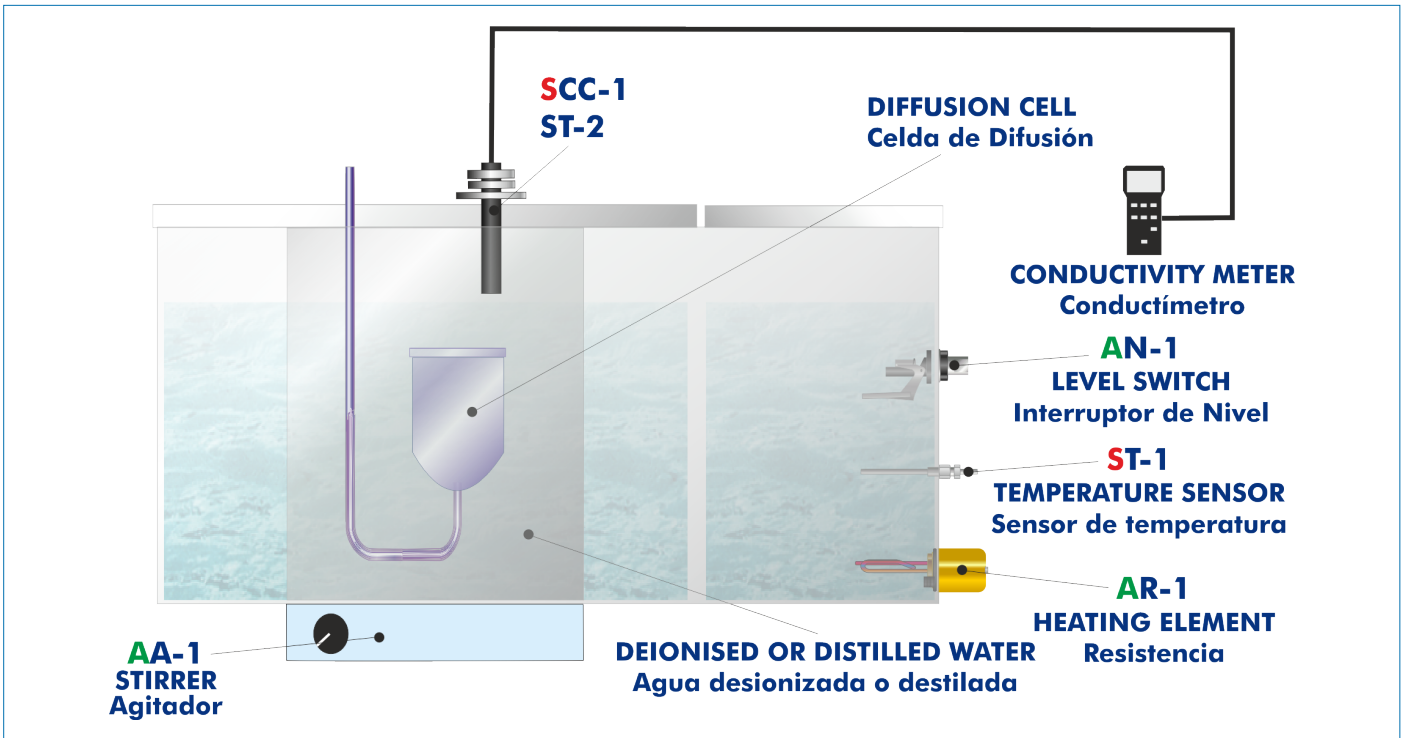
SCC-1
ST-2

DIFFUSION CELL
Celda de Difusión

CONDUCTIVITY METER
Conductímetro

AN-1
LEVEL SWITCH
Interruptor de Nivel

ST-1
TEMPERATURE SENSOR
Sensor de temperatura

AR-1
HEATING ELEMENT
Resistencia

AA-1
STIRRER
Agitador

DEIONISED OR DISTILLED WATER
Agua desionizada o destilada

INTRODUCTION

Mass transfer phenomena are common in nature and important in all branches of the engineering. Some examples within the industrial processes are: the removal of polluting materials from the discharge currents of gases and contaminated water, the neutron diffusion inside nuclear reactors, the diffusion of substances to the interior of activated carbon pores, the speed of biological and chemical catalyzed reactions, etc.

The molecular diffusion (or molecular transport) is a mass transfer mode that can be defined as the transfer (or displacement) of individual molecules through a fluid by the disorganized and individual displacements of the molecules, due to concentration differences. Diffusion may take place in stagnant fluids systems or in fluids in motion.

GENERAL DESCRIPTION

The Liquid Mass Transfer and Diffusion Unit, "QDTL", is a teaching unit that allows the students to familiarise with the notions of mass transfer theory, specially the diffusion in liquid systems, obtaining experimental data and results which are very useful for an ideal practice understanding of the process and consequently, for the technical teaching of the students.

The experimental determination of the diffusion coefficient D for a binary mixture, can be performed with a device such as the one AB described below.

A small volume tube with a filtering cell which has a certain number of pores has been placed at one of its ends. A concentrated solution of salt (sodium chloride) has been introduced inside. The tube is introduced in a vessel with pure solvent (distilled water). Now, the diffusion starts, and it will be indirectly measured by the conductivity data.

A thermostatic bath allows us to make the experiments at different temperatures.

SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

Transparent tank for liquids (experimentation vessel), capacity: 2.5 l.

Magnetic stirrer and magnet, range: 0 – 300 rpm.

Conductivity meter and conductivity cell:

Conductivity

Range	Measurement	Resolution
200 μS	0.1 to 199.9 μS	0.1 μS
2 mS	0.2 to 1.999 mS	0.001 mS
20 mS	2 to 19.99 mS	0.01 mS

μS - micro Siemens; mS – milli Siemens.

Temperature

Measurement range: 0 °C – 60 °C.

Resolution= 0.1 °C.

Accuracy= 0.8 °C.

Diffusion cell:

Capillaries number (N) = 317.

Capillary length (x) = 5 mm.

Capillary diameter (D) = 1 mm.

Thermostatic bath:

Water vessel, capacity: 8 l.

Heating element, 500 W.

Level switch.

Temperature sensor "J type".

Electronic console:

Metallic box.

Temperature sensor connection.

Level switch connection.
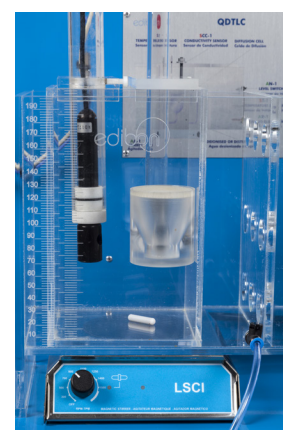
Heating resistance switch.

Stirrer switch.

Heating element temperature controller.

Main switch.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

QDTL detail

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Fick´s law application to calculate the diffusivity.

2.- Accurate measurement of mass transfer rates.

3.- Determination of the molar density rate.

4.- Effect of concentration on diffusion coefficients.

5.- Simple analysis of a first order unsteady state process.

6.- Concentration and conductivity relation.

7.- Study of the temperature effect on diffusion coefficients.

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.

DIMENSIONS AND WEIGHTS

QDTL:

  Unit:

      -Dimensions: 500 x 370 x 500 mm approx.

           (19.68 x 14.56 x 19.68 inches approx.)

      -Weight: 20 Kg approx.

          (44 pounds approx.)

  Electronic console:

      -Dimensions: 300 x 230 x 135 mm approx.

           (11.81 x 9.05 x 5.31 inches approx.)

      -Weight: 2 Kg approx.

          (4.4 pounds approx.)

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- Stop Clock.

- Balance.

REQUIRED CONSUMABLES (Not included)

- Distilled water.

- NaCl.

SIMILAR UNITS AVAILABLE

<u>Offered in this catalog</u>:

- QDTL. Liquid Mass Transfer and Diffusion Unit.

<u>Offered in other catalogs</u>:

- QDTLC. Computer Controlled Liquid Mass Transfer and Diffusion Unit.

- QDTGC. Computer Controlled Gaseous Mass Transfer and Diffusion Unit.

- QDTG. Gaseous Mass Transfer and Diffusion Unit.

QDTL/ICAI. Interactive Computer Aided Instruction Software:
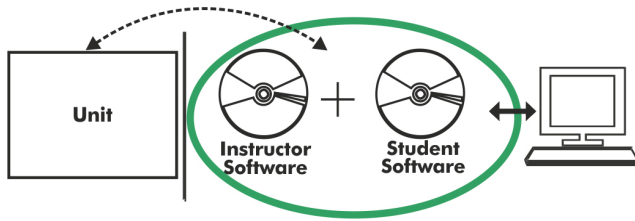
With no physical connection between unit and computer, **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.
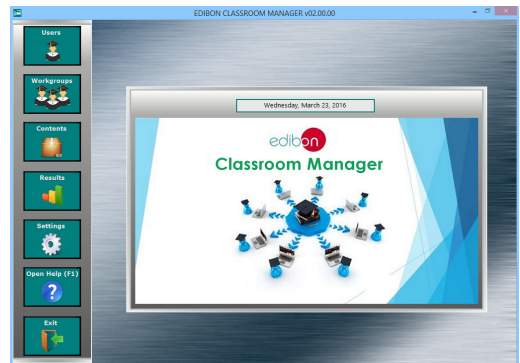
<u>Instructor Software</u>

### - ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

• **User Data Base Management.**

• **Administration and assignment of Workgroup, Task and Training sessions.**

• **Creation and Integration of Practical Exercises and Multimedia Resources.**

• **Custom Design of Evaluation Methods.**

• **Creation and assignment of Formulas & Equations.**

• **Equation System Solver Engine.**

• **Updatable Contents.**

• **Report generation, User Progression Monitoring and Statistics.**
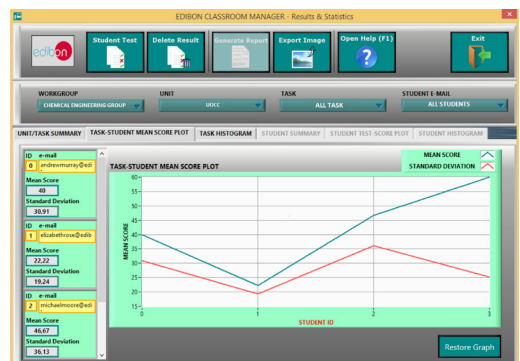

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen
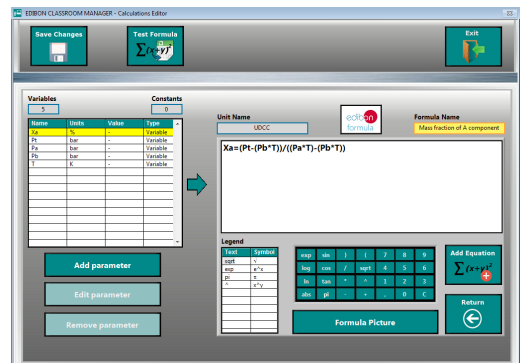
ECAL. EDIBON Calculations Program Package - Formula Editor Screen
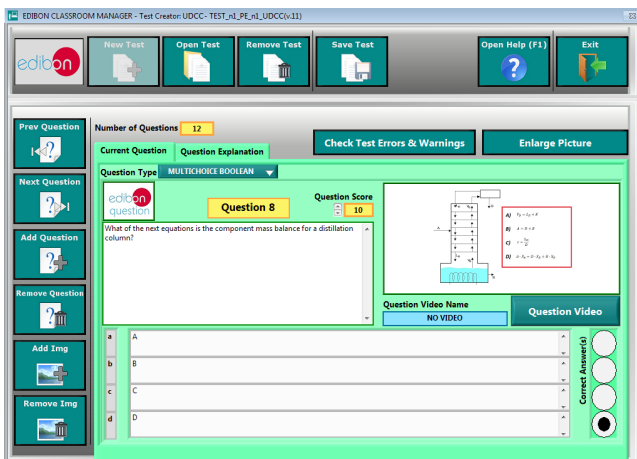
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

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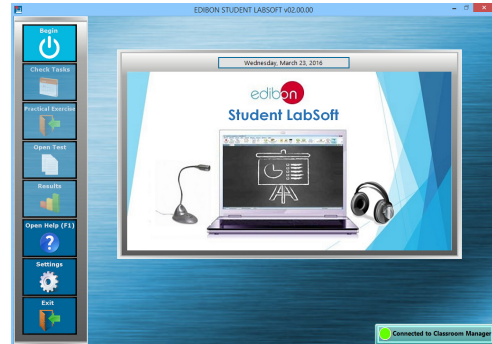## - ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

• **Student Log-In & Self-Registration.**

• **Existing Tasks checking & Monitoring.**

• **Default contents & scheduled tasks available to be used from the first session.**

• **Practical Exercises accomplishment by following the Manual provided by EDIBON.**

• **Evaluation Methods to prove your knowledge and progression.**

• **Test self-correction.**

• **Calculations computing and plotting.**

• **Equation System Solver Engine.**

• **User Monitoring Learning & Printable Reports.**

• **Multimedia-Supported auxiliary resources.**

For more information see **ICAI** catalogue. Click on the following link:
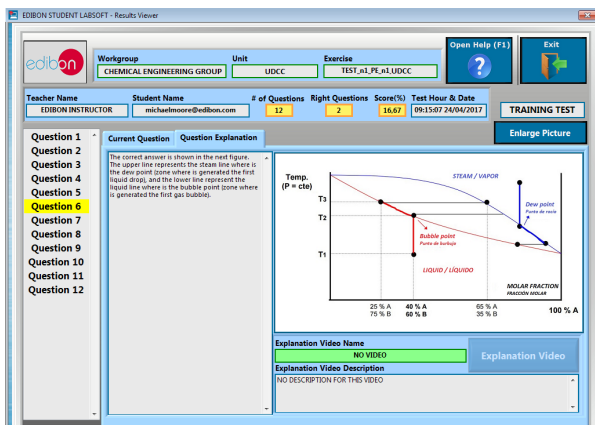
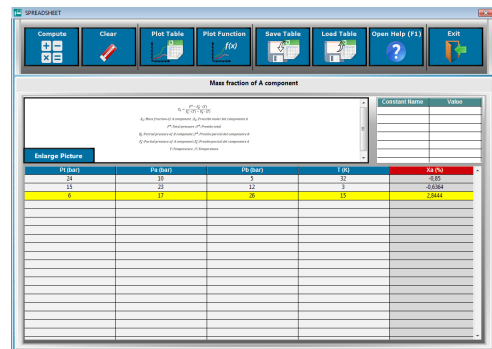www.edibon.com/en/files/expansion/ICAI/catalog

ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen
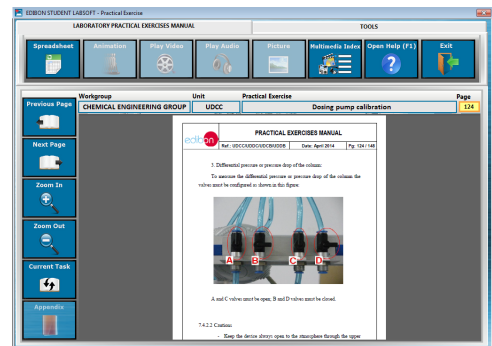
EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.

REPRESENTATIVE:

edibon
INTERNATIONAL

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