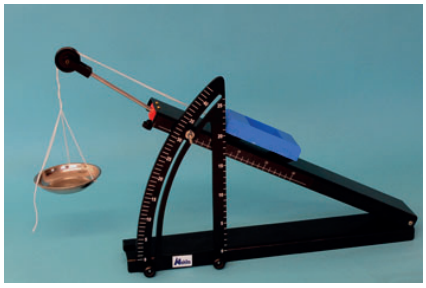
Inclined plane

Code QLB001



- This instrument has been design for the study of the concepts of movement on an inclined plane and its relation with friction. The whole structure is made of metal providing a good durability and robustness.
- It is made of 2 metal plates hinged at one end; one of the plates is used as base and the other one as inclined plane. The plate acting as inclined plane presents a graduated scale 20-40 cm (divisions of 1 cm) in one side to measure the lineal distance along its length and can be inclined and fixed at any angle from 0 to 40º. A vertical scale 0-25 cm is also printed to measure the height of the inclined plane at any point. The end of the inclined plane is also provided with an adjustable pulley to hang weights, a pan, etc…
- The instrument is completed with a plastic trolley with hook, a set of weights (including 1x100 g, 1x50 g y 1x20 g) and a pan with a lightweight cord.

Force table

Code QLB002

- Used to verify the laws of composition and resolution of forces using vector diagrams of several concurrent forces. Made of a thick aluminium circular table, of about 40 cm diameter and covered by scratch resistant black epoxy coating. The external rim presents a circular scale graduated from 0º to 360º (divisions every 1º and marked every 10º).
- The table is mounted on a heavy, stable cast metal tripod base that presents 3 height adjustable screws to correctly level the force table.
- It is also provided with 4 pulleys with clamps that can be attached anywhere along the rim. A small detachable pin positioned at the centre of the table allows checking the balance of the forces through the centring of a ring tied to the cords carrying masses and suspended through the pulleys around it.
- The instrument is supplied complete with a set of cords tied to the centring ring, a detachable pin and 4 sets of slotted masses with hanger. Each set of masses is composed of 1x100 g, 1x10 g, 1x20 g, 1x50 g and one hanger of 100 g.

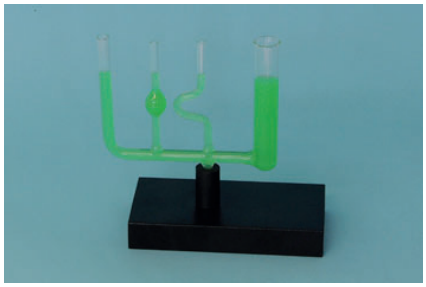
Free fall apparatus with digital timer

Code QLB003

- The instrument consists of an electromagnet mounted on a plastic case to allow releasing a metallic ball fitted on a square sectional rod. When the electromagnet is switched off the metallic sphere is released and timer starts; once the ball hits the impact sensor placed at the lower platform, the timer stops. The time taken by the sphere since it is released until it hits the impact sensor is shown on timer display to calculate the g by free fall.
- The instrument includes a precise digital timer with the possibility of programming the time in micro seconds, miliseconds or seconds. The time is shown on a 7-segment LED display. The timer can be also used as stopwatch. It also includes all the necessary connection cables.

Communicating vessels

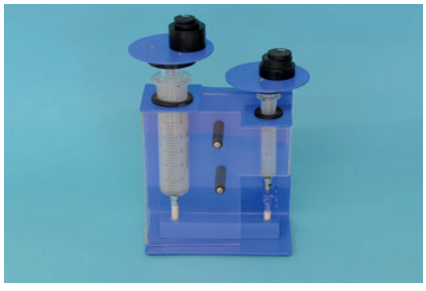
Code QLB004



- It is composed of 4 glass tubes each one of them with different section diameter and shape, connected together at the bottom through a common horizontal glass tube, sealed to a manifold and mounted on a stand. It demonstrated that the liquid level in communicating vessels remains the same irrespective of the shapes and sizes of the vessels.

Pressure syringes

Code QLB005



- The simple construction permits the use of water or even air for demonstration of the concepts involved. Comprises a pair of graduated glass syringes of capacities 50 and 10 cm3 respectively; both having ground pistons with limit stop to prevent their complete ejection from the barrels and providing a cross-sectional area ratio of 3:1 respectively. The syringes are mounted on a stable, non-skid metal base with a platform at their top to place the weights; the nozzles of both syringes are connected by a 3-position valve by means of which they can be opened to the atmosphere, isolated or interconnected as desired. The thick wall of syringes make them capable of withstanding pressures involved.
- The graduated syringes also permit simple Boyle's Law experiments to be performed.
- Set of weights included: 1x200 g, 1x100 g, 1x50 g, 2x20 g and 1x10 g

Bell jar with hand vacuum pump

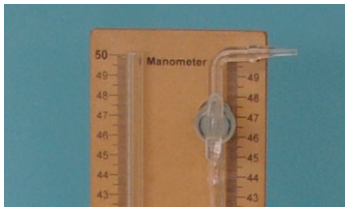
Code QLB006

- This instrument is composed of a transparent bell jar and a hand-operated vacuum pump, both made of resistant ABS plastic and suitable for performing vacuum physics experiments. The bell jar is provided with a robust chamber capable of withstanding full vacuum without danger of implosion or shattering and fitted with a vacuum release valve and a vacuum gauge.
- A rubber gasket ring on the pump ensures airtight seal with the jar. A manual piston pump in the base provides quick and convenient evacuation of the air inside the jar.
- Note: the exposure or contact of the apparatus to organic solvents or vapours or other aggressive chemicals must be totally avoided. The instrument is non-autoclavable.

U-tube manometer

Code QLB007

- Glass manometer U-shaped tube with stopcock near the end of one of the arms and mounted on a stand. The scale presents a graduation 50-0-50 cm with divisions of 1 mm.



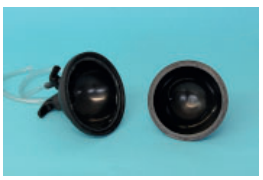
Detail of stopcock

Magdeburg hemispheres

Code QLB008

- A simple and economical device for demonstrating the effect of atmospheric pressure. The instrument consists of two plastic hemispheres of about 100 mm diameter, both with a handle at their top. One of them presents a plastic stopcock for pumping out air and releasing vacuum and a rubber O-ring seal inside. The lightweight plastic construction makes them easy to handle and use.

Detail of stopcock



Opened hemispheres

Mechanics kit

Code QLB009

■ Kit for the study of mechanical movement with different components with which to demonstrate Hook's Law and Newton's third law, among others.
■ The components of the kit are:

- 1 dynamometer 1N
- 1 dynamometer 2N
- 1 inclined section
- 2 weighing plates
- 2 weights with hook
- 1 balance lever
- 1 support with scale
- 4 "S" hooks
- 3 magnet holders
- 4 laced bolts
- 1 spring
- 2 magnetic holders
- 1 set of weights
- 1 tape measure with scale in blocks, magnetic with pointer
- 1 Torque chart
- 1 pulley support
- 1 level
- 1 48 mm pulley
- 1 106 mm pulley

Metal cube set

Code QLB010

■ Set of 6 x 20 mm cubes in various materials: brass, lead, iron, copper, aluminium, and zinc. Supplied in a transparent plastic case.

Density cylinder set

Code QLB011

■ Composed of 12 cylinders of various materials: copper, brass, acetyl, rubber, acrylic, aluminium, polypropylene, PVC, nylon, oak, maple and walnut.
■ The cylinders have different lengths, from 38 mm to 60 mm, but the same diameter of 12.5 mm.

Aluminium cylinder set for density determination

Code QLB012

- Composed of 12 aluminium rods of different lengths (different mass and volume), but the same diameter of 12.5 mm.
- Useful for showing constant density with size variation. Can also be used to study the specific heat capacity of the material.

Specific Gravity Determination Set

Code QLB013

- Composed of 4 cylindrical rods of the same size but of different materials: brass, aluminium, copper and iron.
- Dimensions of each cylinder (mm): Ø 12.5 x L 50

Elastic materials kit

Code QLB014

- For the study of the elastic behaviour of varied materials. The components of the kit are:
  - 25 extendible steel springs 13 × 29 mm
  - 2 wide steel springs of approximately 114 × 75 mm (L × D)
  - 2 blocks of soft latex foam
  - 1 spool of copper wire 32 SWG, 50g
  - 2 spools of copper wire 26 SWG, 50g
  - 1 soft rubber tube (50 cm)
  - 4 laces with ring at both ends
  - 4 soft erasers for twisting

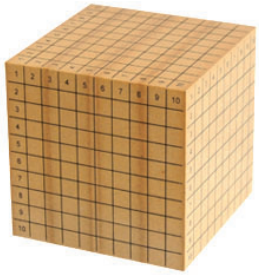
Set of metal buckets with hook

Code QLB015

- Designed for use with specific density, gravity and heat in educational experiments.
- Composed of 20 mm cubes with hook for easy suspension and the following materials: brass, lead, copper, iron, aluminium, zinc, and tin.

Decimetre cube

Code QLB016



- 10 cm hardwood volume cube, precisely cut and finished, with a total volume of 1 dm^3 (1000 cm^3/ 1 l).
- Each face of the cube has a 10x10 grid with a total of 100 1 cm squares. The first row and column of each face are marked with a number from 1 to 10.

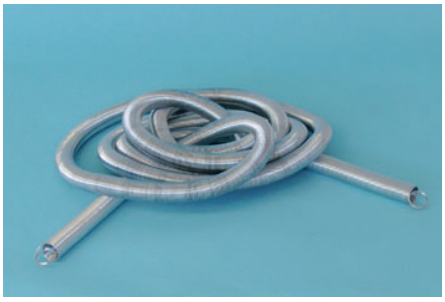
Density sphere

Code QLB017

- Demonstrates the relationship of the density of a liquid to temperature.
- It consists of a hollow copper sphere, with a sealed mouth, carefully adjusted to float in chilly water and sink in warm water.

Wave form helix

Code QLD001, QLD002



■ Steel wire helixes specially designed for demonstration of wave motion. The Snakey helix presents looped ends for safety.

Code	Description	Diameter	Length
QLD001	Snakey helix	19 mm	3 m (9 m extended)
QLD002	Slinky helix	75 mm	10 cm

Vibrator generator with accessories

Code QLD003

■ It is especially designed to produce mechanical oscillations when it is connected to a power supply. A especially designed coil system enables the unit to be operated at its maximum rating for a prolonged period of time without any damage due to overheating. The frequency of response covers the whole of the audio spectrum and beyond.
■ The voltage input is via a pair of 4 mm banana sockets and mechanical oscillation output is obtained through a shaft at the top. A locking device provides safety to the apparatus during storage or transportation by blocking the move-
■ ment of the shaft.

The instrument is supplied complete with the following accessories:

1| **Chladni plates:** square and circular plates. They allow observation of the resonance patterns thanks to the spread of a thin layer of san don their surface. The plates resonances are also audible.

2| **Steel strips:** set of various length of metal strips. Frequencies at 11, 15, 21, 36 and 50 Hz can be observed. Standing waves can be heard up to 900 Hz and observed up to 300 Hz.

Melde's apparatus

Code QLD004

- For showing the effects of vibrations in a stretched cord and investigate the relationship between frequency, tension and density. In addition, the presence of electrical contacts, opened and closed by a vibrating armature, allows the apparatus to be used as high-speed changeover switch in. Composed of a thin steel rod mounted on a in a clamp formed by a pair of 4 mm terminal sockets, so that its free length may be adjusted as desired.
- An AC energizing coil surrounds the armature and a permanent magnet provides the necessary magnetic polarization. The free end of the armature equipped with a small bosshead and clamp serves for tying the cord and also as the moving contact when the apparatus is operating as a changeover switch.

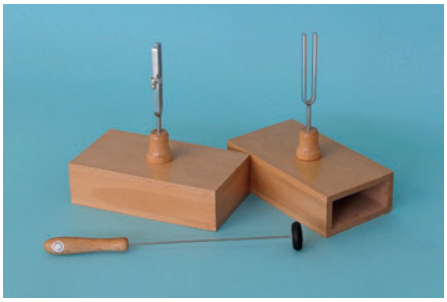
Pendulum

Code QLD005

- Designed to perform a large number of experiments related to pendulum motion in a quickly and accurately way.
- The apparatus consists of a metric ruler with a 0 at the base, graduated in millimetres and with readings every centimetre, which is attached vertically to the rod of a support. From the upper end of the support, a rod from which hangs three spheres, each 25 mm in diameter and made of different materials (wood, steel and aluminium). The suspension length of each pendulum can be controlled.
- The apparatus is completed with a metal base.

Pair of tuning forks with box

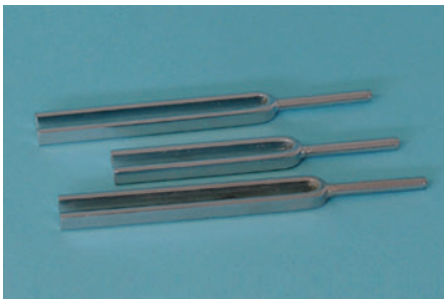
Code QLD006

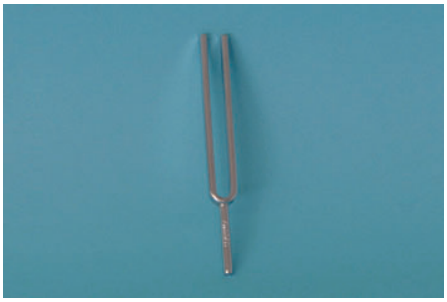


- This set allows the study of the concept of resonance through sympathetic and forced vibration, and the phenomenon of beats. It comprises two matched nickel plated tuning forks of frequency A (426.6), each one of them mounted on top of hollow wooden box open at one end. Both forks present a sliding mass on one prong by means of which its frequency can be varied from the nominal 426.6 Hz. When both forks are sounded a clearly audible "beat" is produced, its rate depending upon the difference in frequency between the forks.
- The instrument also includes a disk-shaped rubber mounted hammer.

Set of 8 tuning forks, steel

Code QLD007

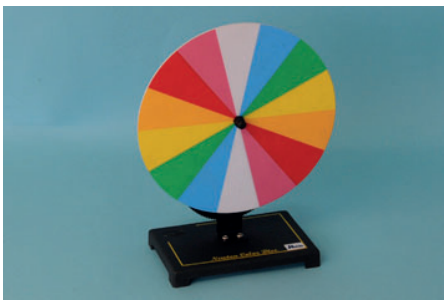




- With the best quality, plain shanks and with frequency clearly marked. Each set is composed of 8 forks, one each of diatonic scale frequencies: C1-(256), D-(288), E-(320), F-(341.3), G-(384), A-(426.6), B-(480) y C2-(512).
- The complete set is supplied in a box.

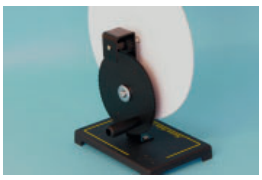
Newton colour disks

Code QLG001, QLG002



- Especially designed for demonstrating that white light is composed of the additive mixing of all the spectral colours. They consist of a multi-coloured circular disk having sectors of various spectral colours in proper proportions. By rotating the disk at sufficient speed, all the colours will be observed to disappear by merging into a single white colour.

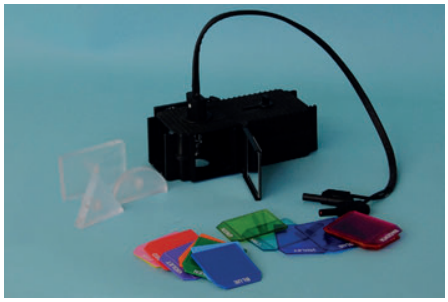
Code	Diameter	Type
QLG001	200 mm	Manual (Handle at the back)
QLG002	80 mm	Motorized (Low DC voltage motor)



Back of instrument, QLG001

Light box and optical set

Code QLG003



Set of acrylic prisms, lenses and mirrors

Detail of inside

■ A complete kit providing comprehensive range of optical experiments involving reflection, refraction and colour mixing. The kit designed around a light box, all black, well ventilated, consisting of a light source 12V, 24W vertically straight filament lamp fitted in the holder through top of the box. The light box incorporates a collimating lens towards one end for producing convergent, divergent, or parallel light beams, with other end having triple aperture system for colour mixing experiments; adjustable hinged mirrors along both sides of the box facilitates colour mixing of all three beams. All apertures in the box are provided with vertical channels to hold slits plates and colour filters. A two core flexible connecting lead terminating in a pair of 4 mm banana plugs connect it to low voltage AC power source.

■ The complete optical set includes:

1| **Set of 5 acrylic prisms:** one each of rectangular, semi-circular, equilateral triangular 60°x60°x60°, triangular 90°x60°x30° and right angled triangular 90°x45°x45°. All prisms are free of optical imperfections and sharp edges.

2| **Set of 3 acrylic lenses:** one double concave, one double convex (both having same radius of curvature) and one thick double convex.

3| **Set of 3 mirrors:** highly polished reflecting surfaces and free standing. One each of parabolic, semi-circular and plane shaped glass.

4| **Set of 2 slit plates, black:** one with 1 and 3 narrow slits and the other with 4 narrow slits and 1 wide slit.

5| **Set of 8 colour filters:** 3 primary colours (red, blue and green) and 5 secondary colours (cyan, violet, orange, yellow and magenta)

6| **Set of 8 colour plates:** red, blue, green, violet, orange, cyan, yellow and pink.

■ All acrylic prisms, lenses and mirrors are provided with finger grips, enabling their handling without touching their active optical surfaces. The bottoms of all refractive components are frosted to minimize internal reflections and revealing the path of light as it passes through.

■ The set is supplied complete with a spare bulb and in a moulded Styrofoam case for long life storage.

Optical bench

Code QLG004

Detail of instrument

Detail of instrument

■ An optical bench made of cross sectional aluminium pipe with closed ends, fitted on two moulded supports with levelling screws. A scale graduated in millimetres is fitted on top of the optical bench. It is provided with easy sliding tilt proof riders with index mark for mounting various accessories; the height of the accessories can be adjustable with the help of knobs fitted in the riders. The optical bench is supplied complete with the following accessories:

1| Light source: halogen lamp 12V / 24W placed on a heat resistant Support. With 2 flexible cables with 4 mm banana plugs for connecting to the power supply.

2| Circular plane glass: mounted on a metal frame.

3| Lens holder: for holding lenses of 50 mm diameter

4| Circular black metal screen with a 10 mm central aperture covered with 1.5 mm wire mesh gauze.

5| Diaphragm: circular plate with an attached rotary circular disk with 6 holes of different aperture.

6| Ground glass screen mounted on a metal frame

7| Grating holder: rectangular plate with a centred circular aperture and fitted with two clips to hold the different size gratings.

8| Cross slits with arrowhead: to Project the arrow head images

9| Jolly's photometer: a thin aluminium foil is sandwiched in between two equal sized rectangular acrylic blocks fitted inside a plastic moulded block. Two eyepieces fitted on opposite sides of the block to differentiate between the light intensity of two light sources.

10| Support with needles: four needles mounted on a plastic block in straight line.

11| Receiving screen: a white rectangular acrylic sheet with two printed perpendicular lines, one of them with a graduation of 60 mm in vertical direction.

■ This instrument allows the performance of optics related experiments such as image formation, reflection/refraction through optical elements, etc

Accessory: Set of lenses for optical bench

Code QLG016

■ Set of three concave and three convex lenses for ref.: QLG004.
Characteristics:

- Diameter: 50 mm LF: 100 mm
- Diameter: 50 mm LF: 200 mm
- Diameter: 50 mm LF: 500 mm

Hartl disk, complete

Code QLG005

■ This instrument has been designed for studying the different concepts of optics including reflection and refraction using the ray tracing technique. It is composed of a rotatable white metal disk, of around 30 cm diameter. The disk presents a graduation of 90°-0-90°-0-90° (divisions of 1°) that divides the disk in 4 equal quadrants with its centre clearly marked. Shapes of various optical elements are also clearly marked on the disk to facilitate their placement while performing experiments.

■ The apparatus is supplied with a laser type light source that allows the projection of 1, 3 or 5 parallel beams for performing different experiments. A complete set of optical elements is also included:

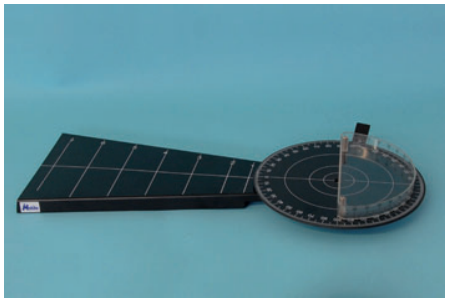
1| **Acrylic prisms (refraction):** semi-circular, biconvex, biconcave, right angled-prism, equilateral prism and trapezoidal prism.

2| **Mirrors (reflection):** plane and semi-circular

■ All optical elements are provided with powerful magnets at their bottom for placing them securely on the disk either in horizontal or vertical disk position. The bottoms of all refractive components are frosted to minimize internal reflections and revealing the path of light as it passes through.

Refraction disk

Code QLG006



■ A metallic circular disk graduated (0-90º) in 4 quadrants and subdivided into 1º. A transparent acrylic semi-circular tank is fitted on the metallic disk to find out the refractive index of different liquids as for example water, oil, etc. All this assembly is fitted on a metallic base which is graduated from 1-7 to place the light box at any desired level.

Laser ray box, red

Code QLG007

■ Laser ray box of red colour (wavelength 650 nm) with the option of 1, 3 or 5 parallel beams. It is supplied complete with power adapter.

Hand spectroscope

Code QLG008

- A simple device for the rapid qualitative examination of the composition of emission and absorption spectra. It presents the main components as collimator, prism and telescope mounted inside an straight tube; one of the ends of the tube presents an adjustable slit to regulate the light entering inside and the other end is provided with an eyepiece. The drawtube of the eyepiece can be slide along its length for sharp focusing the spectrum.
- Supplied complete in a wooden box.

Power supply for spectral tubes

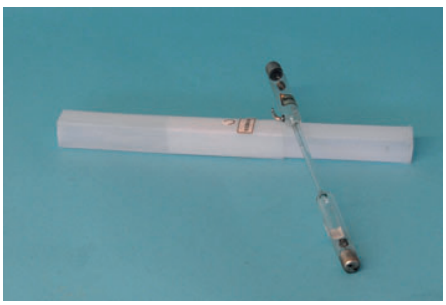
Code QLG009

- It presents a sturdy and durable case made of metal and allows placing the tubes vertically. With On/Off switch and shielded sockets for safety during use. The socket for fitting and connecting the tubes are also properly isolated and allow holding the spectral tube firmly. The lower socket is spring loaded to enable quick and easy changing of spectral tubes.
- Black color of the case eliminates distracting ambient light.

Code	Description	Power supply
QLG009	Power supply for spectral tubes	220-240 V AC, 50 Hz

Spectral tubes

Code QLG010, QLG011, QLG012, QLG013, QLG014, QLG015



- With straight shape and about 20 cm long, each tube is filled with a type of gas or vapour for studying their respective emission spectra. The central part of each tube (about 50 mm) presents a thin diameter for observing more easily the effect of the electrical discharge in the gas. The metal cap electrodes at both ends serve as connection to the high voltage power supply.

Code	QLG010	QLG011	QLG012	QLG013	QLG014	QLG015
Type of gas	Argon	Helium	Neon	Hydrogen	Nitrogen	Mercury

Laser optics kit

Code QLG017

- The components of the kit are:
  - Diode laser box: Consists of 5 independent laser modules with a peak wavelength of 635mm
  - Power adapter
  - Beam selector
  - Human eye sheet
  - Camera sheet
  - Galilean telescope sheet
  - Kepler telescope sheet
  - Spherical aberration sheet
  - Periscope sheet
  - Hartle circular blade
  - Biconvex lens, biconcave lens, flat convex lens r=45 mm, flat convex lens r=75 mm, flat concave lens
  - Concave mirror
  - Convex mirror
  - Plane mirror
  - Rectangular slab
  - Prism
  - Optical fibre
  - Magnetic board

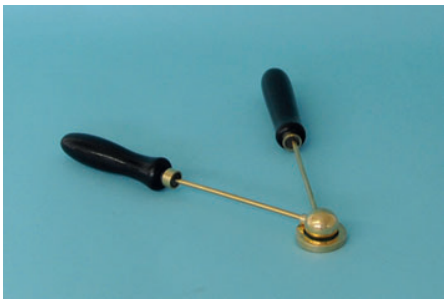
Magnetic optics kit

Code QLG018

- The components of the kit are:
  - Light box.
  - Power supply.
  - 1- and 2-slot diaphragm.
  - 3- and 5-slot diaphragm.
  - Right-angled prism.
  - Concave Lens.
  - Convex Lens.
  - Trapezoidal acrylic body.
  - Semicircular body.
  - Parabolic Mirror.
  - Smooth mirror.
  - Colour filter set
  - Optical disc.
  - Metal board.

Gravesande's ring and ball

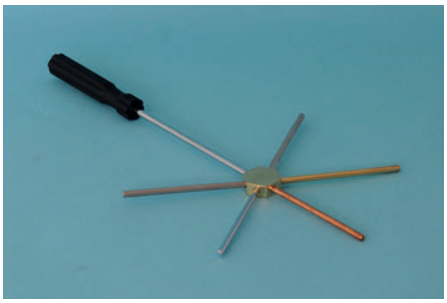
Code QLJ001



■ A simple and economical device for demonstrating the thermal expansion of solids. It is composed of a brass ring and ball each one of them mounted on separate insulated handles. When cold, the ball of 19 mm diameter easily passes through the ring but does not pass when heated. If the ring is heated on the same extent than the ball, then it passes through the ring.

Thermal conductivity apparatus star shaped

Code QLJ002



■ For demonstration of differences in the thermal conductivity of five different metals: brass, copper, aluminium, mild steel and stainless steel. The 5 metal rods spread radially outwards and are equally spaced on each side of hexagonal brass hub. Each rod has a small well at the end for holding paraffin wax. The instrument is completed with an isolating handle.

■ When the central hub is heated, the paraffin wax contained in the cavities of different metals melts at different times depending on the thermal conductivity of the corresponding metal.

Joule's calorimeter

Code QLJ003

■ It is composed of an inner vessel of about 300 mL of capacity contained inside and outer vessel of about 900 mL both of them made of aluminium and separated by an isolating material that minimizes heat loss. The set is closed with an acrylic transparent lid provided with a resistance at the bottom to be conveniently introduced in the vessel and two 4 mm banana sockets for electrical connection. The lid is also provided with stirrer and a hole to put a thermometer (thermometer is not included).

Calorimeter block

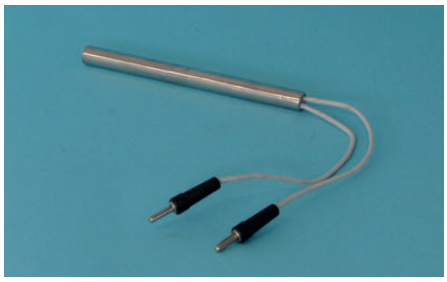
Code QLJ004, QLJ005, QLJ006, QLJ007

■ A simple calorimeter for quick experiments of determination of the specific heat capacity of different metals. Each block is cylindrical shaped, has a mass of 1 Kg ± 2% and presents 2 holes, a large central hole (about 12.5 mm diameter) to accept special immersion heater and a smaller hole (about 7.5 mm diameter) to accept a thermometer or temperature sensor.

Code	Material
QLJ004	Aluminium
QLJ005	Steel
QLJ006	Copper
QLJ007	Brass

Heating resistance for calorimeter blocks

Code QLJ008



■ It is a especial heater designed for use with metal block calorimeters. The heating element is enclosed in a stainless steel tube with two flying leads coming out of the sealed tube body for electrical connections. It operates on 12 V, 50 W.

Boyle's law apparatus

Code QLJ009

■ This instrument allows the study of the Pressure/volume relationship of air at a constant temperature. It consists of a graduated cylinder of (0-300) cm3, made of transparent material and mounted on a support. One of the ends of the cylinder is closed by a piston and the other end presents a valve to adjust the mass of air contained inside the cylinder. The reading of the pressure inside the cylinder is made by a pressure gauge placed near the valve and graduated from (0-3.4) x 105 Pa.

Gas kinetics theory model

Code QLJ010

For demonstration of the kinetic theory of gases explaining the molecular motion of the gases, thinning of air with increasing altitude, increase in pressure/volume with temperature, etc. It is composed of a clear cylindrical tube closed at the top through a loose-fitting lid and with a rubber diaphragm at the base; through the connection of the instrument to a low voltage power supply an oscillatory movement is of the diaphragm is produced. The instrument also includes a set of small metal spheres and a cardboard disk for loading at the top.

Thermodynamics kit

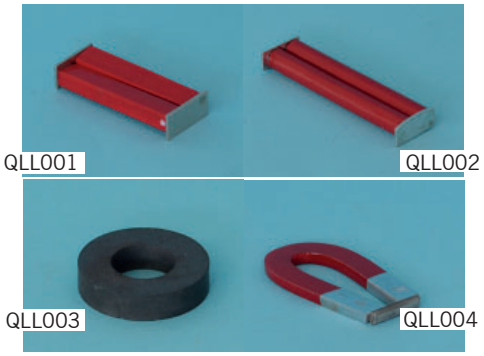
Code QLJ011

The components of the kit are:

- 1 aluminium rod
- 1 iron rod
- 2 radiation cans
- 1 propeller
- 2 boss head
- 1 hook
- 1 Bunsen burner
- 1 Erlenmeyer flask
- 2 test tubes
- 1 small glass tube
- 2 large glass tubes
- 1 wax crayon
- 1 bimetallic tape
- 1 conductivity meter
- 1 right-angled steel needle
- 1 pointer
- 1 graduated thermometer
- 1 thermometer without graduation
- 1 wire gauge
- Paraffin
- 1 tube of silicone
- 1 aluminium block
- 1 iron block
- 3 support rings
- 1 alcohol burner
- 4 U-shaped tubes
- 1 test tube
- 1 water convection tube
- 1 calorimeter with lid
- 1 tall glass
- Food colouring
- Sodium thiosulphate
- 2 plugs with 1 hole
- 2 plugs with 2 holes
- 3 silicone plugs with 1 hole
- 2 cork stoppers without hole
- 2 universal clamps

Magnets

Code QLL001, QLL002, QLL003, QLL004



- Different models of magnets for performing experiments of magnetism and visualization of magnetic fields.

Code	Shape	Dimensions	Material	Quantity/pack
QLL001	Rectangular	75x15x10 mm	Alnico	2 uds/pack
QLL002	Cilyndrical	100x12 mm	Alnico	2 uds
QLL003	Ring	36x18x8 mm	Ceramics	1 ud
QLL004	Horeshoe	75x12x5 mm	Chromed steel	1 ud

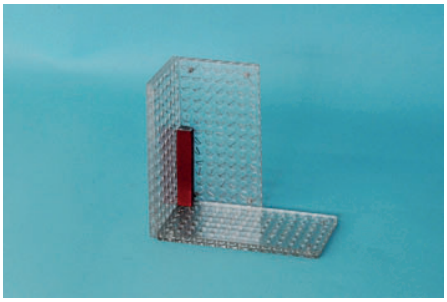
Iron filling, fine

Code QLL005

- For the study of magnetic fields. Supplied in box of 500 g.

Magnetic field demonstrator, 3D

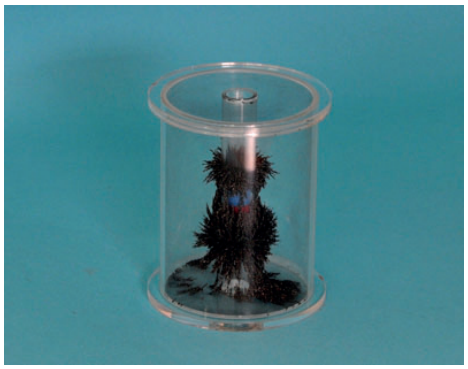
Code QLL006



- Set of 4 transparent plate with size 155x76x6 mm that present a matrix of small circular chambers (14x7 mm) each one containing an iron rod and that act as small compasses. The plates can be placed in different positions as for example a large bidimensional surface or as the faces of a cube; this way it is possible to show the configuration of a magnetic field in 2 or 3 dimensions with the properties of attraction and repulsion of magnets. The transparent nature of the plates makes them suitable to be used with a projector.
- The set also includes a rectangular magnet.

Magnetic field chamber

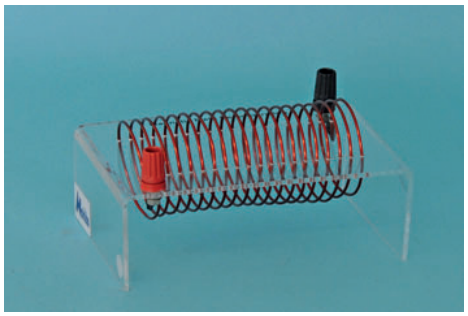
Code QLL007



- Demonstrates the three-dimensional nature of the magnetic field associated with cylindrical magnets.
- Consists of a hollow transparent acrylic chamber with a tunnel in its centre to house cylindrical magnets. The chamber is filled with high quality iron filings.
- It also allows you to investigate magnets of other shapes by placing their poles adjacent to either side of the camera.

Magnetic field demonstrators

Code QLL008, QLL009, QLL010



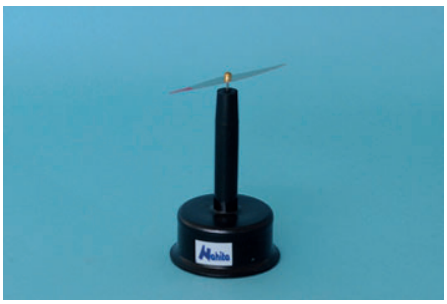
QLL010

- Fort eh study and demonstration of magnetic fields associated to different shapes of an electrical current conducting wire. Mounted on a transparent acrylic base they can be placed on a retro projector for classroom demonstrations. Each instrument presents a pair of sockets for 4 mm banana plugs to be connected to a power supply. The effects of the magnetic field can be observed by using iron fillings.
- 3 models are available depending on the shape of the conducting wire:
  1| **Straight:** U-shaped copper wire vertically mounted on the base. Maximum current of 8 A.
  2| **Circular coil:** 1-coil copper wire. Maximum current of 8 A.
  3| **Solenoid:** copper solenoid of about 52x125 mm (diam. x length).

Code	Shape
QLL008	Straight
QLL009	Coil
QLL010	Solenoid

Stand with magnetic needle

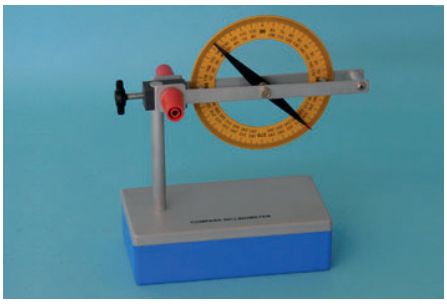
Code QLL011



- Stable circular base of bakelite with non-magnetic pillar and carbon steel pivoting point for the needle. Total height of about 110 mm.

Compass inclinometer

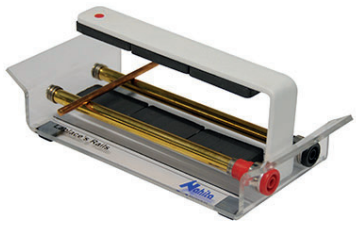
Code QLL012



- To demonstrate the earth's magnetic field and to illustrate the thumb rule. It consists of an aluminium ring with a double pointed needle pivoting in the centre; the ring is graduated from 0-360° in both clockwise and anticlockwise directions. The whole assembly is fitted on an aluminium pillar and mounted on a plastic base of approx. 142x80x40 mm.

Laplace's rail

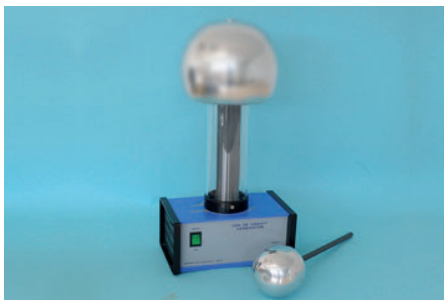
Code QLL013



- Demonstrates the action of a magnetic field on a freely moving conductor across two current-carrying elements.
- It consists of two 120 mm long brass rails mounted parallel to each other on a transparent acrylic base. A copper rod rests on both rails and can move along their length. When a U-shaped magnet is placed between the rails and current flows through them, the copper rod moves.

Van de Graaff generator

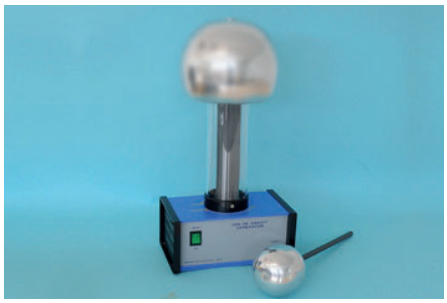
Code QLL014



- Used for electrostatics experiments where a continuous high voltage source is necessary. The aluminum base features plastic insulating sides for increased safety. An internal motor allows the continuous movement of a rubber belt between two pulleys, producing the transfer of charge from the belt to the metal dome through charge collector “combs.” The hollow dome is specially designed with a smooth, polished surface free of imperfections and without corners, edges, or ridges to minimize charge loss.
- The motor operates on AC 220-240 V, 50/60 Hz, and is activated by an On/Off switch.
- The equipment has a 4 mm banana plug connector at the base for grounding and another at the top for charge transfer or accessory placement. It is supplied complete with accessories and a discharge sphere with an insulating handle.
- When the discharge sphere is positioned close enough to the charged dome, the charge is transferred to the ground in the form of an electric spark that jumps from the dome to the discharge sphere. Under favorable conditions, it can develop an electric potential of up to 200 kV with a spark up to 70 mm in length.

Accessory: Belt for Van de Graaff generator

Code QLL016



Reference	Material	Dimensions (mm)
QLL016	Silicone	750x46

Wimshurst electrostatic generator

Code QLL015

QLL010

- A traditional device capable of generating high electrostatic potentials that can produce sparks of length up to 7 cm approx. in favourable environmental conditions. It is equipped with 2 acrylic plates each one of approx. 25 cm of diameter with aluminium sectors permanently pasted radially along the rim. Both plates are parallel to each other and rotate in opposite directions through a system of pulleys and belts; the pulley of one of the plates has a handle to make the system rotate manually.
- The device has also 2 crossed rods with collecting “combs” at their end and 2 discharge spheres mounted at the end of a pair of arms which opposite end presents an isolating handle to adjust the distance between both spheres.
- The charge can be accumulated in a couple of high capacity Leyden jars that can be connected or disconnected as desired for increasing the accumulated charge. When the machine starts rotating, the spheres start accumulating charge until the charge transfer between both spheres takes place in the form of an electric spark. The spark is produced intermittently by the continuous rotation of plates.
- The complete machine is mounted on a well-isolated base that has also a couple of sockets for earth connection of the Leyden jars.

Accessory: Belt for Wimshurst machine

Code QLL019

Fiel lines and equipotential lines kit

Code QLL018

- Power supply (2-12 V AC). Output voltage 2, 3, 4, 5, 6, 8, 10 and 12 V AC full wave, rectified, unsmoothed and unregulated D.D. in max. 8 steps. Overload protection with adjustable thermal trip. Operating voltage 230 V AC, 50 Hz.
- The components of the kit are:

- Cuvette
- Needle
- Rod with plug
- Multi-meter
- Cylindrical base
- Rod electrode
- Disc electrode
- Ring electrode
- Support rod
- Electrode head
- Flexible plug cable (set)

Power supply 1-12 V AC/DC

Code QLN001

■ By simply selecting the proper voltage, this power supply is the solution for those experiments that requires a voltage supply up to 12 V. The AC/DC power supply can provide a voltage from 1 to 12 V in steps of 1 V, adjustable by means of a rotating knob at the frontal panel. The equipment is provided with overloading and short circuit protection.
■ The AC current is supplied through a couple of blue sockets while the DC current is supplied through a pair of colour coded sockets (black/red). The earth connection point is placed between AC and DC sockets.

Code	QLN001
Power supply	220-240 V AC, 50 Hz
Output voltage	AC/DC 1-12 V
Intensity	6 A máx.
Primary protection	Fuse 2 A
Secondary protection	Thermal switch

Regulated power supply 1-15 V DC

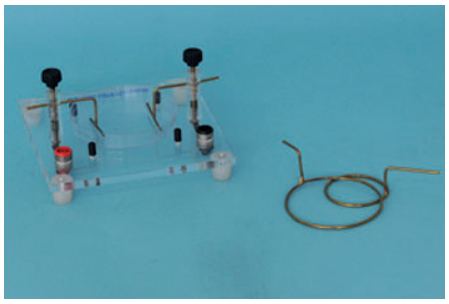
Code QLN002

■ High performance power supply with DC current output suitable for a wide range of applications in the laboratory such as development, assembly and installation of circuits. The power supply output is an adjustable voltage in a continuous range of 0-15 V DC at a maximum intensity of 2 A and through a colour coded sockets (black/red).
■ The output voltage and intensity adjustment knobs are placed on the front panel as well as LED displays for parameter visualization.

Code	QLN002
Power supply	110-220 V ± 10% AC, 50/60 Hz
Output voltage	0-15 V DC, continuous variable range
Intensity	0-2 A max., continuous variable range
Displays	2 LED displays for voltage and intensity
Environmental cond. of use	0-40°C, 95% HR

Electric field apparatus

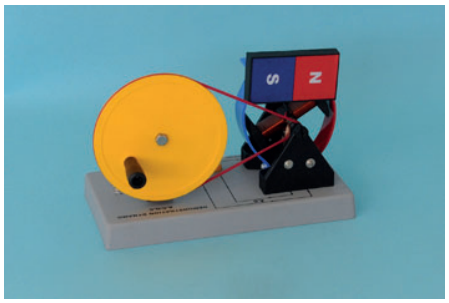
Code QLN003



■ For the study of the electric field generated by different electrode configurations. The apparatus consists of a transparent rectangular base equipped with two 4 mm banana plug connectors that can hold various electrodes. It is supplied complete with a transparent circular plastic plate, 2 linear-shaped electrodes, and 2 circular-shaped electrodes (with diameters of 35 mm and 70 mm, respectively).

Demonstration dynamo AC/DC

Code QLN004



■ It shows the conversion of mechanical energy into electrical energy and the principle of operation of simple dynamos. The whole instrument is mounted on a base and is capable of generating AC and Dc current simultaneously as it is shown by the illumination of a couple of light bulbs placed at the base. The equipment consists of an isolated copper wire coil mounted on a support that is placed between two curved metal strips; the support presents a commutator for DC output on one side and a commutator for AC output on the other side. A permanent magnet placed at the top of the metal strips generates the magnetic field. The instrument is completed with a hand operated pulley connect to the coil support through a rubber belt.

Connection cables

Code QLN005, QLN006

■ Power cords with 4 mm banana type connectors, available in red and black colour and length of 1 m.

Code	Colour
QLN005	Black
QLN006	Red

Power supply for vibration generator

Code QLN007

- Frequency ranges: 10-110Hz, 1-1.1 KHz, 1-11 kHz, 10-110 KHz
- Sweep frequency range in specific range from 1 to 11 steps
- Max. Amplitude 5V p.p
- Sine and square waveforms selectable via push-button switch
- Internal loudspeaker selectable via push-button switch
- Operating voltage: 110V/220V±10%, 50/60Hz AC main.
- Operating conditions: 0-40°C, 90 % RH

Electrical and electronics kit

Code QLN008

- Components in aluminium case.
- The components of the kit are:
  - Electrical circuit and resistance, divided circuit, electrical power.
  - Transistors, ohmic semiconductor diode
  - Capacitor in DC circuit
  - Capacitor and resistor in AC circuit
  - Electric motor
  - Coil, capacitor, resistor, transistor, diode
  - Logic circuits, open-loop and closed-loop control circuits
  - Transistor as an amplifier.
  - Light transmission
  - Power supply not included