

SECTION 01 - CATALOGUE GENERAL

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PHYSICS LABORATORY SETS

Page 5

Our proposal of complete physics laboratories:

5625.1/5626.1 - MOBILE LABORATORIES (PHYSICS AND BIOLOGY)

5614 - SMALL PHYSICS LABORATORY (suitable for primary schools)

5621 - "ACTIVE SCHOOL" SET (suitable for primary schools)

5597 - PHYSICS SET FOR GROUP EXERCISES (suitable for secondary schools)

5592 - 6 PHYSICS SETS FOR TEAM WORKING (suitable for secondary schools)



PRIMARY AND MIDDLE SCHOOL - KIT BASIC

Page 10

These kits **"First steps into science"** are suitable for the students of primary schools.

- the experiments aren't dangerous for the students;
- the materials used to create the components aren't toxic;
- no net tension is needed to use them.

The experiments are easy to be performed and they are suitable for students. The experiments have been performed in our laboratories by competent staff, this ensures the good development of them. The aim is to give students the possibility to approach science field observing elementary phenomena, catching their interdisciplinary aspects. The steps suggested for each experiment are easy to be checked and stimulate the curiosity of the students towards further questions and elaborations. The experiments are easy but not superficial, they help students to understand subjects which seem to be complicated from a theoretical point of view. The analysis of natural phenomena shouldn't be only explained by the teacher but it has to be performed directly by the students through several experiments. It is important to say that these kits are cheap but they present a high teaching efficiency. Each experiment is illustrated in the english manual together with a list of items to be used and the specific steps to follow to perform the experiment (teaching guides provided in pdf version).



HIGH SCHOOL - KIT ADVANCED

Page 17

The most effective way to introduce the world of science to young people is to teach them concepts representing the base for further investigation on the subject; a wider research could take place further on.

There are some fields of knowledge regarding our daily life we perceive as a whole; they house several phenomena.

For example, the air we breath is not only necessary for life, but it is also the seat of meteorological, sound and electrical phenomena, as well as many others, involving different scientific fields.

The same goes for water, energy, light and many other things. The first approach to the study of these subjects must feature a vision of the subject as a whole, through an experimental and interdisciplinary course. This new series of kits has been designed to offer teachers a valid educational instrument to deal with these phenomena in a unitary way, through a series of simple but effective experiments.



Small physics laboratory

Suitable for primary schools

96 performable experiments

5614



Topics

MECHANICS

- Knowing forces
- Forces in action
- Weight is a force
- The spring scale and its calibration
- Other kinds of forces
- A strange addition
- Friction forces
- Center of gravity
- Let's use our force in a wise way
- The equilibrium of a rod
- Levers
- Pulleys
- Inclined plane

THERMOLOGY

- Let's tell apart heat and temperature
- Alcohol burner
- The combustion
- The thermometer and its calibration
- Thermal expansion of solids
- Thermal expansion of liquids
- Thermal expansion of gases
- Heat and temperature
- Heat propagation through conduction
- Good conductors and bad conductors
- Propagation of heat into liquids
- The convection of heat
- Irradiation
- Fusion and solidification
- Evaporation
- Boiling
- Steam condensation
- Fractional distillation

OPTICS

- Optical projector
- Why do we see objects?
- Do light rays exist?
- Lighting law
- The game of shadows
- Eclipses
- Reflection of light
- Spherical mirrors
- When the light passes from the air to a transparent body
- When the light passes from a transparent body to the air
- Total reflection
- Lenses
- Decomposition of white light
- Images in flat mirrors
- Images in lenses
- The eye and its defects
- Composed microscope
- Slides projector

ELECTROLOGY

- Knowing electricity
- Static electricity
- Protons and electrons
- Electric forces
- Electric induction
- Conductors and insulators
- The electroscope
- Let's learn how to use an electroscope
- Flashes and lightings
- Electricity on the move
- Batteries
- The electric circuit
- Light bulbs in series and in parallel
- Transformation of electric power into heat
- Electric conduction in liquids
- Electrolysis
- Magnets
- Magnetic poles
- Magnetic effect of the electric current
- The electromagnet
- Electric alarm



"Active School" set

Suitable for primary schools.

85 performable experiments**Topics****SIMPLE MACHINES**

- Simple machines
- The spring scale
- Equilibrium of a pivoted rod
- First kind of lever
- Second kind of lever
- Third kind of lever
- Verification form
- Fixed pulley
- Mobile pulley
- Simple hoist
- Inclined plane

FLUID STATICS

- What fluids are
- The spring scale
- Graduated cylinder
- Specific weight
- Measuring the specific weight of a solid
- Measuring the specific weight of a liquid
- Pressure
- Atmospheric pressure
- Pascal's principle on liquids
- Pascal's principle in aeriforms
- Principle of communicating vessels
- Capillarity
- When a body is dipped into water
- Archimedes' principle
- Flotation

THERMOLOGY

- Heat and temperature
- Alcohol burner
- Combustion
- The thermometer and its calibration
- Linear thermal expansion
- Volumetric thermal expansion
- Thermal expansion of liquids
- Thermal expansion of gases
- Fusion and solidification
- Evaporation
- Boiling
- Condensation
- Fractioned distillation

OPTICS

- Dioptric projector
- Rectilinear propagation of light
- Eclipses
- Lighting law
- Diffusion of light
- Reflection of light
- Spherical mirrors
- Refraction of light
- Total reflection
- Decomposition of white light
- Lenses
- Images in flat mirrors
- Images in converging lenses
- Conjugate points
- The eye and its defects
- Correction of the eye's defects
- Composed microscope
- Slides projector

ELECTROLOGY

- Knowing electricity
- Static electricity
- Protons and electrons
- Electric forces
- Electric induction
- Conductors and insulators
- The electroscope
- How to use the electroscope
- Flashes and lightnings
- Electricity on the move
- Batteries
- Electric generator
- Electric circuit
- Light bulbs in series and in parallel
- Electric power
- Transformation of electric power into heat
- Electric conduction in liquids
- Electrolysis
- Magnets
- Magnetic poles
- Magnetic field
- Ampère's theory
- Magnetic effect of the electric current
- The electromagnet
- Attractive power of a coil

Physics set for group exercises**5597**

Suitable for secondary schools.

110 performable experiments

**Topics****MECHANICS**

- Error theory
- Measurement of small distances using calibrated instruments
- Law of the elastic lengthenings
- Forces
- Friction forces
- Equilibrium of the moments
- Center of gravity
- Levers
- Other simple machines
- The scale
- Ways of weighing
- Fluid statics
- Archimedes' principle
- Applications of Archimedes' principle
- Periodic motions

THERMOLOGY

- Error theory
- Bunsen burner and the thermometer
- Behaviour of solids when the temperature changes
- Behaviour of liquids when the temperature changes
- Behaviour of gases when the temperature changes
- Calorimetry/specific heat
- Fusion and solidification
- Vaporization
- Condensation and fractional distillation
- Endothermic and exothermic phenomena

OPTICS

- Error theory
- Optical projector
- Propagation and diffusion of light
- Reflection of the light
- Refraction of the light
- Refraction of the light through lenses
- Refraction of the light through a prism/dispersion
- Measurement of the focal length of a mirror and of a lens with spherometer
- Images given by mirrors
- Images given by lenses
- Optical instruments

ELECTROLOGY

- Error theory
- Simple electrostatic phenomena
- Electric sources
- Electric circuit and measuring instruments
- Use of the multimeter
- Ohm's laws
- The reostat and the potentiometer
- The electric circuit with several charges in series
- The electric circuit with several charges in parallel
- Electric nets
- Some methods for measuring the electric resistance
- Resistance depending on temperature
- Thermal effect of the electric current
- Electric conduction into liquids/the electrolysis
- Simple magnetostatic phenomena
- The magnetic effect of electric current
- Electromagnetic induction
- The transformer

5597**6 Physics sets for team working****5592**

In order to have an effective laboratory practice, all working groups must not be composed of more than 4 - 5 units.

Since classes are composed of an average of 24-30 students, Optikascience offers the group of 6 physics sets (code 5597), whose equipments are contained in two metal wardrobes. The wardrobes are organized in order to put in evidence rods, metal rods, cables, etc., and are composed of stands and containers for tidy storage of an the equipment.

The group of 6 physics sets include all the equipment shown here beside, except for 6 timers which can be ordered apart (for the timers, please view section "MEASUREMENT INSTRUMENTS").

**5592**

MOBILE LABORATORY

"Stand-alone" system: equipped with sink, completely independent thanks to an independent hydraulic circuit and an adjustable electric power supply.

Sturdy and ergonomic structure, mounted on four swivel wheels, suitable for intense use: the equipment provided with the mobile lab is easy to use, functional and durable in time. The mobile laboratory is designed to contain in an orderly manner all the products needed to help the professor in laboratory practices.

We offer two different types of equipment:

- mobile laboratory of physics "**Genius**" code **5625.1**.
- mobile laboratory of biology "**Eureka**" code **5626.1**.

Each type has been studied specifically for primary schools and secondary schools, responding in the best way to every type of educational need.

OPTIKA mobile laboratory can be completely set up according to the teacher's needs.

We offer technical support aimed at purchasing and preparing the most suitable equipment for scientific practice in educational laboratories.



These photos may be different from the appearance of the delivered product, the correct dimensional and functional specifications will be provided once requested.

Genius - Mobile laboratory of physics**5625.1**

Kits provided with "Genius" mobile lab: A1 + A4 +A5 +A7

83 Feasible experiments**Topics****A1 - Statics of solids**

- Forces and their effects
- Elastic extensions: Hooke's law
- Spring scales
- Composition of forces with opposite direction
- Composition of forces with same direction
- Balance of moments
- Center of gravity
- The balance of the leaning bodies
- Levers
- Test
- Pulleys
- Inclined plane

A4 - Thermology

- Thermal sensations
- Thermoscope
- Thermometer
- Thermometric scales
- Thermal motion of the molecules
- Linear thermal expansion
- The coefficient of linear thermal expansion
- Bimetallic strip
- Volumetric thermal expansion
- Thermal expansion of liquids
- Thermal expansion of aeriform substances
- Thermal energy
- How to increase the temperature of a body
- Another way to increase the temperature
- Heat
- The relationship between heat and temperature
- Thermal balance
- Water equivalent of the calorimeter
- Measurement of the specific heat of a solid
- Propagation of heat by conduction
- Propagation of heat by convection
- Irradiation
- Change in states
- Melting
- Vaporization
- Condensation of a vapor

A5 - Geometric optics

- Light
- Rectilinear propagation of light
- Law of illumination
- Rays light

- Light diffusion
- Eclipse
- Light reflection
- Reflection in spherical mirrors
- Light refraction
- The laws of refraction
- Total reflection
- Lenses
- Refraction through lenses
- Images in the flat mirrors
- Images in spherical mirrors
- The conjugated points in spherical mirrors
- Lenses images
- The conjugated points in lenses
- The human eye
- Defects of the human eye and their correction
- Dispersion of light
- Color filters

A7 - Electrodynamics

- Electricity
- Electric charge
- Electric charges in matter
- Conductors and insulators
- Electric field
- The energy of the electric field - electric potential
- Battery
- Voltmeter
- Electric circuit
- The intensity of the electric current - the ammeter
- The first law of Ohm
- The second law of Ohm
- Resistivity
- How to measure the electrical resistance
- Series of resistors
- Rheostat
- Parallel of resistors
- Electric networks
- Potentiometer
- Internal resistance of a battery
- The thermal effect of the electric current
- Electrical conduction in liquids
- Electrolysis

5625.1**Eureka - Mobile laboratory of biology****5626.1**

Kits provided with "Eureka" mobile lab: 5630+5631

48 Feasible experiments**Topics****5630 - Plants**

- Classification of roots
- Roots: osmosis
- Roots: root hairs
- Roots are oriented
- Stem classification
- Stem: the morphology
- The underground stems
- Stem: the capillarity
- The leaf: chlorophyll
- The leaf: photosynthesis
- The leaf: perspiration
- The leaf: starch
- Flower: the morphology
- Flower: the reproductive organs
- Algae
- Ferns, mosses and lichens
- Mushrooms, molds and yeasts
- Seed morphology
- Seed classification
- Fruits classification
- Fruits pulp
- Carbon dioxide
- The reserve substances of plants
- Plants classification

5631 - Animals and human beings

- Protozoa
- Annelida
- Crustaceans
- Mollusca
- The shells of mollusca
- Insects
- Insect growth
- The anthill
- Anatomy of fish
- Habitats and living conditions
- Animal cells
- Glandular tissues
- Muscle tissues
- Starch digestion
- Fats digestion
- Protein digestion
- Enzymes
- Blood
- Osmotic pressure
- Breathing
- Skeleton
- Skin appendages: fish and reptiles
- Thermal insulation: birds and mammals
- pH and organic reactions

5626.1**NEW PACKAGING**

New stackable and multi-function storage box with lid equipped with closing clip.

All components, after use, can be neatly stored in the special preformed polystyrene drawers.

Thanks to the high resistance to impact and atmospheric agents, the products contained in it will be protected over time.

Dimensions of the box: 46 x 36 mm h 23.5 mm.



States and properties of matter - Measurement

B1

24 feasible experiments

Topics

- Space
- Matter
- Bodies
- The three states of matter
- A property of bodies: impenetrability
- Other properties of bodies
- The meaning of the comparison between different bodies
- Qualitative and quantitative comparisons
- Measurable properties and physical magnitudes
- Measurement of a physical magnitudes
- The metric decimal system
- Length
- The linear rule: a calibrated tool
- Geometry
- The fundamental bodies of geometry and the real world
- Straight lines and curved lines
- The metric wheel
- The curvimeter
- Closed lines
- Plane figures, borderline and surface
- Perimeter of a flat figure
- Area of a flat figure
- Simple polygons
- Regular simple polygons
- Isoperimetric polygons and polygons having same area
- How to compare two polygons
- Rectangles and squares
- How to measure the area of an irregular polygon
- Volume of solid bodies
- Volume of liquid bodies
- Graduated cylinder
- Volume of an irregular solid



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B1

Equilibrium and simple machines

B3

14 feasible experiments

Topics

- Know the forces
- How to sum forces
- The parallelogram rule
- The resultant of parallel forces having same direction
- How to use our strength intelligently
- Equilibrium of a rod
- Simple machines
- First class of lever
- Second class of lever
- Third class of lever
- Some examples of levers
- Pulleys
- Fixed pulley
- Movable pulley
- Simple tackle
- Inclined plane



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B3

Motion

B5

15 feasible experiments

Topics

- At rest or in motion?
- Motion along a line
- Motion on a plane
- Motion in space
- Trajectory
- Time
- Periodic motions
- Pendulum motion
- The period of a pendulum
- Does the period of a pendulum depend on the amplitude of its oscillation?
- Does the period of a pendulum depend on its length?
- Does the period of a pendulum depend on its mass?
- A tool for measuring time intervals
- The average speed
- Instantaneous speed
- The uniform rectilinear motion and its law depending on time
- Forces and motion
- Friction forces
- The motion almost frictionless
- The principle of inertia
- The action of a force on a body at rest
- Acceleration
- The uniformly accelerated motion and its law depending on time
- How to measure acceleration
- Does acceleration depend on the intensity of the force?
- The fundamental law of dynamics
- The unit of measurement of force in physics



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B5

Forces**B2****22 feasible experiments****Topics**

- Meaning of words
- Force, a primitive concept
- Contact force and non contact force
- Plastic materials and elastic materials
- Contact force: elastic force
- Non contact force: weight
- The effects of forces
- Active forces and passive forces
- How to compare forces
- A property of elastic bodies: from qualitative to quantitative
- Spring scale
- The unit of measurement of forces
- How to use the spring scale
- Vector representation of forces
- The center of gravity
- When a body falls freely
- The weight does not remain constant
- Do heavy bodies or light bodies fall first?
- The origin of weight and the force of gravity
- Why does not the moon fall on the earth?



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B2**Pressure, fluids and flotation****B4****20 feasible experiments****Topics**

- How to walk on the snow
- When a force is distributed on a surface
- The footprints
- Footprint depth
- The concept of pressure
- Pressure: a new physical magnitude
- The non-precision of common language
- Knives, nails, thumbtacks and so on
- Pressure and liquids
- How to apply a force to a liquid
- How to apply a force to a gas
- Pressure in liquids
- When the pressure in a liquid is generated by its weight
- The specific weight
- A property of pressure generated by the weight of a liquid
- Two applications of Stevin's law
- Atmospheric pressure
- Archimede thrust
- The principle of Archimede
- Floating



Teaching guide in digital format

B4**Temperature, heat and changes in status****B6****19 feasible experiments****Topics**

- Thermal sensations
- How to compare thermal sensations
- A new physical magnitude: the temperature
- Thermal expansion of solids
- Thermal expansion of liquids
- Thermal expansion of aeriform substances
- How to compare temperatures - The thermoscope
- The thermometer
- The thermometric scales
- How to use the thermometer
- When two bodies at different temperatures touch each other
- Thermal balance
- Heat
- Propagation of heat in solids
- Propagation of heat in liquids
- Propagation of heat in gases
- Irradiation
- The relationship between heat and temperature
- Changes in status
- Fusion and solidification
- Evaporation
- Boiling
- Condensation



Teaching guide in digital format

B6

Light and its phenomena


23 feasible experiments

B7

Topics

- | | |
|---|--|
| <ul style="list-style-type: none">• The optical projector• Why we see objects• Rectilinear propagation of light• Law of illumination• Shadow and dim light• Eclipse• The rays of light do not exist, the diffusion of light• Reflection of light• Reflection due to spherical mirrors• Refraction of light | <ul style="list-style-type: none">• Refraction law• Total reflection• Lenses• Refraction due to lenses• The images in the flat mirrors• Images in the lenses• The conjugated points• Human eye• The defects of the human eye• White light: light scattering• Color filters |
|---|--|



 Teaching guide in digital format

B7

Sound

27 feasible experiments

B8

Topics

- | | |
|---|---|
| <ul style="list-style-type: none">• Hearing• When do we hear a sound?• The oscillations• The period of oscillations• The frequency of oscillations• The graphic representation of the oscillations• Why we hear sounds• Acoustic waves• How acoustic waves are transformed into sounds• The ear: a receiver of acoustic waves• The ear-brain system | <ul style="list-style-type: none">• The limits of audibility• The sensitivity of the hearing system• How to reinforce auditory sensitivity• The distinctive characters of the sounds• Stereophony• The reflection of acoustic waves• Interference of acoustic waves• The beats• The sonometer• Resonance• Stringed musical instruments• Musical instruments working with air• Take care of the hearing system |
|---|---|



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B8

Electricity and electric current

21 feasible experiments

B9

Topics

- | | |
|--|---|
| <ul style="list-style-type: none">• Electricity• Triboelectricity• Protons and electrons• Electric actions• Electrostatic induction• Double electric pendulum• Contact electrization• The leaf electroscope• Electrical state of a body• Determination of the electrical state of a body• Even the air can be electrified• The biological effects of air ionization• Lightning | <ul style="list-style-type: none">• Electricity in motion• Batteries• Volta battery• Electric potential difference• Voltmeter• Electrical circuit• Conductors and insulators• Intensity of the electric current• Ammeter• Electrical resistance• Electric energy• Lamps in series and lamps in parallel• The domestic electrical system |
|--|---|



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B9

Magnets and electromagnets

15 feasible experiments

B10

Topics

- Magnets
- Magnetic poles
- Materials and magnets
- Magnetic needle
- Terrestrial magnetism
- The compass
- Magnetic interactions
- Magnetic levitation
- Magnetic field
- Magnetic induction
- How to create a magnet
- The magnetic effect of the electric current
- Electromagnet
- The attractive power of a coil
- Electric bell



Teaching guide in digital format

B10

Work and energy - renewable energy

20 feasible experiments

B11

Topics

- What is a transformation
- Physics and chemical transformations
- Balanced forces and unbalanced forces
- The concept of work in everyday language
- The concept of work in physics
- Work: a new magnitudes
- When the force is not parallel to displacement
- The concept of energy in everyday language
- The concept of energy in physics
- Work and energy
- How energy is measured
- The two forms of mechanical energy
- Kinetic energy
- Gravitational potential energy
- Plastic materials, elastic materials
- The potential elastic energy
- Other forms of energy
- The properties of energy
- The transformations of mechanical energy
- Unusable energy
- The atomic theory of matter
- The potential electric energy
- Hydraulic circuit
- Electric circuit
- Power
- Renewable and non-renewable energy sources
- The biggest source of energy: the sun
- How to transform solar energy into electricity
- Wind energy
- Other forms of alternative energy



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B11

Water and its properties

30 feasible experiments

B12

Topics

- Hydrosphere
- Water is a chemical compound
- Surface tension
- Water is not elastic
- Movement of water molecules
- The three states of water
- Volume of water
- Capillarity
- Weight of the water
- Water heating
- Thermal expansion of the water
- Water evaporation
- Boiling water
- Condensation of water vapor
- Water cycle
- Rain
- Rain gauge
- Specific weight and density of the water
- Archimede's principle
- Floating on water
- Water pressure
- Communicating vessels
- Pascal principle
- Solid water: ice
- The melting of ice
- The cycle of ice
- Various types of water
- Water for life
- Water pollution
- Acid rains
- Acidity indicators
- Water, a precious asset to save



Teaching guide in digital format

B12

Air and its properties

32 feasible experiments

B13

Topics

- | | |
|---|--|
| <ul style="list-style-type: none">• Atmosphere• Air exists• Air composition• Absolute and relative humidity• Air is impenetrable• Air is elastic• Air pressure• Pascal principle• Compressed air and rarefied air• Air temperature• When the air warms up• Winds | <ul style="list-style-type: none">• How winds are used• Air has a weight• Atmospheric pressure• Some applications of atmospheric pressure• Barometers• When the air is moving• Air to fly• Air brakes the fall• Air for life• Air pollution• Greenhouse effect• Consequences of the greenhouse effect |
|---|--|



 Teaching guide in digital format

B13

Plants

25 feasible experiments

B14

Topics

- | | |
|--|---|
| <ul style="list-style-type: none">• Introduction• Seed morphology• Seed germination• Aqueous solutions• Osmosis• Mineral salts• Roots• Root hairs• Movement of the roots• Stem• Internal structure of the stem• Underground stems | <ul style="list-style-type: none">• Absorption of the lymph• Capillarity• Why in the summer the leaves are green• Why in autumn the leaves are yellow• Chlorophyll photosynthesis• The transpiration of plants• Starch• Morphology of the flower• Fruit• Development of carbon dioxide in plants• How to build an herbarium |
|--|---|



 Teaching guide in digital format

B14

Animals

15 feasible experiments

B15

Topics

- | | |
|---|--|
| <ul style="list-style-type: none">• Biology• Cells• The food chain• Eat to live• Starch in foods• Digestion of starch• How to recognize fat types• Digestion of fats• How to recognize protein types• Protein digestion• Enzymes• Taste buds• Energy and life of animals• Combustion• Breathing of animals• pH and organic reactions | |
|---|--|



 Teaching guide in digital format

B15

Eye and sight

B16

*28 feasible experiments***Topics**

- Light
- Light sources and lighting bodies
- If there was no air
- The light carries energy
- The nature of light
- Electromagnetic waves spectrum
- Sight
- Eye: a light receiver
- Lenses
- Eye as an optical system
- Defects of the eye and their correction
- Resolving power of the eye and visual acuity
- Eye-brain system
- Persistence of images on the retina
- White light
- Temporal synthesis of colors: Newton disk
- Spatial synthesis of colors
- Binocular vision
- The sense of depth
- Stereoscopic vision
- The visual field of the eye
- Optical illusions



Teaching guide in digital format

B16

Ear and hearing

B17

*16 feasible experiments***Topics**

- Oscillatory motion
- Graphic representation of oscillatory motion
- When we hear a sound
- Why we hear sounds
- Acoustic waves
- How acoustic waves are transformed into sounds
- Ear: a receiver of acoustic waves
- The ear - brain system
- Audibility limits
- Distinctive characters of the sounds
- Sensitivity of the auditory system
- How to reinforce auditory sensitivity
- Stereophony
- Echo and reverberation
- How to take care of the hearing system



Teaching guide in digital format

B17

Touch, smell and taste

B18

Touch (11 feasible experiments) - Topics

- Skin
- Skin sensitivity
- Stimulus of contact
- Pressure stimulus
- Pain stimulus
- Temperature and heat
- Body temperature
- Thermal stimulus
- See with touch
- Fingerprints
- Skin hygiene

Smell (8 feasible experiments) - Topics

- How the matter is made
- Aggregation states of the matter
- Change in states
- Nose: the smell organ
- How the smells are felt
- How to identify the smells
- Addiction to smells
- Nose hygiene

Taste (6 feasible experiments) - Topics

- Tongue: organ of taste
- How we feel the flavors
- The four basic flavors
- Taste and smell
- Taste and sight
- Good tastes and bad tastes



Teaching guide in digital format

B18

Environment of life

23 feasible experiments

Topics

- Soil as a habitat
- Mineral fraction of the soil
- Organic fraction of the soil
- Soil contains air
- Soil contains water
- Practice on the use of acidity indicators
- Soil acidity
- Carbonates in the soil
- The permeability of the soil
- Water for life
- Water cycle
- Vaporization and condensation of water
- The rain
- Sea water
- Drinking water and its distribution
- Water pollution
- How to look for ammonia
- How to look for nitrite
- How to look for sulphates
- The research of surfactants
- What the atmosphere is?
- Air composition
- Absolute and relative humidity
- Atmospheric pollutants
- Acid rains
- The greenhouse effect



B19



Teaching guide in digital format

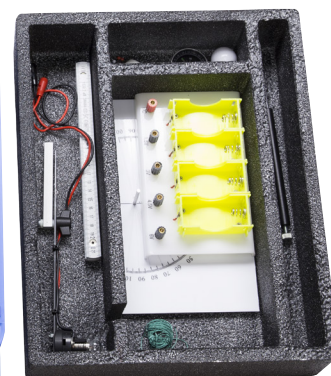
B19

The apparent motion of the sun

14 feasible experiments

Topics

- Light sources and illuminated bodies
- The light source
- Shadows
- Light propagates in a straight line
- Length of the shadow
- A bit of geometry
- When the source changes height and position
- How we see the sun moving from the Earth
- How the height of the sun varies on the same day
- Time zones
- Summer time
- How the height of the sun varies on different days
- Solstices and the equinoxes
- The movement of the sun is apparent
- Earth's motion of revolution around the Sun
- A consequence of Earth rotation: day and night
- A consequence of polar axis inclination
- Astronomical seasons
- Earth heating
- Earth natural satellite: the Moon
- Lunar phases
- Lunar eclipse
- Sun eclipse



B21



Teaching guide in digital format

B21

Introduction to chemistry

23 feasible experiments

Topics

- Alcohol burner
- Matter
- Atoms
- Molecules
- Cohesion force
- Molecules motion
- Physics and chemistry phenomena
- Elements and compounds
- The three states of matter
- Change in states
- Fusion and solidification
- Vaporization and condensation
- The mixtures: solid in solid
- The mixtures: solid in liquid
- The mixtures: liquid in liquid
- Solutions
- Crystals
- Chemical reactions
- Oxidation
- Combustion



B20



Teaching guide in digital format

B20

Statics of rigid bodies

A1

17 feasible experiments

Topics

- Forces and their effects
- Elastic extensions: Hooke's law
- Spring scales
- Composition of forces with opposite direction
- Composition of forces with same direction
- Balance of moments
- Center of gravity
- The balance of the leaning bodies
- Levers
- Test
- Pulleys
- Inclined plane


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A1

Static of fluids

A2

16 feasible experiments

Topics

- Specific weight
- Density
- Pressure
- Pascal's principle
- Stevin's principle
- Principle of communicating vessels
- Atmospheric pressure
- The pressure gauge: how to measure the pressure
- The principle of Archimedes and its applications
- Floating


 Teaching guide in digital format

A2

Dynamics

A3

26 feasible experiments

Topics

- | | |
|--|---|
| <ul style="list-style-type: none"> • Motion • Motion is relative • Reference systems • Trajectory • Displacement • Time table • Tools for the experimental study of motion • Manual time counting • Automatic time counting • Average speed • How to measure the average speed • Instantaneous velocity • How to measure instantaneous velocity • Average acceleration • How to measure average acceleration • Instantaneous acceleration • Various types of motion • Uniform rectilinear motion | <ul style="list-style-type: none"> • Uniformly accelerated rectilinear motion • Uniformly accelerated motion: how to study it • Causes of the motion • When no forces are applied to a body • When a constant force is applied to a body • Taking stock of the work • Mass • The fundamental law of dynamics • Energy conservation • Free fall of a grave • Periodic motions • Simple pendulum • Energy of an oscillating pendulum • Gravity acceleration • Springs properties • Elastic pendulum |
|--|---|


 Teaching guide in digital format

A3

Dynamics and mechanical energy conservation

A10

29 feasible experiments

Topics

- Motion
- Motion is relative
- Reference systems
- Trajectory
- Displacement
- Time table
- Tools for the experimental study of motion
- Manual time counting
- Automatic time counting
- Average speed
- How to measure average speed
- Instantaneous velocity
- How to measure instantaneous velocity in one point
- How to measure instantaneous velocity in two points
- Average acceleration
- How to measure average acceleration
- Instantaneous acceleration
- Various types of motion
- Uniform rectilinear motion
- Uniformly accelerated rectilinear motion
- How to achieve uniformly accelerated motion
- Causes of motion
- The concept of force in dynamics
- When no forces are applied to a body
- When an impulse is given to a body
- Friction
- When a constant force is applied to a body
- Taking stock of the work
- Mass
- Fundamental law of dynamics
- Interactions
- Forces at work
- Work when the force is not constant
- Elastic force
- Work of the elastic force
- Conservative forces
- Concept of energy in physics
- Kinetic energy of translation
- Gravitational potential energy
- Force of gravity is conservative
- Elastic potential energy
- Conservative forces and potential energy
- Principle of conservation of mechanical energy
- Periodic motions
- Gravitational pendulum
- Energy of a swinging pendulum
- Elastic pendulum

ATTENTION: The teaching unit A10 contains all the material of the teaching unit A3 and other material for the study of mechanical energy conservation



Teaching guide in digital format

A10

Simple harmonic motion

A11

14 feasible experiments

Topics

- Simple harmonic oscillations
- The simple pendulum
- The period of a simple pendulum
- The force that moves a simple pendulum
- Elasticity
- The elastic constant of a spring
- The mass - spring oscillator
- The period of a mass-spring oscillator
- The force that moves a mass-spring oscillator
- An important conclusion
- The hourly law of simple harmonic motion
- Speed and acceleration in simple harmonic motion
- The dynamics of simple harmonic motion
- A check on the elastic pendulum



Teaching guide in digital format

A11

Vacuum and atmospheric pressure

5701

12 feasible experiments

Topics

- Suction pump
- Vacuum plate
- Pressure
- Atmospheric pressure
- Isotropy of atmospheric pressure
- Pressure tear device
- Magdeburg hemispheres
- Straws and suction cup valve
- The balloon experiment
- Flask experiment
- Boiling water
- Acoustic waves propagation
- Newton tube
- Baroscope



Teaching guide in digital format

5701

Thermology

24 feasible experiments

A4

Topics

- Thermal sensations
- Thermoscope
- Thermometer
- Thermometric scales
- Thermal motion of the molecules
- Linear thermal expansion
- The coefficient of linear thermal expansion
- Bimetallic strip
- Volumetric thermal expansion
- Thermal expansion of liquids
- Thermal expansion of aeriform substances
- Thermal energy
- How to increase the temperature of a body
- Another way to increase the temperature
- Heat
- The relationship between heat and temperature
- Thermal balance
- Water equivalent of the calorimeter
- Measurement of the specific heat of a solid
- Propagation of heat by conduction
- Propagation of heat by convection
- Irradiation
- Change in states
- Melting
- Vaporization
- Condensation of a vapor



Teaching guide in digital format

A4

Geometric optics

26 feasible experiments

A5

Topics

- Light
- Rectilinear propagation of light
- Law of illumination
- Rays light
- Light diffusion
- Eclipse
- Light reflection
- Reflection in spherical mirrors
- Light refraction
- The laws of refraction
- Total reflection
- Lenses
- Refraction through lenses
- Images in the flat mirrors
- Images in spherical mirrors
- The conjugated points in spherical mirrors
- Lenses images
- The conjugated points in lenses
- The human eye
- Defects of the human eye and their correction
- Dispersion of light
- Color filters



Teaching guide in digital format

A5

Light, color and vision

35 feasible experiments

5504

Topics

- Know the light
- Light sources and illuminated bodies
- Light brings energy
- Do the rays of light really exist?
- Two properties of light
- Illuminance
- Light reflection
- Light refraction
- Total reflection
- I prismi a riflessione totale e le fibre ottiche
- Nature of light in physics terms
- Colors
- White light
- Light filters
- Colors of the objects
- Additive synthesis of colors
- Subtractive synthesis of colors
- Sky and Sun color
- Lenses
- Images in the lenses
- Eye and vision
- Defects of the eye
- Binocular vision and the dominant eye
- The sense of depth
- Optical illusions



Teaching guide in digital format

5504

Physics of sound

22 feasible experiments

Topics

- Introduction
- When we hear a sound
- Oscillatory motion
- Period and frequency of oscillating motion
- Time dependence of oscillatory motion law
- Oscillatory motion energy
- Features of sounds
- Why we hear sounds
- Acoustic waves
- Equation of a sine wave
- How acoustic waves are transformed into sounds
- The limits of audibility
- The sensitivity of the auditory system
- Reflection of acoustic waves
- Interference of acoustic waves
- Beats
- Stationary waves
- Resonance
- Stringed musical instruments
- Musical instruments working with air
- Sounds timbre



A6



Teaching guide in digital format

A6

Electrodynamics

24 feasible experiments

Topics

- Electricity
- Electric charge
- Electric charges in matter
- Conductors and insulators
- Electric field
- The energy of the electric field - electric potential
- Battery
- Voltmeter
- Electric circuit
- The intensity of the electric current - the ammeter
- The first law of Ohm
- The second law of Ohm
- Resistivity
- How to measure the electrical resistance
- Series of resistors
- Rheostat
- Parallel of resistors
- Electric networks
- Potentiometer
- Internal resistance of a battery
- The thermal effect of the electric current
- Electrical conduction in liquids
- Electrolysis



A7



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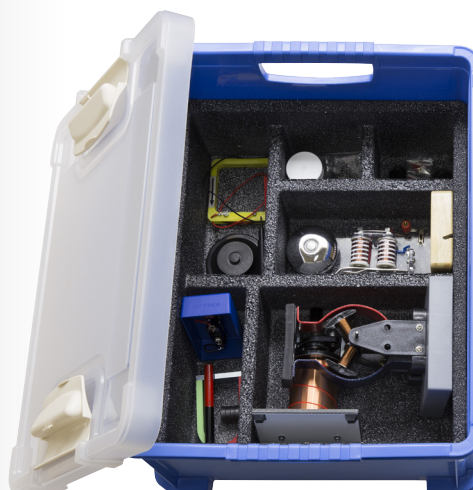
A7

Electromagnetism

18 feasible experiments

Topics

- Magnets
- Magnetic materials
- Magnetic poles
- Magnetic levitation
- Magnetic induction
- Magnetic field
- Magnetic field flow lines
- The magnetic field vector
- Lorentz force
- Earth's magnetic field
- The magnetic effect of electric current
- When the conductor is rectilinear
- When the conductor is a coil
- Electromagnet
- Electric bell
- The electric motor in direct current
- Ampère theory on magnetism



A8



Teaching guide in digital format

A8

Electromagnetic induction and alternating current

A9

18 feasible experiments

Topics

- Faraday's experiences with the permanent magnet
- Faraday's experiences with the electromagnet
- Magnetic flux
- Neumann law
- Lenz law
- The law of electromagnetic induction
- Magnetic flux and sinusoidal law
- Alternating current
- The properties of alternating currents: the effective value
- Measurement instruments for alternating current
- Transformer
- The efficiency of a transformer
- The self-induction
- Self-induction and alternating current
- Impedance
- Inductive reactance



Teaching guide in digital format

A9

How to measure the passage of time

5506

30 feasible experiments

Topics

- Introduction
- Time in science
- Motion
- Velocity
- Periodic motion
- The period of a pendulum
- Elasticity phenomenon
- Elastic pendulum
- Pendulum clock
- Natural periodic motions
- Earth shape
- Poles, meridians and circle of latitude
- Latitude and longitude
- The apparent motion of the Sun
- The motion of revolution of the Earth
- The sidereal day and the solar day
- The time in the various points of the Earth
- The date change line
- Gnomon
- The sundial
- Summer time
- Calendar
- Moon: Earth satellite
- Month
- Lunar phases
- Moon eclipse
- Sun eclipse
- The age of the trees



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5506

The sun, the earth and the moon

5655

25 feasible experiments

Topics

- Solar system
- Breakdown of sunlight
- Earth shape
- Poles, meridians and circle of latitude
- Earth magnetism
- Orientation
- Earth motions
- The apparent motion of the Sun
- Day and night
- The height of the sun during the day
- Measurement of time
- Time zones
- The sundial
- If the earth's axis were not inclined
- Consequences of the inclination of the earth's axis
- The solar irradiation on the earth's surface
- Seasons
- Earth satellite: the Moon
- Lunar phases
- Eclipses



Teaching guide in digital format

5655

Meteorology

5654

25 feasible experiments

Topics

- What meteorology is?
- Solar radiation
- Irradiation
- The greenhouse effect
- The apparent motion of the Sun
- Seasons
- Atmosphere
- Gases contained in the air
- Air temperature
- Room thermometer
- Maximum and minimum thermometer
- Air has a weight
- Atmospheric pressure
- Barometers
- When the air warms up
- Winds
- Anemoscope and anemometer
- Water cycle
- Rain: the rain gauge
- Water vapor in the air
- Relative humidity: the psychrometer
- Atmospheric precipitations
- Weather forecasting



Teaching guide in digital format

5654

Ecology

5632

30 feasible experiments

Topics

- Soil: organic mineral fraction
- Soil porosity
- Soil acidity
- Carbonates in soil
- Agricultural land
- Habitat: life in soil
- Water cycle
- Habitat: life in water
- Drinking water and its distribution
- Water pollution
- Search for the main pollutants
- Biological indicators
- Atmosphere
- Atmospheric pollutants
- Acid rains
- The greenhouse effect
- Atmospheric dust
- Smog and thermal inversion



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5632

Plants

5630

33 feasible experiments

Topics

- Classification of roots
- Roots: osmosis
- Roots: root hairs
- Roots are oriented
- Stem classification
- Stem: the morphology
- The underground stems
- Stem: the capillarity
- The leaf: chlorophyll
- The leaf: photosynthesis
- The leaf: perspiration
- The leaf: starch
- Flower: the morphology
- Flower: the reproductive organs
- Algae
- Ferns, mosses and lichens
- Mushrooms, molds and yeasts
- Seed morphology
- Seed classification
- Fruits classification
- Fruits pulp
- Carbon dioxide
- The reserve substances of plants
- Plants classification



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5630

Animals and humans

5631

35 feasible experiments

Topics

- | | | | |
|--|--|---|--|
| <ul style="list-style-type: none"> • Protozoa • Annelida • Crustaceans • Mollusca • The shells of mollusca • Insects | <ul style="list-style-type: none"> • Insect growth • The anthill • Anatomy of fish • Habitats and living conditions • Animal cells • Glandular tissues | <ul style="list-style-type: none"> • Muscle tissues • Starch digestion • Fats digestion • Protein digestion • Enzymes • Blood | <ul style="list-style-type: none"> • Osmotic pressure • Breathing • Skeleton • Skin appendages: fish and reptiles • Thermal insulation: birds and mammals • pH and organic reactions |
|--|--|---|--|



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5631

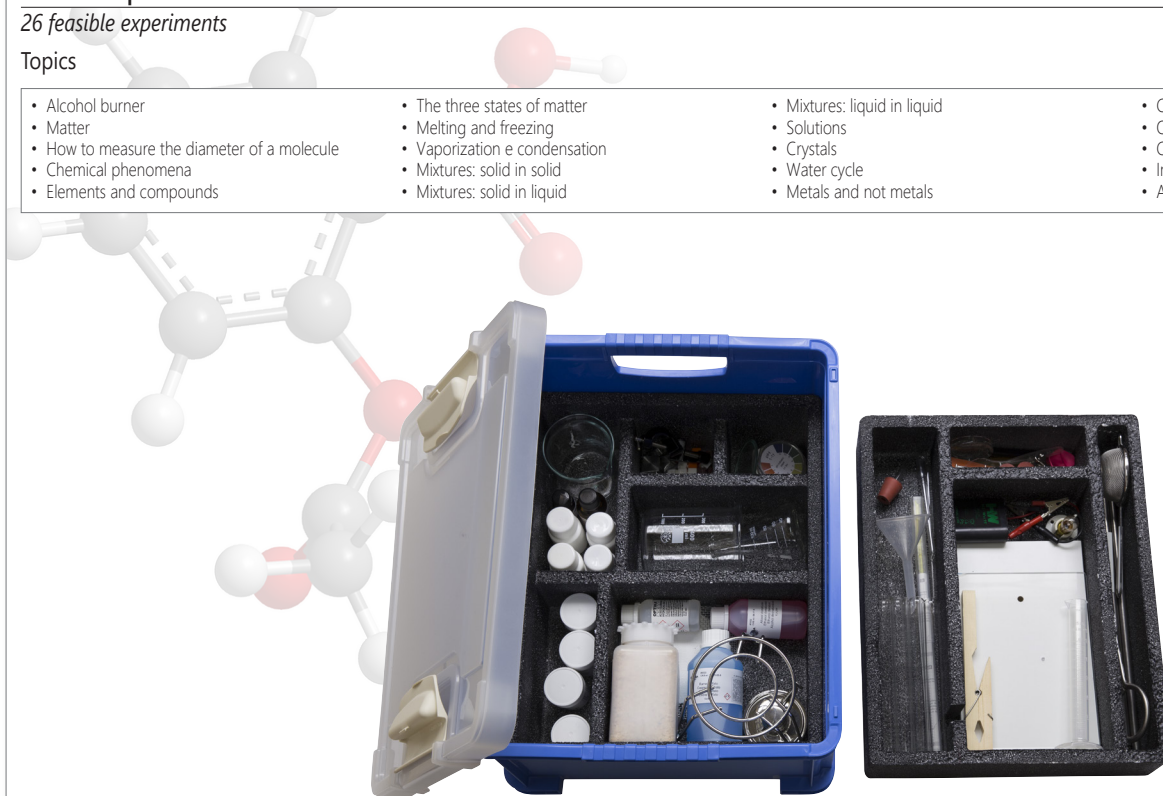
Chemical phenomena

5627

26 feasible experiments

Topics

- | | | | |
|---|--|---|---|
| <ul style="list-style-type: none"> • Alcohol burner • Matter • How to measure the diameter of a molecule • Chemical phenomena • Elements and compounds | <ul style="list-style-type: none"> • The three states of matter • Melting and freezing • Vaporization e condensation • Mixtures: solid in solid • Mixtures: solid in liquid | <ul style="list-style-type: none"> • Mixtures: liquid in liquid • Solutions • Crystals • Water cycle • Metals and not metals | <ul style="list-style-type: none"> • Chemical reactions • Oxidation • Combustion • Indicators • Acidity analysis |
|---|--|---|---|



Teaching guide in digital format

5627

Physical and chemical phenomena

5510

*11 feasible experiments***Topics**

- Comparison between two types of phenomena
- Sublimation
- Filtration of a suspended solid
- Separation of two liquids in a mixture and separation of a solvent from the solute by distillation
- Crystallization of the copper sulphate
- Preparation of a mixture and preparation of a compound and their determination
- Examples of chemical reaction
- Some flame tests



Teaching guide in digital format

5510

General chemistry basis

5511

*10 feasible experiments***Topics**

- Lavoisier law
- Proust law
- Flame tests
- Acid or basic character of compounds
- Precipitation reactions
- How to create an aeriform compound
- Redox reactions



Teaching guide in digital format

5511

Electrochemistry

5513

*9 feasible experiments***Topics**

- Electrolyte conductivity
- Comparison on the electropositivity of some elements
- Construction of the Daniell battery
- Electrolysis of a solution of potassium iodide
- Water electrolysis
- Electrolytic coating of a metallic object



Teaching guide in digital format

5513

Organic chemistry

5515

*8 feasible experiments***Topics**

- Presence of carbon and hydrogen in organic substances
- Nitrogen research in organic compounds
- Preparation of acetic aldehyde
- Preparation of ethyl acetate
- Presenza di amminoacidi in sostanze proteiche
- Fehling test
- Recognition of a polysaccharide
- Bakelite preparation



Teaching guide in digital format

5515

Chemistry set

5516

The four kits mentioned below:

5510 Physical and chemical phenomena**5511 General chemistry basis****5513 Electrochemistry****5515 Organic chemistry**

They can be bought separately or as a unique set with a lower cost than the global cost of the four kits because some parts that are repeated in the 4 kits are eliminated when buying the set. The contents and the possible experiments of the set correspond to the sum of those contained in each kit. The kits permit experiments related to topics that are part of Chemistry lessons plan in senior high schools. Two main features that make the set particularly efficient:

- quick assembly of the different parts and ease of use. These features meet user safety and same time;
- Contents clearly and unambiguously explained.

Each kit is supplied with a teaching guide in which every practical experiment is explained in detail.

At the end of every experiment there's a series of questions about the observed phenomena.

These kits are an essential aid for teachers and can also be useful for students collective experiments on specific subjects.

**Topics****5510 Physical and chemical phenomena**

- Comparison between two types of phenomena
- Sublimation
- Filtration of a suspended solid
- Separation of two liquids in a mixture and separation of a solvent from the solute by distillation
- Crystallization of the copper sulphate
- Preparation of a mixture and preparation of a compound and their determination
- Examples of chemical reaction
- Some flame tests

5511 General chemistry basis

- Lavoisier law
- Proust law
- Flame tests
- Acid or basic character of compounds
- Precipitation reactions
- How to create an aeriform compound
- Redox reactions

5513 Electrochemistry

- Electrolyte conductivity
- Comparison on the electropositivity of some elements
- Construction of the Daniell battery
- Electrolysis of a solution of potassium iodide
- Water electrolysis
- Electrolytic coating of a metallic object

5515 Organic chemistry

- Presence of carbon and hydrogen in organic substances
- Nitrogen research in organic compounds
- Preparation of acetic aldehyde
- Preparation of ethyl acetate
- Presence of amino acids in protein substances
- Fehling test
- Recognition of a polysaccharide
- Bakelite preparation



Teaching guide in digital format

5516

Chromatography**5 feasible experiments**

5517

Topics

- Paper chromatography with common filter paper
- Separation of the pigments contained in green leaves through paper chromatography
- Separation of the amino acids coming from a protein substance through paper chromatography
- Separation of colourants included in the ink
- Separation of the mixture of colourants through column chromatography division



Teaching guide in digital format

5517