OBSERVING, MEASURING AND MODELLING IN SCIENCE

✓ Methods in Science

- Scientific reasoning
- Measuring and uncertainty
- Modelling and data fitting

✓ Energy in Science

- Structure and properties of matter
- Physical and chemical transformations
- Force and motion
- Energy transformation
- Energy matter interaction

✓ Living organism

- Cell
- Human body
- Animal and plant life
- Biosphere
- Ecosystems

✓ Earth Science

- Earthquakes
- Water in rocks
- Earth modifications
- Earth history
- Earth in the space

OBSERVING, MEASURING AND MODELLING IN SCIENCE

1. Methods in Science:	**Scientific reasoning** **Measuring and uncertainty** **Quantitative modelling and data fitting**
2. Optics	**Reflection law** **Refraction law** **Imaging and lenses** **Diffraction and Interference**
3. Earth Science:	**Water in rocks and soils** **Earthquakes (3 chapters)**
4. Energy in Science	**Mechanics** **Chemistry**

SMART Modules and didactic units in Science

Methods in Science

Scientific reasoning:

✓Lesson 0: Introduction

"Believe, Know, Understand"

✓Lesson 1: Mirrors and reflectivity

"A look into the mirrors"

"Observing and Measuring reflection"

"The reflection law"

✓Lesson 2: Plant reproduction →

"Thermogenesis and Sexual Reproduction in plant species: Arum italicum: an example of scientific reasoning in Biology"

✓Lesson 3: The mole concept

"Quantity of matter: Mole concept from microscopic to macroscopic"

SMART Modules and didactic units in Science

Methods in Science

Measuring and uncertainty:

✓ Direct Measurement uncertainty: sheet, xls :
"measure of the height of a person standing up and lying down"

✓ Error propagation: MonteCarlo Method: sheet, xls
"Monte Carlo method as a way to estimate the errors quickly "

Modelling and data fitting

✓The snell law: Sheet, xls
"measure of the refraction low"

✓Gas dilatation (Gay Lussac Law): sheet, xls
"measure the gas expansion coefficient and evaluate the absolute zero temperature by estrapolation"

✓Parabolic fall: sheet
"the free fall of a real object, as a basket ball, is quantitatively investigated using Tracker software"

SMART Modules and Didactic units in Science

Optics

Reflection and Refraction law

✓Sheet 01: sheet, xls

"verify the Snell's second law using graph paper, compass and pencil"

✓Sheet 02: Sheet, xls

✓Sheet 03: sheet, xls

✓Sheet 04: sheet

"verify the Snell's second law using graph paper, compass and pencil"

Imaging and lenses

✓ Thick lenses: sheet, xls

"effect of approximations and optical aberrations"

Diffraction

✓ Diffraction by a slit: sheet

✓ Diffraction by a hair: sheet

SMART Modules and Didactic units in Science

Energy in Science

Mechanics

✓ Energy conservation 1: sheet, xls
"rotational contribution to the total energy in case of an extended body"

✓ Energy conservation 2: sheet
"extension of the previous to account for the friction"

Chemistry

✓ Food: pdf
"how junk food can be used to update approach to calorimetric measurements and thermodynamic laws"
5 chapters: Heat of combustion, Project and construction, Measure of Mc, Heat of combustion, data analysis and results"

SMART Modules and Didactic units in Science

Energy in Science

- Batteries (1 chapter, 2 experiments; under development, 15 march)
- Electrochemistry (1 chapter, 3 experiments; under development, 15 march)
- Photosynthesis (under development, 15 march)

SMART Modules and Didactic units in Science

Earth Science

Earthquake: pdf file;
3 chapters
✓WHAT IS AN EARTHQUAKE?
✓IS AN EARTHQUAKE PREDICTABLE?
✓CONSEQUENCES OF AN EARTHQUAKE

Water in rocks (under development, 15 March)