SECTION 2

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PHYSICS

5614 SMALL PHYSICS LABORATORY

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Basic level

5614

5621 "ACTIVE SCHOOL" SET

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3. Graduated cylinder
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7. Pressure
8. Atmospheric pressure
9. Pascal's principle on liquids
10. Pascal's principle in aeriforms
11. Principle of communicating vessels
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14. Archimedes' principle
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8. Thermal expansion of gases
9. Fusion and consolidation
10. Evaporation
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OPTICS
1. Dioptric projector
2. Rectilinear propagation of light
3. Eclypses
4. Lighting law
5. Diffusion of light
6. Reflection of light
7. Spherical mirrors
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ELECTROLOGY
1. Knowing electricity
2. Static electricity
3. Protons and electrons
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6. Conductors and isulators
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16. Transformation of electric power into heat
17. Electric conduction in liquids
18. Electrolysis
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20. Magnetic poles
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22. Ampére's theory
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24. The electromagnet
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Intermediate level

5621

5597 PHYSICS SET FOR GROUP EXERCISES

110 experiments

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2. Measurement of small distances using calibrated instruments
3. Law of the elastic lengthenings
4. Forces
5. Friction forces
6. Equilibrium of the moments
7. The center of gravity
8. Levers
9. Other simple machines
10. The scale
11. Ways of weighing
12. Fluid statics
13. Archimedes' principle
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6. Ohm's laws
7. The rehostat and the potentiometer
8. The electric circuit with several charges in series
9. The electric circuit with several charges in parallel
10. Electric nets
11. Some methods for measuring the electric resistance
12. Resistance depending on temperature
13. Thermal effect of the electric current
14. Electric conduction into liquids/the electrolysis
15. Simple magnetostatic phenomena
16. The magnetic effect of the electric current
17. Electromagnetic induction
18. The transformer

Advanced level

5597

5592

5592 GROUP OF 6 PHYSICS SETS FOR GROUP EXERCISES

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(code 5656).
The wardrobes are organized in order to put in evidence rods, metal rods, cables, etc., and are composed of stands and containers for a tidy storage of the whole equipment.
Moreover, this group of sets offers the advantage of a price equal to the sum of the 6 sets only, because two metal wardrobe, stands, hooks and containers are supplied freely.
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").

5656 2-DOOR METALLIC CLOSET

Size: 100x45x200h cm

5670

Basic level

5670 FORCES

22 experiments

CONTENTS
1. Knowing forces
2. Forces in action
3. Weight is a force
4. The spring scale and its calibration
5. Other kinds of forces
6. A strange addition
7. Friction forces
8. The center of gravity
9. Let's use our force in a wise way
10. The equilibrium of a rod
11. Levers
12. Pulleys
13. Inclined plane

SUPPLIED EQUIPMENT
- 1 Bench vise
- 1 String
- 1 Centre of gravity object
- 1 Hooked rod
- 2 20g mass holder
- 1 Spiral spring
- 1 10g masses
- 1 Lever rod
- 1 Metallic roller
- 1 Spring scale
- 1 Protractor
- 2 Disc magnet
- 1 Metallic rod
- 1 Pulley
- 1 Angle pin
- 2 Thread pin
- 1 Double thread pin
- 1 Thread hook
- 3 M4 Wing nut
- 1 M 3.5 Wing nut
- 1 Inclined plane
- 1 250 ml beaker
- 1 Smoll box
- 1 Experiment

5602

Intermediate level

5602 SIMPLE MACHINES

10 experiments

CONTENTS
1. Simple machinesi
2. IThe spring scale
3. Equilibrium of a pivoted rod
4. First kind of lever
5. Second kind of lever
6. Third kind of lever
7. Control cards
8. Fixed pulley
9. Mobile pulley
10. Simple block and tackle
11. Inclined plane

SUPPLIED EQUIPMENT
- 1 Clamp Ø13 mm
- 1 Rod with hook Ø 6 mm
- 1 String
- 1 Table clamp
- 1 Pivot with wing nut, for rod
- 1 Rod with hook Ø 4 mm
- 2 Weight-holders 20 g
- 1 Fixed pulley
- 2 Slotted masses 50 g
- 10 Slotted masses10 g
- 1 Mobile pulley
- 1 Spring scale 250 g
- 1 Lever rod
- 1 Inclined plane with fixed pulley
- 1 Metal roller
- 1 Ruler 30 cm
- 1 Metal rod 50 cm with knurler
- 1 Experiment Guide
- 1 Case

5603

Intermediate level

5603 PRINCIPLES OF FLUID STATICS

14 experiments

CONTENTS
1. What fluids are
2. The spring scale
3. Graduated cylinder
4. Specific weight
5. Measuring the specific weight of a solid
6. Measuring the specific weight of a liquid
7. Pressure
8. Atmospheric pressure
9. Pascal's principle on liquids
10. Pascal's principle in aeriforms
11. Principle of communicating vessels
12. Capillarity
13. When a body is dipped into water
14. Archimedes' principle
15. Flotation

SUPPLIED EQUIPMENT
- 1 250 ml beaker
- 1 Clamp Ø 13 mm
- 1 Rod with hook Ø 6 mm
- 1 100 ml beaker
- 1 String
- 1 Base for rod
- 1 Metal disassemblable rod 70 cm
- 1 250 ml Graduated cylinder
- 1 Steel sample
- 1 Aluminium sample
- 1 Test tube
- 1 Scale pan
- 1 Archimende's double cylinder
- 1 250 g Spring scale
- 1 Pascal apparatus with communicating
- 1 Vessels
- 1 Funnel
- 1 Distilled water bottle
- 1 Small bottle of potassium permanganate
- 1 Denaturated alcohol bottle
- 1 Experiment Guide
- 1 Case

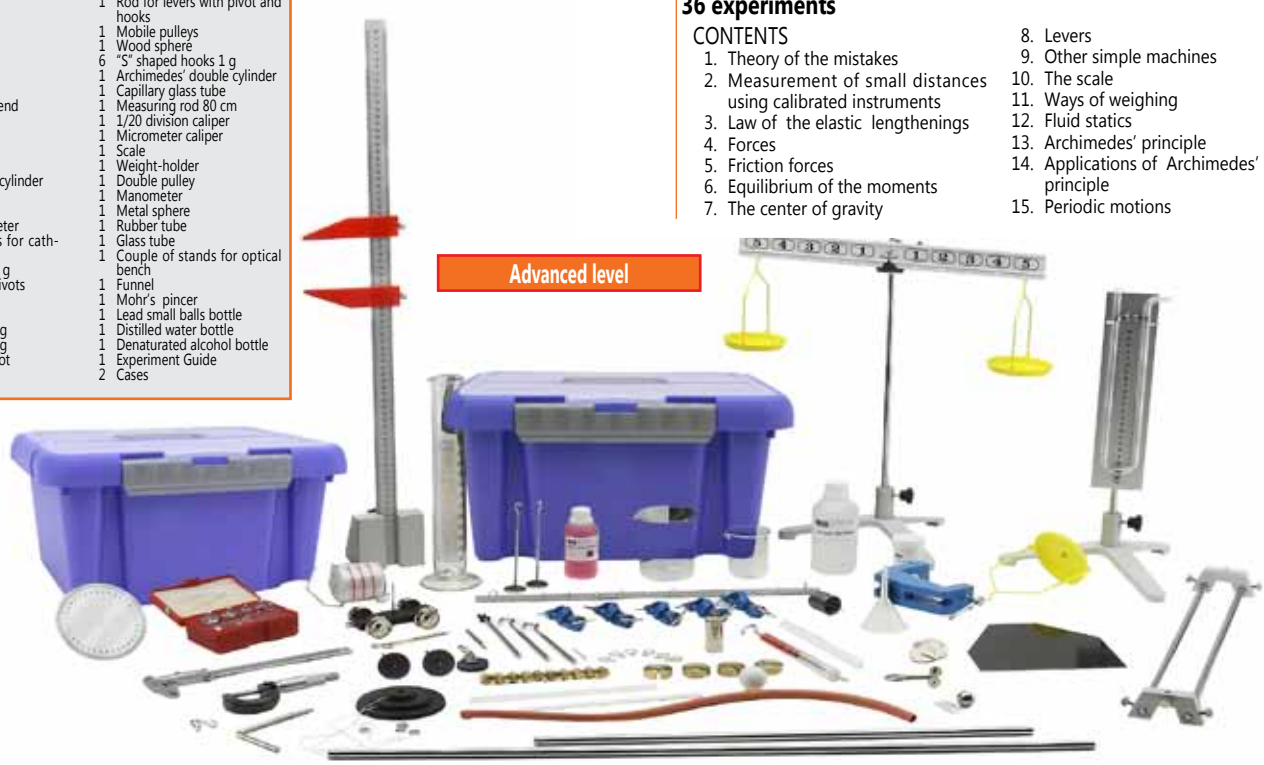
5593 MECHANICS

36 experiments

CONTENTS
1. Theory of the mistakes
2. Measurement of small distances using calibrated instruments
3. Law of the elastic lengthenings
4. Forces
5. Friction forces
6. Equilibrium of the moments
7. The center of gravity
8. Levers
9. Other simple machines
10. The scale
11. Ways of weighing
12. Fluid statics
13. Archimedes' principle
14. Applications of Archimedes' principle
15. Periodic motions

SUPPLIED EQUIPMENT
- 1 250 ml beaker
- 2 Tripod bases
- 3 Metal rods 50 cm
- 2 Rods with hook
- 1 Table clamp
- 1 Metal rod 75 cm
- 5 Double clamps
- 1 Rod with reduced end
- 1 Square-pivot
- 1 Rod with clip
- 1 100 ml beaker
- 1 Thread
- 1 250 ml Graduated cylinder
- 1 Test-tube
- 1 Steel sample
- 1 Base for cathetometer
- 1 Couple of indexes for cath-etometer
- 2 Weight-holders 20 g
- 1 Trolley with stop pivots
- 1 Coil spring
- 2 Fixed pulleys
- 8 Slotted Masses 10 g
- 4 Slotted Masses 50 g
- 1 Protractor with pivot
- 1 200 g Spring scale
- 1 Metal sheet for center of gravity
- 1 Rod for levers with pivot and hooks
- 1 Mobile pulleys
- 1 Wood sphere
- 6 "S" shaped hooks 1 g
- 1 Archimedes' double cylinder
- 1 Capillary glass tube
- 1 Measuring rod 80 cm
- 1 1/20 division caliper
- 1 Micrometer caliper
- 1 Scale
- 1 Weight-holder
- 1 Double pulley
- 1 Manometer
- 1 Metal sphere
- 1 Rubber tube
- 1 Glass tube
- 1 Couple of stands for optical bench
- 1 Funnel
- 1 Mohr's pincer
- 1 Lead small balls bottle
- 1 Distilled water bottle
- 1 Denaturated alcohol bottle
- 1 Experiment Guide
- 2 Cases

Advanced level



5593

5591 MECHANICS BASE

20 experiments

CONTENTS

1. Theory of the mistakes
2. Measurement of small distances using calibrated instruments
3. Law of the elastic lengthenings
4. Forces
5. Friction forces
6. Equilibrium of moments
7. The center of gravity
8. Levers
9. Other simple machines
10. The scale
11. Ways of weighing
12. Fluid statics
13. Archimedes' principle
14. Applications of Archimedes' principle
15. Periodic motions

SUPPLIED EQUIPMENT

- 1 Piano inclinato con carrucola
- 1 Vasi comunicanti con capillari
- 1 250 ml beaker
- 1 Tripod bases
- 3 Metal rods 50 cm
- 2 Rods with hook
- 1 Table clamp
- 1 Metal rod 75 cm
- 5 Double clamps
- 1 Rod with reduced end
- 1 Square-pivot
- 1 Rod with clip
- 1 100 ml beaker
- 1 Thread
- 1 250 ml Graduated cylinder
- 1 Test-tube
- 1 Steel sample
- 2 Weight-holders 20 g
- 1 Trolley with stop pivots
- 1 Coil spring
- 2 Fixed pulleys
- 8 Slotted Masses 10 g
- 4 Slotted Masses 50 g
- 1 Protractor with pivot
- 1 200 g Spring scale
- 1 Metal sheet for center of gravity
- 1 Mobile pulleys
- 1 Wood sphere
- 6 "S" shaped hooks 1 g
- 1 Archimedes' double cylinder
- 1 Capillary glass tube
- 1 Measuring rod 100 cm
- 1 1/20 division caliper
- 1 Scale
- 1 Metal sphere
- 1 Glass tube
- 1 Lead small balls bottle
- 1 Distilled water bottle
- 1 Denaturated alcohol bottle
- 1 Experiment Guide
- 1 200 g Spring scale
- 1 Cases

5591

Demonstration from the teacher's desk

5640 SOLID STATICS

20 experiments

CONTENTS

1. Forces and their effects
2. Elastic lengthenings
3. The spring scale
4. Forces at a distance
5. Composition of concurrent forces
6. Composition of parallel concurrent forces
7. Friction forces
8. Measurement of the grazing friction coefficient
9. Equilibrium of moments
10. The center of gravity
11. Levers
12. Check cards
13. Fixed pulley
14. Mobile pulley
15. Simple block and tackle
16. The inclined plane

5640

SUPPLIED EQUIPMENT

- 3 Ø13 mm clamps
- 2 Rods with hook
- 1 Thread
- 2 Tripod bases
- 1 Stand with rod
- 1 Pivot with wing nut
- 2 Disassemblable metal rods 70 cm
- 1 Clip with thread
- 1 Coil spring
- 2 Fixed pulleys
- 1 Protractor with pivot
- 1 Plate for center of gravity
- 1 Mobile pulley
- 2 "S"hooks
- 1 Magnet
- 1 Linear ruler
- 1 5 N spring scale
- 1 Rods for levers
- 4 50 g slotted masses
- 10 50 g masses with hook
- 1 Metal plate with pivot
- 1 Friction trolley
- 1 Wood block
- 1 Plexiglass rod
- 2 PVC rods
- 1 Magnetic needle
- 1 Experiment Guide
- 1 Case

1100 LINEAR MOTION

8 experiments

CONTENTS

1. Electronic ticker tape timer
2. Tic-marks recording
3. Measurement of a time interval
4. Measurement of the average speed
5. Rectilinear uniform motion
6. Measurement of the average acceleration
7. Motion on an inclined plane
8. Motion under the action of a constant force
9. Friction forces
10. Free fall of a body

Demonstration from the teacher's desk

1100

SUPPLIED EQUIPMENT

- 1 Electronic ticker tape timer with power unit
- 1 Low friction trolley
- 1 100 cm linear ruler
- 1 Metal rod 25 cm
- 1 Table clamp
- 1 Double clamp
- 1 Clamp with pulley
- 1 Thread
- 1 Alluminium plate
- 1 Sponge
- 10 Hooks 1 g
- 4 Slotted masses10 g
- 2 Masses 25 g with hook
- 2 Slotted masses 50 g
- 2 Masses 10 g with hook
- 1 Alligator clip
- 1 Experiment Guide
- 1 Case

5658 FLUID STATICS

16 experiments

Demonstration from the teacher's desk

5658

CONTENTS

1. What fluids are
2. The spring scale
3. The misuring cylinder
4. Specific weight
5. Measurement of the specific weight of a solid
6. Measurement of the specific weight of a liquid
7. The pressure
8. Atmospheric pressure
9. Pascal's principle in liquids
10. Pascal's principle in aeriforms
11. Communicating vessels principle
12. The capillarity
13. When a body is dipped into a liquid
14. Archimedes' principle
15. The flotation
16. Archimede's principle apllications
17. Constant weight hydrometer

SUPPLIED EQUIPMENT

- 1 250 ml beaker
- 1 Clamp Ø13 mm
- 1 Rod with hook
- 1 100 ml beaker
- 1 Thread
- 1 Tripod base
- 1 Disassemblable metal rod 70 cm
- 1 Steel sample
- 1 Aluminium sample
- 1 250 ml misuring cylinder
- 1 Scale pan
- 1 Pack of little lead balls
- 1 Archimede's double cylinder
- 1 Spring scale
- 1 Pascal's apparatus and communicating vessels
- 1 Funnel
- 1 Distilled water bottle
- 1 Denaturated alcohol
- 1 Metylene blue bottle
- 1 Test-tube
- 1 Dropper
- 1 Experiment Guide
- 1 Case

MECHANICS KITS

5701

Demonstration from the teacher's desk

5701 VACUUM AND ATMOSPHERIC PRESSURE

13 experiments

CONTENTS

1. The lift pump
2. The pressure
3. Atmospheric pressure
4. Isotropy of atmospheric pressure
5. Pressure tear device
6. Magdeburg hemispheres
7. Straws and suction caps
8. The baloon experiment
9. The flask experiment
10. Water boiling
11. Propagation of the sound waves
12. Newton's tube
13. The baroscope

SUPPLIED EQUIPMENT

- 1 50 ml Beaker
- 1 50 ml conical flask
- 1 Newton's tube
- 1 Pneumatic bell-jar
- 1 Pressure tear device
- 1 Electric alarm
- 1 Silicone grease pack
- 1 Magdeburg hemispheres
- 1 "U"shaped glass tube
- 1 Suction cap
- 1 monostage electrical pump
- 1 Pneumatic bell-jar
- 1 Plate for bell-jar
- 1 Rubber tube for vacuum
- 1 Baroscope
- 1 Rubber little baloon
- 1 Test-tube 16x160 mm
- 1 Experiment Guide
- 1 Case

5616

Demonstration from the teacher's desk

5616 OSCILLATIONS AND THE ACOUSTICS

8 experiments

CONTENTS

1. Oscillatory horizontal motion
2. Oscillatory vertical motion
3. Period and frequency
4. Acoustic waves
5. The sonometer
6. The tuning fork
7. The resonance
8. Resonance boxes

SUPPLIED EQUIPMENT

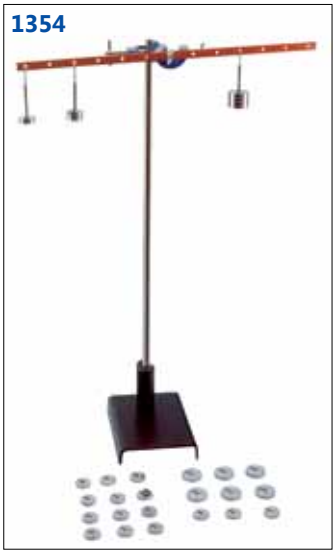
- 1 Double clamp
- 1 Metal rod 50 cm
- 1 Rod with hook
- 1 Thread
- 1 250 ml Beaker
- 1 Tripod base
- 1 Pincer with clip
- 1 Coil spring
- 1 Wood sphere
- 6 Weights 25 g with hook
- 1 Metal sphere
- 1 Wood sphere with thread
- 1 Glass cylinder
- 1 Tuning fork
- 1 Sonometer
- 1 Bell on a rod
- 1 Experience Guide
- 1 Case

EQUILIBRIUM

1352

1066

1354



1310

1353

Masses with hooks

1352 Series of 8 masses with 2 hooks: 1mass 1 g; 2 masses 2 g; 1 mass 5 g;1 mass 10 g; 1 mass 20 g; 1 mass 50 g; 1 mass 100 g.
1398 Series of 10 masses weighing 10 g with double hook.
1399 Serie of10 masses weighing 25 g with double hook.
1066 Series of10 masses weighing 50 g with double hook.

Slotted masses

1309 Series of 9 masses weighing 10 g + hanger 10 g.
1310 Series of 9 masses 20 g + hanger 20 g.
1311 Series of 9 masses 100 g + hanger 100 g.
1312 Series of 9 masses 100 g + hanger 100 g.
1353 Series of 9 masses weight: 1 g, 2 g(2 pcs), 5 g, 10 g, 20 g, 50 g, 100 g, 200 g + hanger 50 g.

Rod for levers with stand

1354 It is supplied with tripod stand, metal rod, pivot and clamp, a series of masses code 1309, and a series of masses code 1310.

Rods for levers

1152 Made of alluminium, with holes and pivot. Length: 38 cm.
1014 Made of alluminium with rings and pivot.

1313 **Unequal-arms scale**
For experiments on the equilibrium of a lever. It is supplied with 10 masses

1382 **Roman Arch**
Sets of 23 assemblable wood blocks. It shows the statics principles of an arch.
It can support the weight of a person. Dimension:45x17x5 cm.

Plastic pulleys
1227 Simple pulley ø50 mm.
1160 Paralel of two pulleys ø50 mm.
1266 Parallel of 3 pulleys ø50 mm.
1228 Series of two pulleys ø50 - 40 mm.
1127 Series of three pulleys ø50 - 40 - 30 mm.
1009 Pulley ø35 mm with perpendicular axes ø6 mm.
1157 Pulley ø35 mm with longitudinal axes ø8 mm.

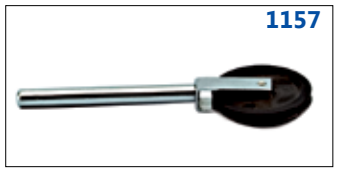
Aluminium pulleys
1058 Simple pulley ø50 mm.
1059 Paralel of two pulleys ø50 mm.
1060 Paralel of three pulleys ø50 mm.
1061 Series of two pulleys ø50 - 40 mm.
1064 Series of three pulleys ø50 - 40 - 30 mm.

8153 **Reel of thread 50 m**
Made of light, twisted nylon, it's thin and flexible.

1360 **Device for experiments on pulley systems**

Components:
7 Simple pulleys
2 Paralels of 4 pulleys
3 Clamps
8 Stands with hook
15 Slotted masses:
1 Skein of thread
2 Series of 3 pulleys
1 Multiple pulley
1 Plane with 3 rods
7 Mass holders
2 pcs. 10g, 2 pcs. 20 g, 2 pcs. 50g, 4 pcs. 100g, 4 pcs. 200g, 1 pc. 500g.
1 Experiment Guide

1166 **Force Table**
Components:
4 mobile pulleys
4 Weights100 g
4 Weights 20 g
4 Strings with rings
4 Weight-holders100 g
4 Weights 50 g
4 Weights 10 g
1 Experiment Guide



1380

1380 **Disk of the momenta**
Accessory of our code 1166. It allows the study the equilibrium of the momenta.

1032 **Forces composition device**
It allows the examination of the laws of both concurrent forces composition (the parallelo gram 's law) and paralel forces composition. It is supplied with a protractor, 8 masses of 10 g and 8 masses of 25 g.
Dimension 45x17x60 cm.

1032

1341 LEVERS AND PULLEYS KIT

12 experiments

CONTENTS

1. The spring scale
2. How to measure a weight or a force
3. Let's learn to use our forces in a wise way
4. Equilibrium of a rod pivoted on its center
5. Simple machines
6. Levers
7. The fixed pulley
8. The mobile pulley
9. The simple block and tackle
10. Couple of pulleys in paralel
11. Couple of pulleys in series

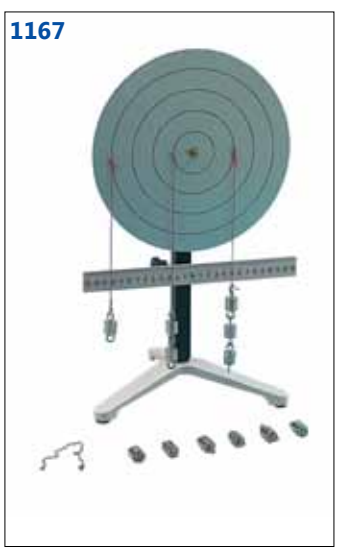
COMPONENTS:

1 Base with rod	2 Couple of pulleys in parallel
1 Rod with hook	2 Couple of pulleys in series
1 Clamp	1 String
1 Perfored rod with pivot	3 Lens holders
1 Spring scale	1 Experiment Guide
10 Weights 50 g with 2 hook	1 Case
2 Simple pulleys	

1341

1362

1167



1362 **Multiple pulley**
It is composed of a group of 4 coaxial and solidal pulleys,whose diameter is Ø 2, Ø4, Ø8 and Ø 12 cm.
It is supplied with a support. Rod and clamp are not included.

1167 **Momenta Apparatus**
It is composed of an aluminium disk rotating around a central pivot. Different weights can be attached to the disk in different positions. Since the arm of every weight can be measured directly on the ruler, it is possible to check that the sum of the clockwise moments is equal to the sum of the counterclockwise moments.
Components: 10 g weights (10 pcs); 25 g weights (10 pcs); 4 strings. Disk's diameter: Ø 25 cm.

1171 **Inclined plane**
Components:
1 Metal inclined plane
1 Spring scale
4 Masses 10 g
1 Stand
1 Low friction trolley
2 Masses 50 g
1 Linear ruler

1103 **Precision inclined plane**
This inclined plane is equipped with a spring scale with 0.02N accuracy and a protractor (accuracy 2°) to allow a direct reading of the slope. Components:
1 Spring scale 100 g
2 Masses 50 g
1 Inclined plane with protractor
Plane dimensions: 95 x 500 mm.
1 Low friction trolley
4 Masses 10 g

1291 **Friction inclined plane**
With this device it is possible to do experiments dealing with the equilibrium laws of an inclined plane, with the laws of the grazing friction and to calculate the coefficient of it.
Components:
1 Wood plane
1 Wood block
1 Low friction trolley
4 Slotted masses 50 g
Plane dimensions: 800 x 100mm.
1 Masonite plate
1 Tin foil
1 Series of 9 masses 20 g +hanger 20 g
1 Inclination protractor

1111 **Hooke's law apparatus**
It allows you to verify that, within specific limits, the lengthening of a spring is proportional to the intensity of the applied force. The graduated scale has 1 mm division and the perfectly balanced weight-holder has an index which can rotate so to consent the perfect allignment with the graduated scale. It is suplied with four 50 g masses, four 10g masses and four different springs.
Height: 82 cm.

8155 **Set of 4 springs and 1 elastic band**
Suitable for perform experiments on Hooke's law and on elastic oscillations.
Two of the springs have the same features in order to be used in series or in paralel.

8158 **Set of 10 springs**
With the same elastic costant and same length. Elasticity constant: K= 6,5 N/m

8179 **Set of 5 springs with index:**
Features:
1 K= 2,4 N/m; carrying capacity: 0,5N
2 K= 5 N/m; carrying capacity: 1N
3 K= 9,8 N/m; carrying capacity: 2N
4 K= 14,5 N/m; carrying capacity: 3N
5 K= 39,2 N/m; carrying capacity: 5N

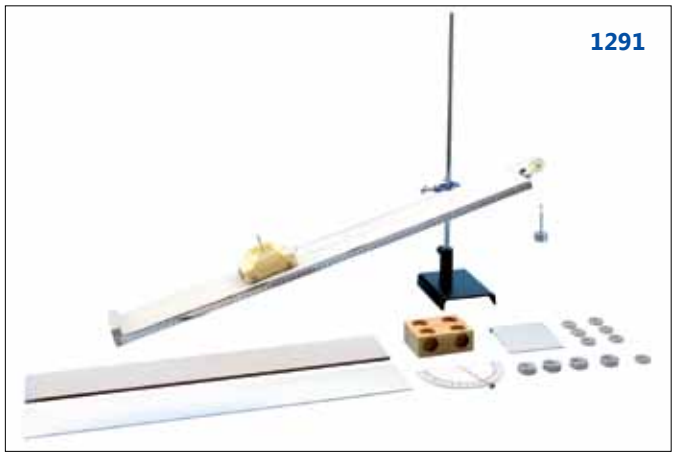
1102 **Device for searching the center of gravity**
Using the plumb-line it is possible to find the vertical passing through the suspension point. Repeating the experiment in several points you will find the center of gravity of the 5 figures supplied. Some of the figures are symmetrical, some others are not. Height: 33 cm.

1078 **Device for the demonstration of equilibrium states**
By moving the two lateral masses, the center of gravity of the system can adopt different position; in this way it is possible to demonstrate how the kind of equilibrium depends on the position of the center of gravity in respect to the basement point. Dimensions: 20x28 cm.

1077 **Demonstrator of object stability**
It consists of an aluminium framework with flexible corners; in this way it mantains paralel bases as it undergoes deformation. By using the plumb-line it is possible to verify the equilibrium conditions of solid bodies standing on a plane. Dimensions : 10x10x26 cm.

1079 **Demonstrator of centre of gravity**
As the cylinder goes down along the inclined plane, the double cone goes up, apparently contravening the laws of mechanics. In reality the center of gravity of both moving bodies goes down.
Made entirely of wood. Length ofthe inclined plane: 50 cm.
Dimensions of the double cone: 35 cm. Dimensions of the cylinder: 35 cm.


1103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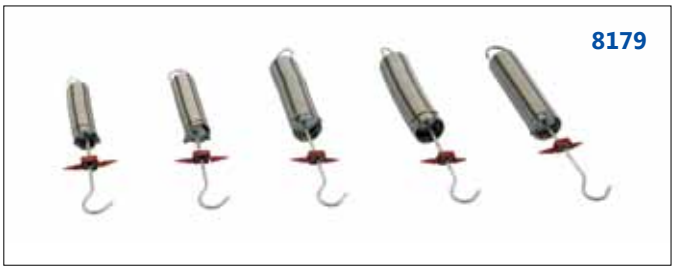
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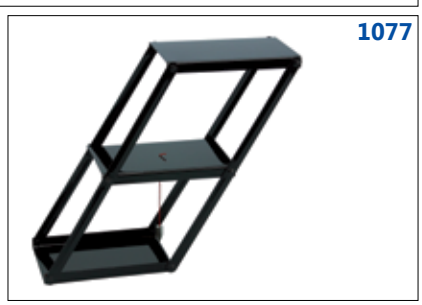

1077

1123

1123 Forces, momenta and machines

Set for experiments on solid statics.
15 EXPERIMENTS

CONTENTS

1. Composition of concurrent forces
2. Decomposition of a force
3. Composition of paralel concording forces
4. Composition of paralel discording forces
5. The center of gravity
6. Hooke's law
7. Equilibrium of a bar
8. Equilibrium of moments
9. Levers
10. Fixed pulley
11. Mobile pulley
12. Simple block and tackle
13. Block and tackle with two couple of pulleys in paralel
14. Block and tackle with two couple of pulleys in series
15. Inclined plane

SUPPLIED EQUIPMENT

1 Frame
4 Clamps Ø6mm
3 Fixed pulleys
1 Spring scale
1 Rod for levers with pivot
2 Rods with hook
2 Series of masses10 g
1 Series of masses 20 g
1 Protractor
1 Metal sheet for center of gravity
3 Clamps Ø10mm
1 Mobile pulley
2 "S"shaped hooks
1 Coil with index
1 Moments' disk
1 Linear ruler
1 Square
1 Inclined plane with protractor
1 Friction trolley
2 Couple of pulleys in series
2 Couple of pulley in paralel
2 Skein of rope
1 Case

1123: Inclined plane

1329 Magnetic board with stand

With white board surface in order to draw diagrams and write formulas.
It can be assembled on a table in vertical position.
Dimensions: 90x60 cm.

Ideal complement for the statics kit (code 1328, page 29).

Composition of forces (1328)

Equilibrium of moments (1328)

Inclined plane (1328)

1328 Statics set for magnetic board

For the performance of statics experiments visble at distance, easy and quick to perform on a magnetic blackboard (sold separately).

CONTENTS

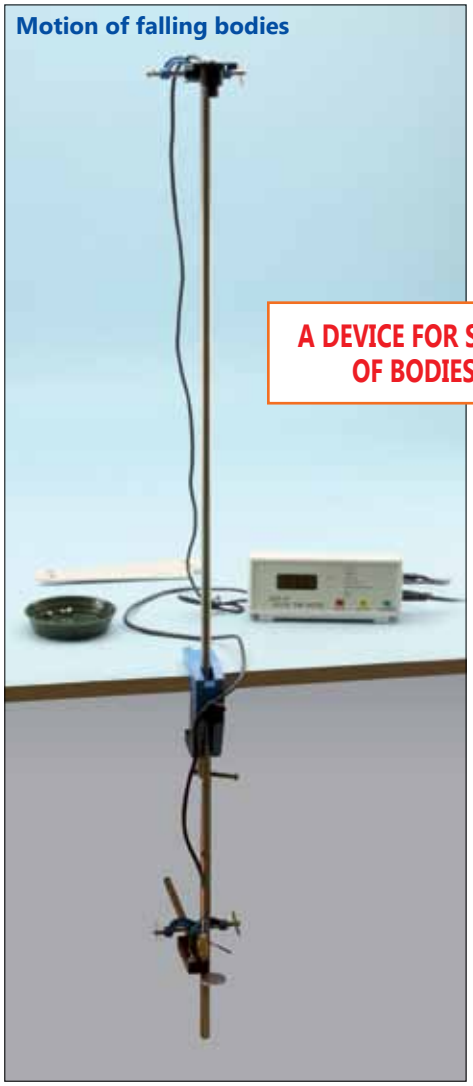
1. Composition of concurrent forces
2. Composition of paralel forces
3. Decomposition of a force
4. Elastic forces
5. Hooke's law
6. The center of gravity
7. Equilibrium of a pivoted rod
8. Equilibrium of moments
9. Levers
10. The inclined plane
11. The grazing friction
12. Pulleys
13. Pulleys in paralel
14. Pulleys in series
15. Combinations of simple machines

20 EXPERIMENTS

SUPPLIED EQUIPMENT

- 4 Magnetic anchors
- 3 Rods with hook
- 2 Mobile pulleys
- 2 Series of weights 10 g with hanger
- 2 Cylindrical masses 50 g
- 1 Rod for levers with pivot
- 1 Spring with index
- 1 Moments'disk
- 2 Couples of pulleys in series
- 1 Wood block
- 2 Strings
- 1 "S"shaped hook
- 1 200 g Spring scale
- 2 Fixed pulleys
- 1 Protractor 3600
- 1 Series of weights 20 g with hanger
- 1 Metal sheet for center of gravity
- 2 Triple pulleys in series
- 1 Linear ruler
- 1 Spring scale clamp
- 1 Inclined plane with protractor
- 1 Friction trolley
- 2 Couples of pulleys in paralel
- 1 Experiment Guide
- 1 Case

1328



A DEVICE FOR STUDYING THE FALL OF BODIES IS INCLUDED !

5585 150-cm air-track with falling bodies apparatus

This set allows you to perform experiments on the kinematic and dynamic aspects of rectilinear motion, and also on the motion of the falling bodies. Because of the simplicity of its functioning and its small size, the track is particularly suitable for group experimentations.

CONTENTS

1. Uniform motion
2. Uniformly accelerated motion
3. Fundamental Law of dynamics
4. Isolated systems
5. Elastic collisions
6. Principle of energy preservation
7. Principle of motion quantity preservation
8. Elastic oscillations
9. Falling bodies

SUPPLIED EQUIPMENT

1	Track150 cm with stands
1	Iron nucleus and electromagnet's stand
2	Photogates
1	Limit switch
2	Friction trolleys with trolley-set
1	Air compressor
1	Double digital time-counter
1	Table clamp
1	Fixed pulley with rod
3	Track's support disks
1	Metal rod 10x1200 mm
2	Double clamps
2	Steel balls
1	Sand collector
2	Coil springs
1	Calibrated weight-holder 5 g
1	Weight 1 g
2	Weights 2 g
1	Weight 5 g
1	Protractor
1	String
1	Steel thread for the cleaning of the holes
3	Height difference disks
12	Masses 50 g
1	Spool
1	Electromagnet spacer
1	Electromagnet cable
1	Elastic buffer
2	Bases with rod ø 10 mm
1	Rod
2	Rods with hook
1	Linear ruler
1	Plumb-line
1	Experiment Guide
1	Case

5585

5598 200-cm air-track with falling bodies apparatus

Questo complesso, è stato studiato per consentire all'insegnante di eseguire a scopo dimostrativo, tutta una serie di esperienze sulla cinematica e sulla dinamica del moto rettilineo e sui sistemi isolati. La rotaia, ha una sezione triangolare e presenta particolari qualità di robustezza, allo scopo di evitare ogni possibile deformazione a causa delle variazioni della temperatura.

CONTENTS

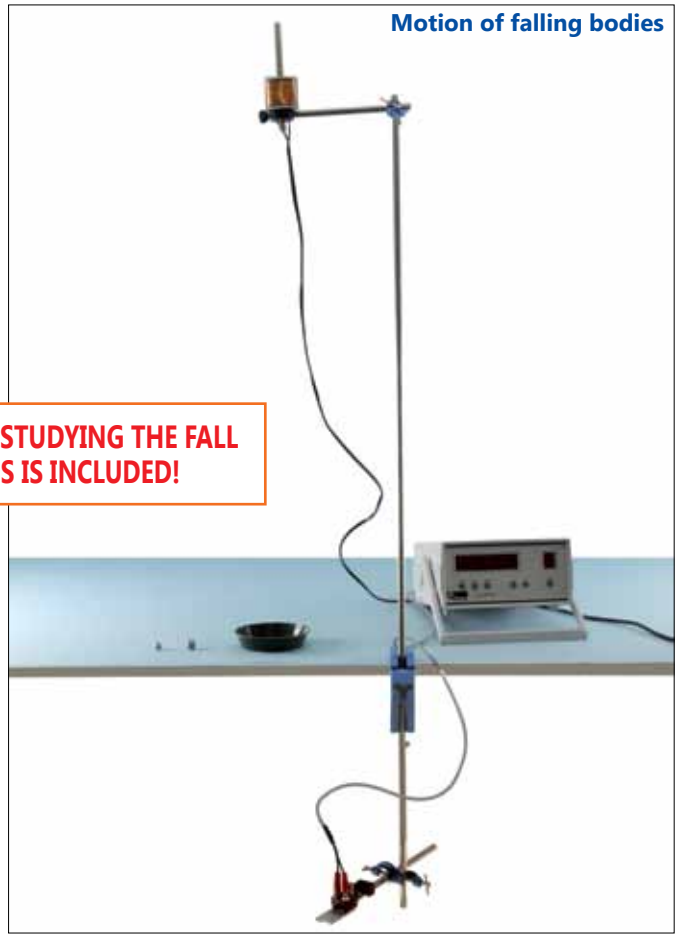
1. Uniform motion
2. Uniformly accellerated motion
3. Fundamental law of dynamics
4. Isolated systems
5. Principle of preservation of the center of gravity
6. Principle of preservation of the motion quantity
7. Elastic collisions
8. Elastic collision against a fixed obstacle
9. Elastic collision among two trolleys
10. Elastic oscillations
11. Principle of energy preservation
12. Falling bodies

A DEVICE FOR STUDYING THE FALL OF BODIES IS INCLUDED!

SUPPLIED EQUIPMENT

1 Track 200 cm with stands	5 Disk-weights 5 g
1 Iron nucleus and electromagnet stand	12 Weights 50 g
1 Electromagnet spacer	1 Protractor
1 Electromagnet cable	1 Spool
3 Photogates	1 Elastic buffer
1 Mobile photogates	1 Base with rod
2 Friction trolleys with trolley-set	1 Steel thread for the cleaning of holes
1 Air compressor	1 Darkening plate 5 mm
1 Double digital time-counter	2 Darkening plates40 mm
1 Clamp	2 Darkening plates 60 mm
1 Fixed pulley	1 Strings
3 Support disks for track	1 Pendolum
3 Height-difference disks	1 Linear ruler
1 Metal rod 10x1200 mm	1 Plumb-line
2 Double clamps	1 Track with sphere ø 20 mm
2 Steel balls	2 Shock-absorbers made of velcro
1 Sand collector	1 Screwdriver
2 Coil springs	1 Experiment Guide
1 Calibrated weight-holder 5 g	1 Case

Motion of falling bodies



5600 Table multilayer folding

Measure: 240x30x2cm

5600

WARNING:
If a laboratory bench at least 240cm long and suited for the application of a table clamp is not available, we recommend the purchase of the table code 5600

5598

1109

1097

1093 (base not included)

1135 (base not included)

1081 (base not included)

1092 (base not included)

1095 (base not included)

1094 (base not included)

1109 Small manual rotating machine
Metal sheet plane 40x30 cm
Equipped with metallic spindle for shafts with 6mm diameter.

1097 Newton's disk
Divided into coloured parts, it allows you to verify the additive color synthesis by rotating it on a rotary machine.

1093 Watt's regulator
It represents the model of a centrifugal regulator. During the rotation , two masses move away and, therefore, press the spring. To be used with a rotary machine.

1135 Device for measuring the centrifugal force
It is composed of a track where a low friction cart can run. By rotating the device with the rotary machine code 1099, it is possible to read the value of the centrifugal force on the spring scale placed on the rotation axis. Moreover, it is possible to verify the centrifugal force formula too, knowing the radius.

1081 Device for pointing out the centrifugal force
Applying this device on a rotary machine,the more the number of turns increases, the more the cylinder presses the spring.

1092 Coaxial cylinders
Since the mass of one cylinder is twice the other cylinder's mass, during the rotation the equilibrium is reached when the distances between each center of gravity and the center of rotation, are inversely proportional to the masses. To be used with any rotary machine.

1095 Foucault's pendulum
It allows you to perform the classic Foucault experiment in order to prove the unchangeableness of the oscillatory plane of a pendulum. It doesn't need a rotary machine.

1094 Elastic rings
They show that the centrifugal force increases as the distance from the rotation center increases.
During the use their shape becomes elliptical.

5617 ROTATIONAL MOTION KIT

7 experimants

CONTENTS

1. Two masses device
2. Two elastic rings device
3. Centrifuge with inclined test-tubes
4. Centrifuge model
5. Newton's disk
6. Savart's siren

SUPPLIED EQUIPMENT

- 1 Elastic rings apparatus
- 1 Inclined test-tube apparatus
- 1 Centrifuge model
- 1 Coaxial cylinder
- 1 Newton's disk
- 1 Hand rotary machine
- 1 Savart's siren
- 1 Experiment Guide
- 1 Case

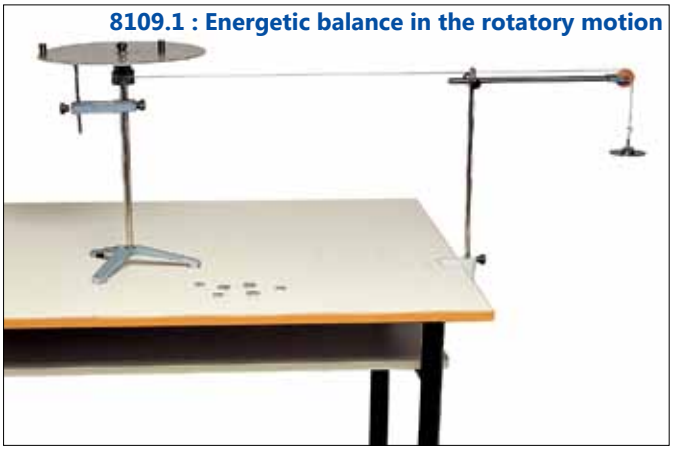
5617

8109.1 Device for the study of the rotational motion

With this device it is possible to perform experiments on the dynamics of the rotational motion and on the moment of inertia of rotating bodies, by using a timer (not included in this kit)

CONTENTS
1. Uniform rotational motion
2. Uniformly accelerated rotational motion
3. Determination of the relationship between angular acceleration and force momentum
4. Dynamic measure of the inertia moment
5. Transformation of potential energy into translational and rotational kinetic energy

SUPPLIED EQUIPMENT
- 1 Stand endowed with ball-bearings
- 1 Metal rod
- 1 Bar with two sliding masses
- 1 Aluminium disk (ø 32cm; thickness:4 mm)
- 1 Weight-holder
- 1 Blocking device
- 1 Clamp
- 1 Linear ruler
- 2 Pawls
- 5 Disk weights10 g
- 5 Disk weights 20 g
- 1 Rod with low-friction pulley
- 1 Rod with sphere
- 1 Rope highly resilient and thin
- 1 Clamping Key
- 1 Experiment Guide
- 1 Case



1177 Rotating platform

Made of metal, it is mounted on a couple of conical bearings which assure great resistance toward solicitations and low friction; it is supplied with seat and many components which allow the performance of experiments on non-inertial systems , otherwise impossible to perform. Platform Ø 50 cm.

CONTENTS
1. "Action and reaction" principle
2. Preservation of the motion quantity moment
3. Non-inertial systems of uniform rotatory motion
4. A falling body in non-inertial systems
5. Centrifugal force and its effects
6. Measurement of the centrifugal force
7. Centrifugal force depending on the rotation radius.
8. Centrifugal force depending on the angular velocity
9. Corioli's force
10. Inertia moment

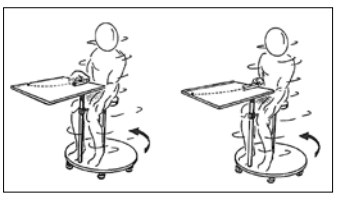
SUPPLIED EQUIPMENT
- 1 Rotating platform
- 1 Ring stand for vertical tube
- 1 Ring stand for falling plane
- 2 Dumb-bells 5 Kg
- 1 Bicycle wheel overburdened by a lead tube
- 1 Metal rod 1200x18 mm
- 1 Metal stand 800x33 mm
- 1 Steel sphere ø 10 mm
- 1 Steel sphere ø 15 mm
- 1 Steel sphere ø 25 mm
- 1 Collecting plane with carbon paper
- 2 Metal pinchers
- 2 Spring pincers
- 1 Arm for falling sphere
- 1 Plane with cannon
- 1 Inclination protractor
- 1 Device for measuring the centrifugal force, with spring scale, string, pulley, cart, pincer and rod.

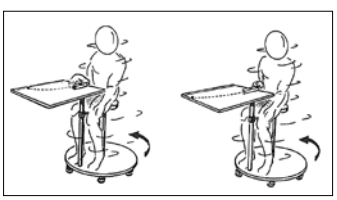
1429 Rotational dynamics

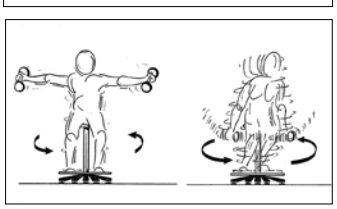
Our apparatus consists in a variable binary gauge: the distance between the two sides of the binary can be varied at its centre by means of a screw activated my an external knob.
The binary is made of iron to prevent that the ball weight (a billiard ball) can deform the system geometry and affect the results. A base to be positioned on the binary and a level ensure the perfect horizontal position of the binary.
During the motion, the kinetic energy continuously transforms in rotational kinetic energy, creating curious effects, which can be explained with a detailed analysis of the centre of gravity position.

CONTENTS
1. Dynamics of roto-translational motion
2. Relationship between gauge and speed of translation
3. Transformation of translational mechanical energy into rotational mechanical energy and vice-versa
4. Research of the point of maximum translational speed

SUPPLIED EQUIPMENT
1 Iron variable gauge guide with supporting pins
2 PVC supporting bases
1 Billiard ball 1 board
1 Level







OSCILLATORY MOTION

1272 Simple pendulum
With this device it is possible to verify the laws of simple oscilations. Moreover it is possible to verify that initial potential energy get preserved regardeless of the trajectory(Galilei's pendulum).The pendulum is suplied with 3 different spheres and their strings. Height: 70 cm.

1104 Simple pendulums apparatus
Composed of 3 simple pendulums whose length can be changed through specific handwheel and whose masses are different. Thus, you can demonstrate that the period of a simple pendulum depends on the length, but doesn't depend on the mass.
A T-shaped rod able to move along a vertical stand, allow you to release all 3 pendulum at the same time. Height: 100 cm

1306 Set of 5 pendulum spheres
Spheres with hook Ø 25 mm. Material: aluminium, brass, iron, wood, copper.

1080 Maxwell's pendulum
By winding the wire onto the shaft of the rotating mass, the latter receives an initial potential energy, that - once abandoned - becomes for a small part translation kinetic energy, and for the most part rotational kinetic energy. It allows to determine the moment of inertia of the rotating mass. Dimension: 28x10x42 cm.

1350 Variable inclination pendulum
It allows you to demonstrate that the period of a simple pendulum depends only on its length and on the gravitational acceleration. The latter can be varied from 0 to g, varying the inclination of the oscillation plane. The oscillating disk is placed on a plank with air-bearing which need to be feeded by an air compressor(code 1331) to purchase separately.
The measurement of the period can be done with the help of a hand timer or of the photogate (code 1268) linked to the digital timer code 1267 (both item must be purchased separately).

1393 Wilberforce's pendulum
This device can demonstrate the surprising phenomenum of the pairing of torsional and longitudinal oscillation in a mass-spring system.
The surprising effect is that , to a faraway observer(who doesn't notice the torsional oscilation) it looks like the vertical oscillation first slows down and eventually stops; then, without external interference, it stats growing up again as if it was under the push of an invisible force. It is supplied without table clamp, metal rod and clamp.

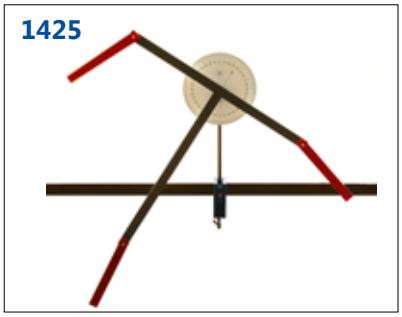
1331 Air blower
To use with the variable inclination pendulum. it is particularly silent and, therefore, suitable for desk experiments.

1302 Forced oscillation apparatus
With this apparatus it is possible to study the conditions required to obtain that the frequence of the forcing system gets close to the one of the forced system. The forcing system is a electromagnetic vibrator, the forced system is a mass-spring system.

Supplied equipment:
1 base for rod;
1 system of 2 low friction pulleys;
1 series of weights 20g;
1 graduated cylinder;
1 metal rod;
5 springs;
1 clamp;
1 electromagnetic vibrator.

For the functioning of the vibrator we suggest to use the funcion generator code 5718 (sold separately).

1425 Todd's Pendulum
This particular device, when placed far away from the equilibrium position, starts to oscillate with a chaotic and unpredictable motion. Repeating the experiment with a slightly different starting angle, the fluctuations evolve in a completely different way than the previous ones. It is useful to understand the importance of initial conditions in the so-called "deterministic chaos".
Interesting conceptual applications to meteorology.



8111 Apparatus for the study of harmonic oscillations

The study of the oscillations of a system consisting of a mass hanging from a spring allows students to be introduced to the motion features of an harmonic oscillator and to be acquitted on one of the most powerfull model for the physic interpretation of a wide range of phenomena.

CONTENTS

1. Hooke's law
2. The elastics oscillations
3. Oscillation period of an elastic pendulum depending on the mass of the system
4. Oscillation period of an elstic pendulum depending on the elasticity constant of a spring
5. Study of the motion from an energetic viewpoint
6. Simple pendulum
7. Period's dependence from the length
8. Physical pendulum
9. Period's independence from the oscillating mass
10. Relation between a physical pendulum's period and its moment of inertia
11. Torsion pendulum
12. Relation between a torsion pendulum's period and its moment of inertia
13. Relation between a torsion pendulum's period and the geometrical and physical sizes which feature the twisted body in torsion.

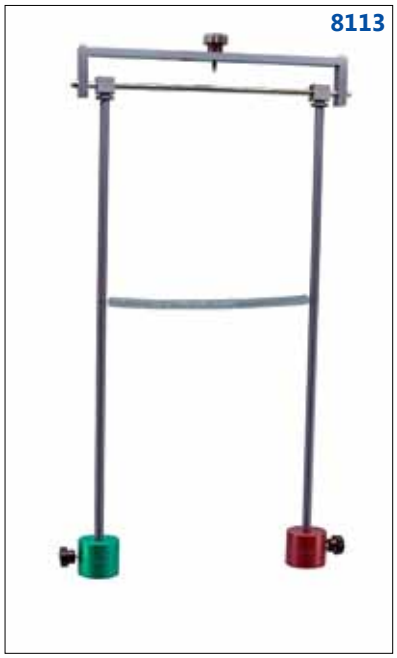
SUPPLIED EQUIPMENT

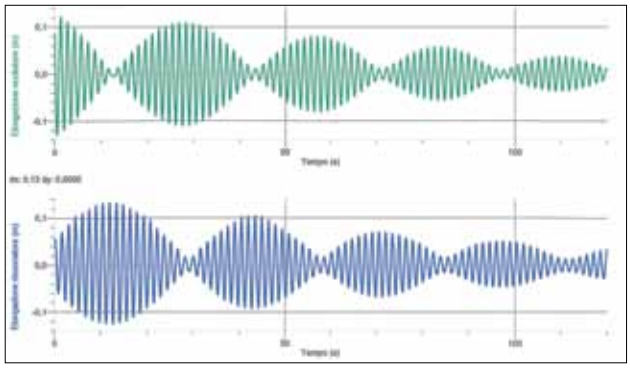
- 1 Metal stand with rod
- 1 Complete stand for elastic pendulum, simple pendulum and composed pendulum
- 1 Elastic pendulum
- 4 Coil springs with different elasticity constant
- 2 Spheres with different mass
- 1 Balance-bar with two cylindrical masses
- 1 Skein of thin, high-resistance thread.
- 1 Compound pendulum with two cylindrical masses
- 1 Tonsion pendulum with 4 metal wires of different length and section
- 1 Experiment Guide
- 1 Case

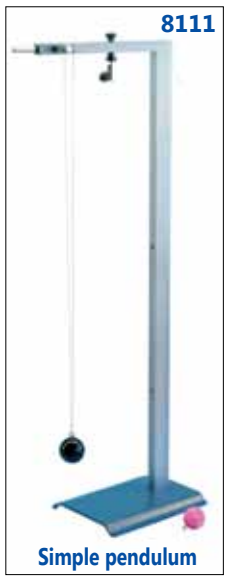
8113 Apparatus of the paired pendulums

This apparatus consists of two physic pendulums which are paired through a coil spring sligtly stretched out; the spring allows the energy transfer between the two pendulums. So it is possible to study the phenomena of resonance and of beats. The study becomes quantitative if we use two distance sensors. In this way you can obtain diagrams like those in the picture. The apparatus can be used as optional equipment of the device code 8111, or with the stand code 0209 (sold separately).

0209 Stand for apparatus of the paired pendulums







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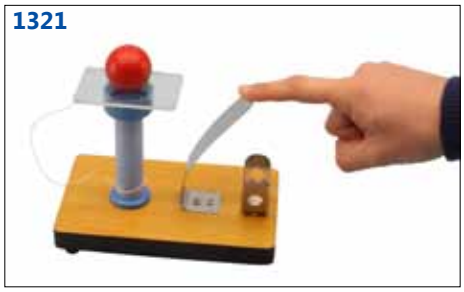

1319

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1396

1394

1113 Newton's cradle
It is composed of five steel balls of equal mass, lined up and in contact with each other. Raising the first ball and then releasing it, its motion quantity and its energy are trasmitted to the last ball. This phenomenona doesn't happen if you place a disk of deforming material between the balls.

1320 Motion's second law apparatus
With this device it is possible to verify that two spheres, thrown at the same moment, one in horizontal and one in vertical direction, touch the ground at the same time. It is supplied with stand and two metal balls.

1321 Inertia apparatus
Releasing the elastic lever, the plate where the sphere stands is launched far away, while the sphere keeps its position because of the inertia.
Base Ø: 25 cm. Height: 25 cm

1319 Free falling bodies apparatus
It is composed of a digital timer with a division of 1/1000 of second which can guide an electromagnet in order to start the fall of a metal ball. A switch records the impact istant in order to measure the fall time of the ball. Once you know the fall's measure and average time, it is possible to deduce the gravity acceleration value *g*.

1342 Apparatus for verifying the action and reaction principle
As a powerful magnet falls through an alluminium tube, it undergoes an electromagnetic force which is equal to the magnet's weight but of opposite direction, a force produced by the tube itself. As the well-known principle states, the magnet reacts on the tube with a force wich is equal and opposite; therefore , during the uniformly motioned fall of the magnet, the spring scale measures an intensity force which is equal to the sum of the tube's weight and of the magnet's weight.

SUPPLIED EQUIPMENT
- 1 Metal rod
- 1 Table clamp
- 2 Clamps
- 1 Rod with hook
- 1 Spring scale
- 1 Alluminium tube 50 cm
- 1 Tube guide
- 1 Couple of neodymium magnets with stand
- 1 String
- 4 Weights 10 g

1394 Conservation of the angular momentum
A sphere is spinned around its PVC handle. Pulling a string, the rotary radius decreases and it is possible to observe the increment of the rotary velocity in order to preseve the angular moment.

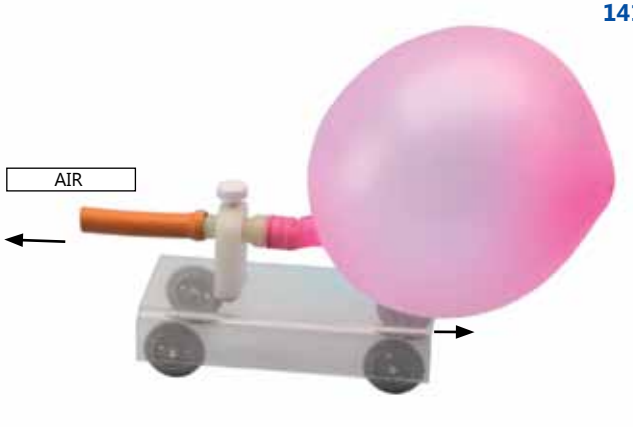
1396 Vertical accelerometer
It is composed of a mass suspended between two springs inside a plexiglass tube with *g* graduation.
Thus, it si possible to observe the variation of the acceleration, i.e. what we can experience in an elevator.

1397 Horizontal accelerometer
A mass hanging from the center of a protractor creates , through its vertical, an angle which depends on the acceleration along the protractor. It is possible to deduce the acceleration value by measuring the deviation angle.

1397

1412 **Action and reaction apparatus**
Flowing air into the baloon and then releasing it out the baloon, the cart moves in opposite direction. It is supplied with didactic guide.

1412



1412

1395 **Gyroscope**
Metal gyro wheel. By spinning it quikly with the help of a string , it is possible to verify the preservation of the angular moment. If you apply a force perendicular to the rotational axis, it is possible to observe the precession phenomenon, i.e. the giroscopic effect.

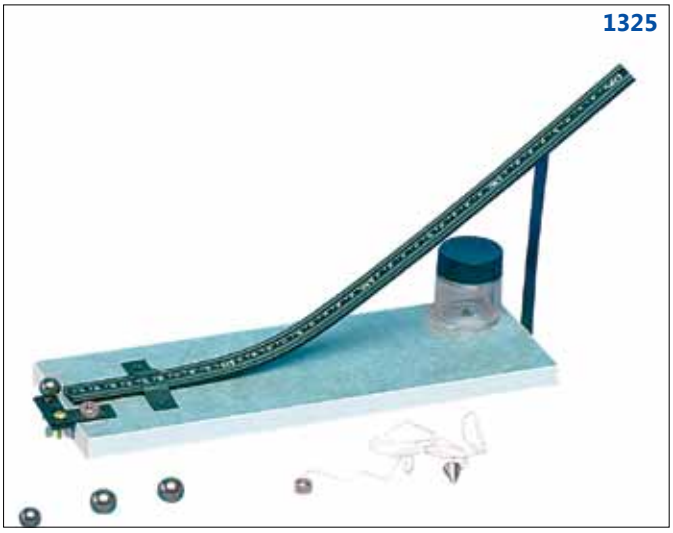
1395

1324 **Set of two carts**
In order to experiment on the principle of motion quantity preservation. On a smooth surface, a spring can expand, launching in opposite direction two friction carts in contact with each other. It is possible to deduce the initial speeds by checking the distances reched by the carts and to compare these speeds with the masses.

1324

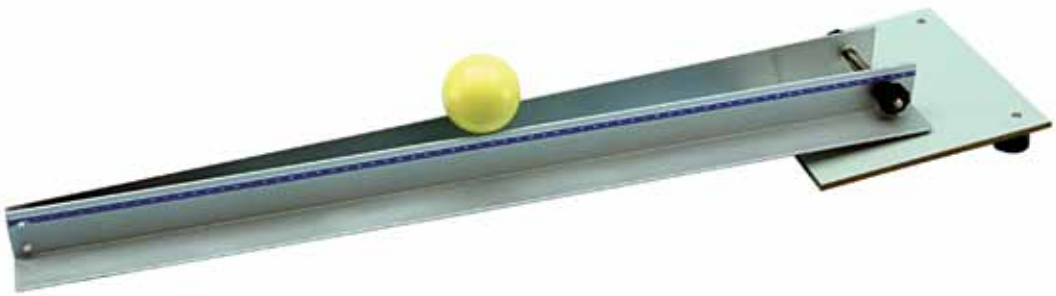
1325 **Two-dimension collision apparatus**
A steel ball rolls down a slide to finally fall freely, leaving a trace on the fall plane thanks to a carbon-paper sheet. It is possible to do calculations on energy preservation and on motion composition by changing the free fall height and by measuring the range.
With two balls, it is also possible to verify the preservation of the motion quantity and of the kinetic energy. The item is supplied with 3 steel balls.Dimensions: 400x100x20 mm.

1325



1401 **Does it go up or down?**
A sphere moves spontaneously along a horizontal variable-gauge rail, and it moves always in the same direction. Which direction? And why? If the rail is inclined, the sphere doesn't always roll in the same direction. Why? The explanation of these phenomena lies in the study of the position of the sphere's center of gravity; a good amount of physics with such a simple device.

1401



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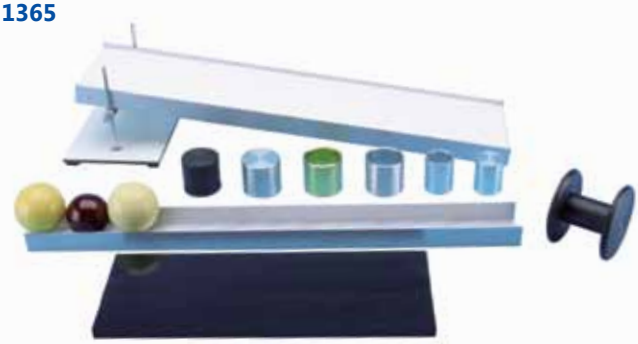


1419

SPEED RACES

Two apparatus are introduced here after; they enable a teacher to promote the comparison between intuition and a strict scientific reasoning into his students'minds. The pheomena investigated by these apparatuses can appear inconsequential; in reality they lead to reflections on the fundamental principles of mechanics.
All items are supplied with their experiment guide.

1364 **Downward speed**
Two balls with the same diameter roll down at the same time, from the same height difference, but following different trajectories. Departing from the same height, which will be the fist ball to reach the finish point?

1365 **Rolling marbles and cylinders and strange accelerations**
Two marbles (or two cylinders) with different diameter or different masses roll down the same inclined plane: which will be the first one to reach the bottom?
A marble rolls down an inclined plane, and another marble, with the same mass and diameter, rolls down a rail with the same inclination of the plane: which will be the first one to reach the bottom?

The answers to these and other questions can be found through the use of the equipment of this kit, which is composed of:

1 Wood plane, dimensions 65x15 cm
1 "U" shaped aluminium bar, dimensions 65x6x3 cm
1 Rubber covered plane, dimensions 40x15 cm
2 Marbles Ø65 mm
1 Marble Ø 58 mm
6 Cylinders of different materials and with different diameters
1 PVC spool
1 Adjustable height stand for inclined plane
1 Case
1 Experiment guide

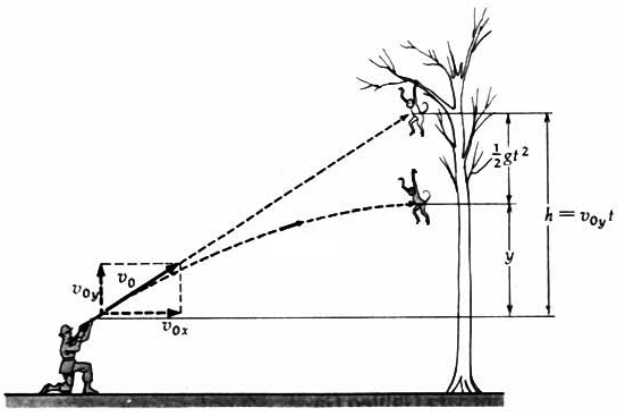
1419 **Marble launcher**
This simple marble launcher enables you to study in a quantitative way the parabolic motion of the projectiles. The body of the device is made of solid wood and the launch mechanism is made of aluminium
Five launch speeds.
Maximum range 7.5 mt.

1419

1420 **The monkey and the hunter: an historical quest**

A spring-powered gun shots ping-pong balls against a monkey model . The monkey is supported by an electromagnet, which is disactivated in the moment the projectile leaves the gun. Thus, it is possible to verify that, provided that the gun aims initially at the monkey, the projectile always hits the monkey regardless of how far away the monkey is.
Batterries not included. Didactic guide included.

1420



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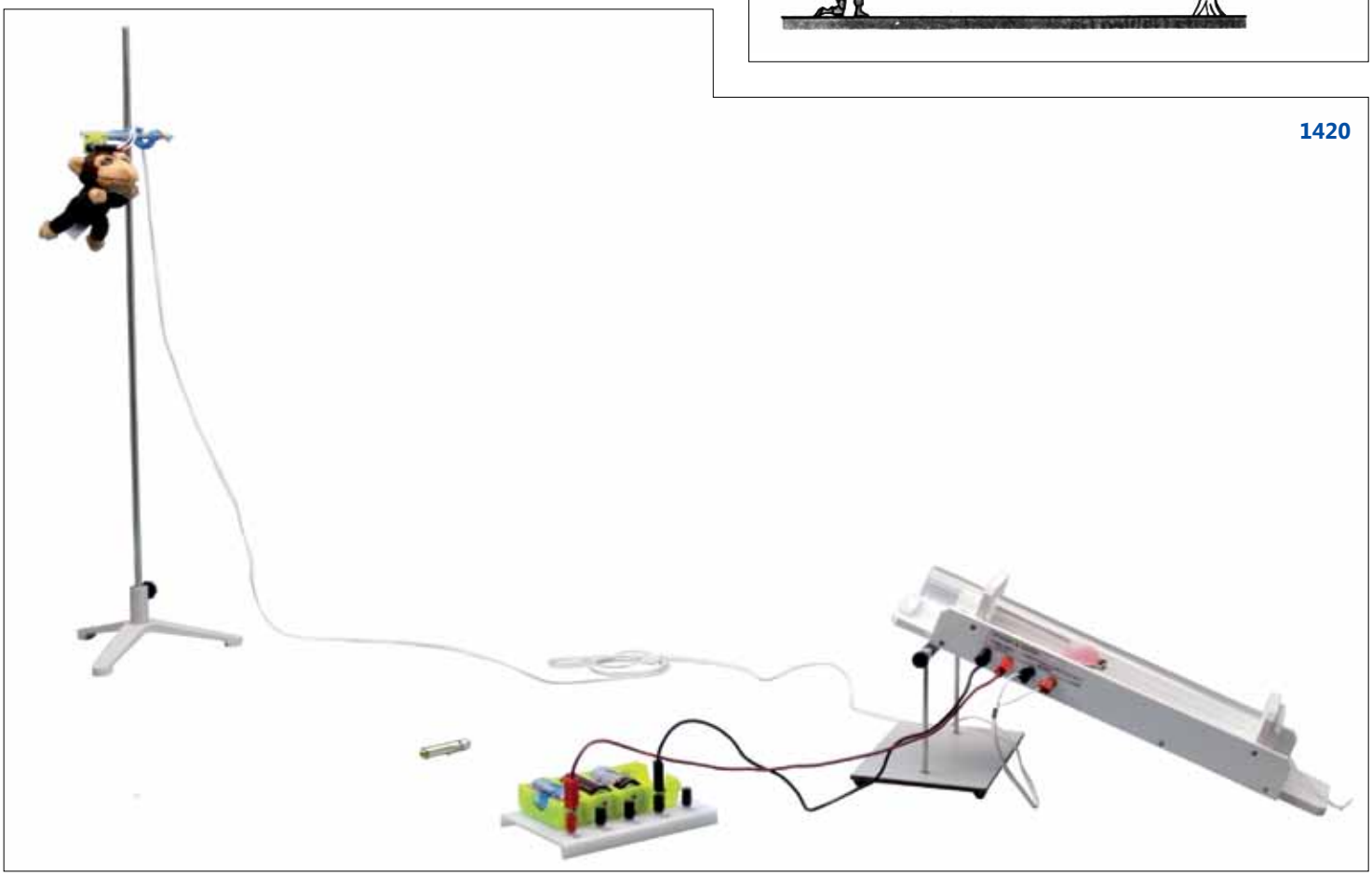

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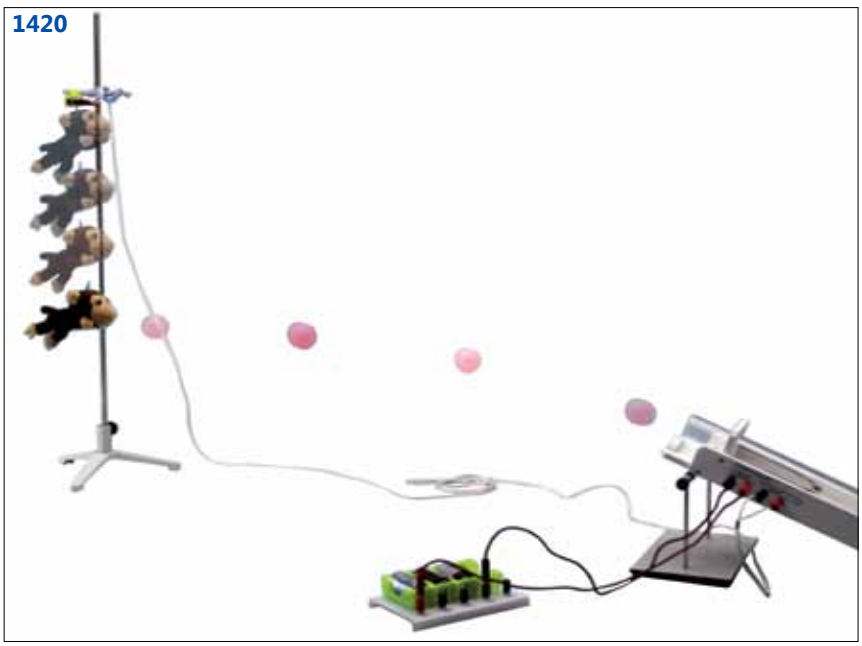
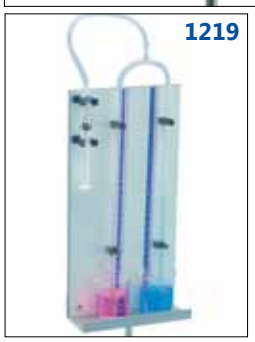




1105 Communicating vessels
For homogeneus liquids.
It is composed of 4 vessels.
Height of water columns 11 cm.

1062 Communicating vessels with capillaries
It is composed of 5 vessels; the last two vessels are capillaries.
Height of water columns 11 cm.

1106 Capillary vessels
It is composed of 4 vessels.
Height of water columns 11 cm.

1185 Pascal's principle apparatus with stand
Pushing the piston, the water creates concentric circles on the basement plane.
The item is made of metal and it is supplied with base and stands. Tube height: 30 cm.

1248 Pascal's principle apparatus without stand
The previuos item, but without stand.

1125 Cartesian devil
This small glass object is hollow and has a small hole in its inferior part. If it is immersed in water, it floats. If you press the elestic membrane on the top, the devil fills itself up with water and finally it sinks. It starts floating again the moment the pressure on the membrane ends.
It is supplied with glass jar and rubber membrane.

1020 Bucket and cylinder
Made of plastic material and brass, it is endowed with hooks.
Dimensions: 53x55 mm.

1124 Series of 5 samples
Three cylinders have the same volume and different density; three cylinders have the same density but different volume. To demonstrate that Archimedes' push depends only on the volume of the immersed body.

1170 Archimedes' principle apparatus
Composed of : stand, spring scale, double cylinder, vase, beaker, graduated cylinder, case.

1001 Apparatus for the study of viscosity
It enables you to do experiments on a sphere falling through a liquid, in order to determine the viscosity coefficient.

SUPPLIED EQUIPMENT

1 Base for rod	3 Steel balls
1 Metal rod75 cm	1 Plexiglass ball
1 Plexiglass tube 75 cm	3 Elastic rings
2 Double clamps	2 Rubber stoppers
2 Rods with clip	1 Magnet with handle
1 Funnel	1 Experiment Guide
1 Glycerine bottle	1 Case

1182 Pascal's apparatus with communicating vessels, modular model
It enables you to perform experiments on communicating vessels, on capillary vessels, on Stevin's principle and on Pascal's principle.

Components:

1 Base	1 Metal rod
1 Stand	3 Angular glass tubes with rubber stoppers
1 Rubber syringe	5 Differently-shaped glass tubes with rubber stoppers
1 Case	

1407 Submarine model
With this simple experiment it is possible to investigate on how a submarine changes its immersion level.

1219 Hare's apparatus
A small depression done with a syringe leads the two liquids to reach different levels if they have different density. If the first liquid is water, it is possible to find the other liquid's density in relationship to the water's. The item is supplied with stand, pincers, syringe and glasses.
Glass part height 35 cm.

1042 **Stevin's principle apparatus**
It is supplied with base, manometer, tube, manometric probe and jar.
Jar height :38 cm.

1132 **Specific weight kit**
To measure the specific weight of solids and liquids.

Possible experiments:
1. Determination of the specific weight of a solid
2. Bodies with the same weight but different volume.
3. Bodies with the same volume but different weight
4. Determination of a specific weight of a liquid

SUPPLIED EQUIPMENT
- 1 Tripod base
- 1 Metal rod 70 cm
- 1 Clamp
- 1 Rod with hook
- 1 Spring scale
- 1 Scale pan
- 1 100 ml Beaker
- 1 Dipper
- 1 Series of 5 samples with the same mass
- 1 Series of 3 samples with the same volume
- 1 String
- 1 Graduated cylinder
- 1 Experiment Guide
- 1 Case

1368 **Set of 6 cylinders with the same mass**
They are suitable for investigations on the density - volume relationship.
Diameter 15 mm; mass 100 g.
Materials: aluminium, copper, brass, zinc, iron and lead.

1369 **Set of 6 cylinder with the same volume**
In order to do experiments on the density-volume relationship.Diameter 10 mm, height 40 mm.
Materials: aluminium, copper, brass, zinc, iron and lead.

1370 **Set of 6 cubes with the same volume**
They are supplied with hook in order to measure the density of solid bodies.
Length of the sides: 32 mm.
Materials: aluminium, copper, brass, zinc, iron and lead.

1367 **Displacement vessel**
In order to measure the volume of solid bodies. Capacity: 600 ml.

1371 **Pycnometer**
In order to measure the density of liquid bodies. Capacity: 100 ml.

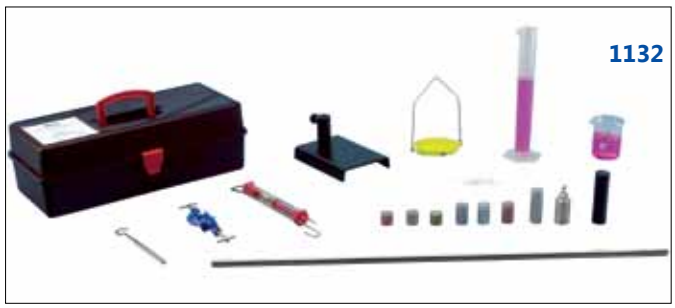
1372 **Density sphere**
Its weight allows the sphere to float if immersed in room-temperature water (<20°C) and to sink if immersed in hot water. Sphere's diameter: 75mm.

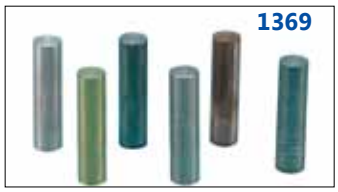
1366 **Capillarity tray**
Plexiglass triangular-shaped tray with 5° opening, suitable to prove the effect of capillarity. It shows the shape of the meniscus of those liquids which dampen and of those liquids which don't dampen.

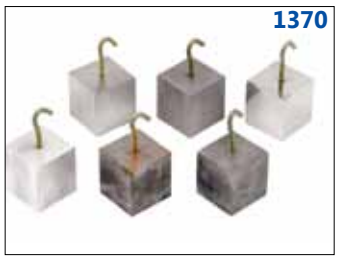
1381 **Pellat's apparatus**
With this item you can prove that the pressure of a liquid on the bottom of a container doesn't depend on the shape of the container, but it depends on the density and the depth of the liquid.

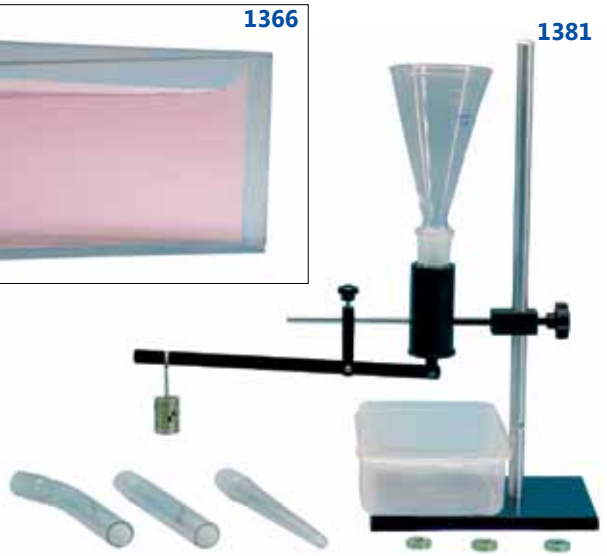
1316 **Heron's fountain**
It is completely made of glass.
Fill the water in the upper container and close it with the stopper. Then, pour water in the basin on the top untill the side tubes are full of it. The displaced air transmits pressure to the upper container, creating a fountain which ends when the lower container is full.

1426 **Torricelli's device**
After filling the cylinder with water up to a certain level, at which height should a hole be made to obtain the maximum flow?
By letting the water flow out through the taps, it can be verified that the maximum flow is obtained when the hole is located at half the level of the liquid in the cylinder.









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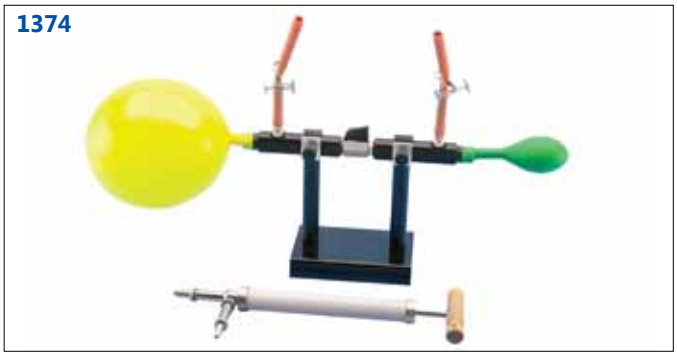

1415 One stage rotatory vacuum pump
Range: 13 liters/minutes.
Minimun pressure: 10Pa.
Engine power: 60W
Power supply 230V
It is supplied with oil and vacuum tube (1m).

1409 Two stage rotatory vacuum pump
Double-phase; vacuum: 99,7%. Engine power: 0,25 Hp-220/280V. Pumped volume: 2 m3/h. Recycled lubrification, tank, fan, silencer. It is supplied with oil; it is not supplied with tube. Power supply 230V.

1402 Vacuum bell with plate, cheap model
Plate diameter: 20.5 cm
Bell height: 19cm.
To be used with a pump.
It comes with a 1m vacuum hose.

0069 Oil refill for pumps
Packaging: 500ml.

1068 Plate for pneumatic bell Ø 250mm
It is made of perfect sealing grinding metal.

1069 Pneumatic bell
It is made of very thick cast glass.
Dimensions: ø external 235mm / internal 185mm; h = 315mm
The lower rim is frosted to have a perfect seal.
To use with silicone grease code 1068.

1373 Round flask for the measurement of the air density
Flask capacity:500 ml.
It must be measured with an electronic scale with a division of at least 0.01 gr

1076.1 High vacuum silicone grease
Tube pack: 50 g.

0090 Rubber tube for vacuum pumps
Dimensions: 7x17x1000 mm.

1374 Pressure's surprises
Flow different amounts of air in two baloons. When you open the communicating tap between the baloons, you would expect to see the air flowing from the most inflated baloons into the less inflated one.
But...

1374

1107 **Empty Newton's tube**
It is made of glass;It doesn't have air inside, but a feather and a wood ball.
Length: 1 mt

1070 **Newton's tube (to be emptied)**
It is made of plexiglass; it has stoppers and tap to link it to a vacuum pump, after having placed small item inside it. Length: 1 mt

1071 **Baroscope**
It shows the Archimedes'push.
In the air, the joke reaches the equilibrium, while in the vacuum the joke tilts on the baloon side, because the Archimedes'push stops working. It can be included in the pneumatic bell code 1069.

1043 **Torricelli's experiment apparatus**
It enables you to perform the classic Torricelli's experiment, thanks to the tube (length 85 cm, Ø 6 mm) with chemically carved millimetric division on the glass all along the interested part. It is supplied with base, basin, stands and funnel. Mercury is sold separately.

1242 **Magdeburg's hemispheres**
They are made of metal, with grinding rims, supplied with rubber-holder in order to be linked to a vacuum pump through a rubber tube. Diameter: 80 mm.

1087 **Magdeburg's hemispheres**
The item is made of metal, with grinding rims and plane in order to be placed on the plate for bell jars. Diameter: 80 mm.

1075 **Magdeburg's hemispheres**
It is made of metal , with grinding rims and plane in order to be placed on the plate for bell jars.
Diameter: 100 mm.

1072 **Pressure tear device**
It is made of grinding and rimmed PVC, with perfect seal.It is supplied with its paper.

1074 **Electric bell**
To use with pneumatic bell. It is powered by batteries

HS3572 **Fire syringe kit**
Perfectly sealed plexiglass cylinder with a piston inside and solid wood base. A quick descent of the piston produces an adiabatic air compression which increases the temperature to the point that it cause the combustion of a small cotton wad. It can be used to explain the functioning principle of the cloud chamber too.

1186 **Boyle-Mariotte's law apparatus**
With this apparatus it is possible to deduce, with a good approximation, the ratio between volume and pressure of the air at constant temperature. The graduated scale is supplied with decimal vernier scale. Metal base. Dimensions:170x240x800h mm.
Mercury is sold separately.

1414 **Boyle Mariotte's Law apparatus**
A graduated cylinder made of transparent material is linked, at its bottom, to a manometer. Acting on the piston through a screw with hand-wheel, it is possible to reduce the volume of the air inside the cylinder and, at the same time, to read its pressure value on the manometer. The item is supplied with digital thermometer.

1414

1107 - 1070

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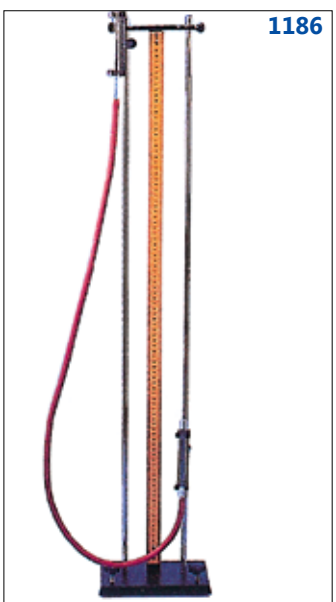
HS3572

1186



GASES AND VACUUM

1137

1047

1122

1050

1137 **Charles'Law apparatus**
With this apparatus it is possible to verify the law that rules the volume variations (at constant pressure) of a gas as its temperature varies. Therefore we can measure the dilatation coefficient (at constant pressure). Burner, tripod and fire-spreading net are sold separately .

1122 **Gay-Lussac's Law apparatus**
With this apparatus it is possible to verify the law that rules the pressure variation (at constant volume) of a gas, as its temperature varies. Burner, tripod and fire-spreading net are sold separately

1217 **Kit for the verification of the laws of gases**
It is composed of two apparatus (code 1137 and code 1122). Saving on the items which are common to both apparatus, the price is slightly lower than the sum of the two prices.

Free air manometers
1047 Height 20 cm, without tap.
1048 Height 30 cm, without tap.
1049 Height 40 cm, without tap.
1050 Height 20 cm, with tap.
1051 Height 30 cm, with tap.
1052 Height 40 cm, with tap.

1088 **Aneroid vacuum-meter**
Mercury: from 0 to 76 cm. To be inserted in series in the vacuum pump in order to measure the depression.

1089 **Bennert's vacuum-meter**
To insert in series in the pump, in order to measure the residual pressure up to 100 mm of mercury.

1088

1089

WAVES PROPAGATION

3011

3025

3006

3011 **Set of 3 elastic strings**
To visualize the propagation of longitudinal and trasversal impulses and their reflection and consequent creation of stationary waves.
Components:
1 elastic string Ø 5 mm; static length : 3 mt ; maximum extension length: 6 m
1 coil spring Ø 10 mm; static length: 50 cm; maximum extension length: 5 mt.
1 coil spring Ø 17 mm; static length: 50 cm; maximum extension length: 12 mt

3025 **Set of 2 coil springs**
It is usefull to perform experiments on longitudinal and transversal waves' propagation, on the creation of stationary waves, on reflection and on other wave-related phenomena.
First spring dimensions: Ø20x1500 mm.
Second spring dimensions: Ø75x150 mm.

3006 **Device for the study of the waves**
With this simple device students can perform experiments on wave propagation and related phenomena. It is composed of an elastic rope with wood sleepers which visualize the vibratory state.

3032 Ripple tank

This ripple tank presents several advantages: mounting semplicity, facility in execution experiences, reliability and repeteability of results and optimus visive resolution of waves fronts. The stroboscope lamp is realized through a 3 W LED at high brightness synchronized with the surface waves generator.
The control unit is supplied also with a digital display and it allows to set up or to prevent the synchronism of vibrator with the lamp and to rule the wave width and its frequence.
The vibrator is of electrodymanic type.
Little tray dimensions: 30 x 30cm.
Basic supplied material:
point source to generate circular front wave
double point source for the interference study
linear hand mixer for linear front waves
biconvex refractive corpse
biconcave refractive corpse
thin layer with parallel plane faces

3033 Accessories for ripple tank 3032

This kit of accessories, that are realized in plexiglass, allows to execute tests for the propagation study, diffraction and interference of surface waves.
Material supplied:
- Barrier with a slit for the waves diffraction.
- Barrier for the reflection on the plane surface.
- Barrier for the diffraction from a corner.

Refractive prism.
Interference from two slits.

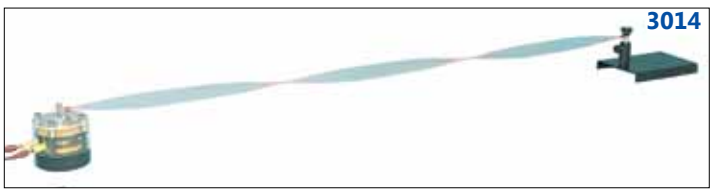
3014 Stationary waves apparatus

With this item you can perform the phenomenon of longitudinal and transversal stationary waves.

SUPPLIED EQUIPMENT

1 Vibrator	1 Double clamp
2 Elastic ropes	1 Base for rod
1 Coil spring	1 Table clamp with pulley
1 Rod 75 cm	1 Series of masses 10 gr
1 Rod 4,8 cm with hand wheel	1 Rod with hook

We suggest you to power the vibrator through the low frequence signals generator (code 5718, page 228 of the catalogue), which is not supplied with this apparatus.



3014.1 Kit for the study of stationary waves

As for code 3014, but without base, rods and clamp.

3100 Ripple tank

It is particularly suitable for students' exercises on wave-related phenomea. It is supplied with projector, electric power unit, vibrator, components for the study of reflection, of refraction, of interference and diffraction. You can observe through the hand stroboscope supplied.

Tank dimensions: 400x400x30 mm.

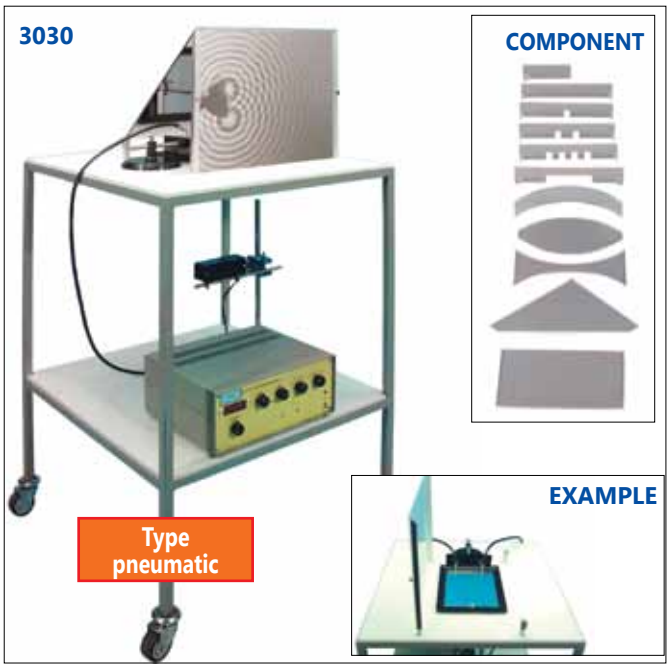
3030 Kit for experiments on surface waves in liquids (ripple tank)

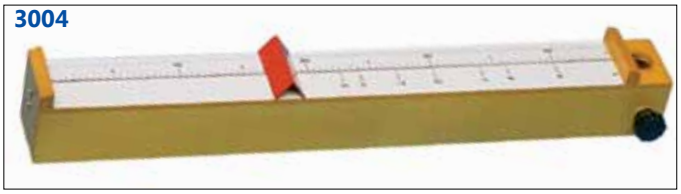
This kit is a fundamental instrument for the study of wave phenomena because it visualizes them. The teacher can project the surface waves on a translucent screen, on a wall or on the ceiling.
Water surface waves are created through air jets; they create regular, steady waves.

The kit is composed of:

1 Double wave generator, supplied with two indipendent air blower,
variable frequence guide from 5 to 35 Hz.
The phase angle between the generators can vary at intervals of 45°.
Moreover, it has a digital display screen with wave generation frequence indicator 1 Built-in Stroboscope, obtained by switching on a lamp with electronic control, in order to see images of still or decelerated waves.

Components:
1 Magnetic fixation beater for plane waves
2 Magnetic fixation beaters for circular waves
1 Concave-convex mirror
1 Converging lens and 1 diverging lens.
1 Plate with plane parallel faces.
1 Trapezoidal plate.
3 Obstacles for diffraction and interference phenomena
1 Wash bottle
Dim.: 60x60x90 cm.





3031 Digital phonometer
This easy-to-read acoustic level meter is suitable for educational experimental applications.
Measuring field: from 30 to 130 dB in 4 intervals.
Resolution: 0,1 dB. Accurancy: 1,5 dB.
Frequence range: from 31,5 to 8500 Hz.
AC/DC output for possible pairing with an external voltmeter.
The item is powered by batteries

1410 Vacuum bell with buzzer
To show that acoustic waves do not propagate in a vacuum.
For use with the pump code1415 or code 1409. Supply voltage 4-6Vdc

3004 One-string sonometer
On the harmonic box there are scales of notes componing the temperated scale, in correspondence to the vibrations' frequency.

3010 Acoustic resonance apparatus
By acting on the discharge tap of a tube full of water, it is possible to let the air column above the liquid enter in resonance with the tuning fork.

3002 Vibrant bell
The pendulums oscillate when the bell is hitted with the hammer, thus demonstrating that the sound is generated by the bell's vibrations. Height 40 cm..

3003 Tuning fork
Oscillation frequency: 440 Hz. It is supplied with resonance box and hammer.

3029 Couple of tuning forks
Oscillation frequency:440 Hz. With resonance box, hammer and spare masses for beats

3020 Set of 8 tuning forks
The items are made of chrome steel, with different length and section of 5,5x8,5 mm.
Hz frequencies : 261,6 - 293,6 - 329,6 - 349,6 - 392 - 440 - 493,9 - 523,2. Error ±0,2% at a temperature of 20°C.
With case and hammer. Suitable for demonstrating the tones-frequencies relationship, and for tuning music nstruments.

3016 Generator of acoustic-frequency sinusoidal oscillations
Frequency field:20 Hz - 20.000 Hz on 3 ranges. Built-in amplificator.
Undistorted output power: 2 W. It is supplied with two 60cm long cables.

3017 Loudspeaker 2,5 W
Supplied with two journal boxes for the linking to the oscillation generator code 3016.
Impendance: 8 ohm

3021 Loudspeaker 0,5 W
With stand (Ø 10 mm) in order to be housed on a base (code 0010).
With two journal boxes at the back to link it to the oscillation generatorcode 3016.
Impedance: 8 ohm..

3022 Piezoelectric Microphone
With stand (Ø 10 mm); predisposed to be linked to the amplifier.

3008 Kundt's tube
The incident acoustic wave interferes with the reflected one, creating the stationary waves. The lycopodium powder visualizes nodes and bellies, so to make wavelength measurement possible. Now, knowing the frequency, you can measure the acoustic waves' speed in the air.
The item is supplied with tube, stands and bases, piston and lycopodium powder spreader.
It must be used with a loudspeaker code 3021 and an oscillation generator code 3016 sold separately.

2110 **Gases' kinetic model**

With this model it is possible to simulate the thermal temperature-related movements of gases' particles. In the vertical cylinder there are very small balls agitated by a piston; the latter is linked to a vibrator with an electric engine (3-6 V) whose speed can be adjusted.
It is provided without power supply. It is recommended the purchase of the power supply -code 5011- is recommended.

HS7610 **Crookes' radiometer**

The radiometer's whirl starts to spin when exposed to a light source; the greater the intensity of the radiation, is the quicker it spins around.
This fact is due to the gas particles inside the radiometer: when they hit the black sides of the whirl's paddles, which are warmer than the white sides because of a greater light-absorbent power, the particles bounce quicker and, therefore , give an impulse which is greater than the one given to the white sides.
Thus the whirl's rotation is generated.

2096 **Air-bearings table for the study of molecular movements**

This device exploits the same principle of the air-bearing track. In comparison with the old models, this kind of table (35x35cm) features the following improvements:
- a greatest visibility; since the table's plane is transparent , it can be placed on an overhead projector
- the collision of the mobile bodies isn't mechanical, but magnetic; therefore the energy losses are almost void

Because of the above-mentioned reasons, this model of air-bearing table is a truthful "window on the microcosm";
It enables you to reproduce a great number of phenomena linked to the following physics processes:

1. Matter's molecular structure
2. Changes of state
3. Gases' kinetic theory
4. Statistics aspects
5. Molecular energy and temperature
6. Molecular diffusion
7. Distribution of density
8. Brownian motion
9. Thermal conductivity of solids
10. Electric conductivity of metals
11. Electric conductivity of semi-conductors
12. Rutherford's atomic model

50 EXPERIMENTS

2048 **Double Radiometer Crookes'**

Having the black sides reversed , the two reels rotate in opposite directions.

2112 **Device for the study of the Brownian motion**

The irregular motion of the tea particles, due to the collisions with the liquid's molecules, can be highlighted with this equipment.The trace of the Brownian motion can be seen on the screen thanks to laser diffusion
By increasing the liquid temperature (e.g. with an hair dryer or by keeping the cuvette in one hand for a few minutes), we can observe the increase of the thermal energy.

5671 HEAT AND TEMPERATURE

Basic level

23 experiments

CONTENTS

1. Let's tell apart heat and temperature
2. Alcohol burner
3. The combustion
4. The thermometer and its calibration
5. Thermal expansion of solids
6. Thermal expansion of liquids
7. Thermal expansion of gases
8. Heat and temperature
9. Heat propagation through conduction
10. Good conductors and bad conductors
11. Propagation of heat into liquids
12. The convention of heat
13. Irradiation
14. Fusion and consolidation
15. Evaporation
16. Boiling
17. Stam condensation
18. Fractional distillation

SUPPLIED EQUIPMENT

- 1Glass tube with stopper
- 1Bent glass tube with stopper
- 1Bottle of denatured alcohol
- 1Tripod burner support
- 6Rubber O-rings
- 1Medicine dropper
- 1Sheet of black paper
- 1 Alcohol burner
- 1 Cubic dilatoscope
- 2 Candles
- 1 Candle-holder
- 1 Spring clamps
- 1 Magnifying lens
- 1 Aluminium foil
- 1 Bag of sawdust
- 1 Iron bar
- 1 Flame-spreading net
- 1 Thermometer, –10°C to +110°C
- 1 250 ml Beaker
- 1 Flask
- 1 Glass stirring rod
- 1 Test tube
- 1 Watch glass
- 1 Instruction guide for experiments

5604 THERMAL EXPANSION AND CHANGE OF STATE

Intermediate level

16 experiments

CONTENTS

1. Heat and temperature
2. Alcohol burner
3. Combustion
4. The thermometer and its calibration
5. Linear thermal expansion
6. Volumetric thermal expansion
7. Thermal expansion of liquids
8. Thermal expansion of gases
9. Fusion and consolidation
10. Evaporation
11. Boiling
12. Consolidation
13. Fractioned distillation

SUPPLIED EQUIPMENT

- 1 Metal rod
- 1 Pincher with clamp
- 1 Linear glass tube with central stopper
- 1 Glass tube with stopper at one end.
- 1 Curved glass tube with stopper
- 1 Base for rods
- 1 Clamp
- 1 Denaturated alcohol
- 1 Rubber stopper with hole
- 1 Stand
- 1 Flange for cubic expansion apparatus
- 1 Sphere with chain for cubic expansion apparatus
- 4 Small round elastic bands
- 1 Hook with handle forcubic expansion apparatus
- 1 Dropper
- 1 Alcohol burner
- 1 Linear expansion apparatus
- 2 Candles
- 1 Candle holder
- 1 Dye bottle
- 1 Thermoscope
- 1 Fire-spreading net
- 1 Thermometer
- 1 250 ml Beaker
- 1 100 ml flask
- 1 20x200 mm test-tube
- 1 Watch glass
- 1 Experiment Guide
- 1 Case

5596 THERMAL PHYSICS

23 experiments

CONTENTS

1. Theory of the mistakes
2. Bunsen burner and the thermometer
3. Behaviour of solids when the temperature changes
4. Behaviour of liquids when the temperature changes
5. Behaviour of gases when the temperature changes
6. Calorimetry/specific heat
7. Fusion and consolidation
8. Vaporization
9. Consolidation and fractioned distillation
10. Endothermic and exothermic phenomena

SUPPLIED EQUIPMENT

- 2 Tripod bases
- 2 Metal rods 50 cm
- 1 Rod with hooked end
- 3 Double clamps
- 1 Rod with reduced end
- 1 Square-pivot
- 1 Rod with clip
- 1 Pincers with clamp
- 1 100 ml Beaker
- 1 400 ml Beaker
- 1 Flask100 ml
- 1 Filtering flask 100 ml
- 1 Graduated cylinder 250 ml
- 1 Rubber stopper
- 1 Steel sample
- 1 Aluminium sample
- 1 Linear ruler
- 1 Thermometer -10°+110°C
- 5 Small round elastic bands
- 2 Rubber tubes 50 cm
- 1 Tripod stand
- 1 Couple of tubes for expansion apparatus
- 1 Index for expansion apparatus
- 1 Flange for cubic expansion apparatus
- 1 Sphere for cubic expansion apparatus
- 2 Glass tubes with stopper
- 1 Fire-spreading net
- 1 Test-tube
- 2 Rubber stoppers with hole
- 1 Watch glass ø 60 mm
- 1 Dropper
- 1 Electric calorimeter with thermometer
- 1 Bunsen burner with rubber tube
- 1 Denaturated alcohol bottle
- 1 Expeiment Guide
- 1 Case

5596

Advanced level

5659 THERMAL PHYSICS

23 experiments

CONTENTS

1. Heat and temperature
2. Alcohol burner
3. The combustion
4. The thermometer and its calibration
5. Thermal expansion of solids
6. Thermal expansion of liquids
7. Thermal expansion of the airforms
8. The connection between heat and temperature
9. Specific heat and thermal capacity
10. Thermal equilibrium
11. The equivalent in water of a calorimeter
12. Measurement of the specific heat of a solid.
13. Heat propagation
14. Fusion and consolidation
15. Evaporation
16. Boiling
17. Steam condensation
18. Fractioned distillation

SUPPLIED EQUIPMENT

- 1 Double clamp
- 1 Metal rod
- 1 Handle with hook
- 1 Rod with clip
- 1 Metal pincer with clamp
- 1 400 ml Beaker
- 1 Glass tube with central stopper
- 1 Glass tube with stopper at the end.
- 1 Curved glass tube with stopper
- 1 100 ml Flask
- 1 Tripod base
- 1 Measuring cylinder 100 ml
- 1 Rubber tube
- 1 Tripod stand
- 1 Flange for cubic expansion apparatus
- 1 Sphere for cubic expansion apparatus
- 1 Test-tube 20x200 mm
- 1 Thread
- 4 Small round elastic bands
- 1 Rubber stoper with hole
- 1 Watch-glass 60 mm
- 1 Alcohol burner
- 1 Fire-spreading net
- 1 Device for heat-conduction
- 1 Calorimeter with thermometer
- 1 Candle with candle-holder
- 1 Aluminium foil sheet
- 1 Black paper sheet
- 1 Mohr clamp
- 1 Wood clamp
- 1 Thermoscope
- 1 Steel sample
- 1 Aluminium sample
- 1 Denaturated alcohol
- 1 Potassium permanganate bottle
- 1 Dropper
- 1 Experiment Guide
- 1 Case

5659

Demonstrations from the teacher's desk

TEMPERATURE AND HEAT

2046 Linear expansion apparatus
To prove the thermal expansion of a bar. It works with cotton wads soaked in denaturated alcohol and it is supplied with three rod made of iron, brass and aluminium.
Dimensions: 30x13 cm.

2070 Ball and ring apparatus, with stand
In order to prove the volumetric thermal expansion. It can be used with the alcohol (or gas) burner.
Height: 30 cm.

2140 Ball and ring apparatus
The previous item, but without stand.

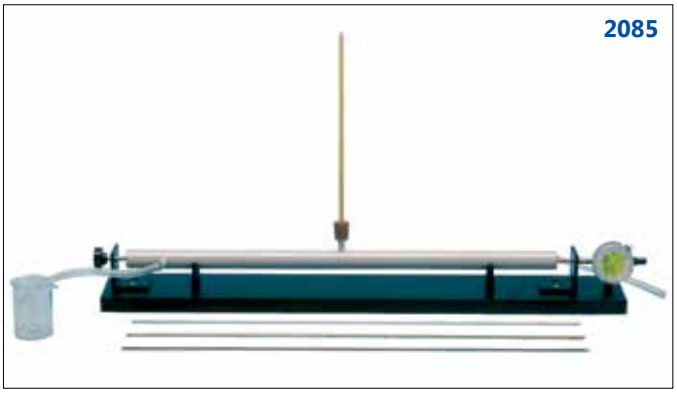
2062 Bi-metallic strip
Two foils fixed together, made of iron and copper, expand in different ways, causing the foil to bend.

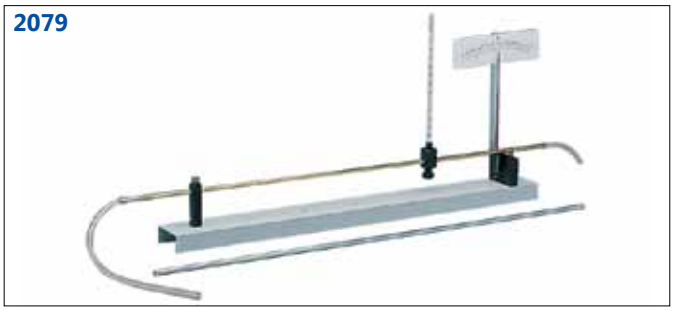
4T Thermoscope
It is suitable for experiments on the thermometer calibration. Length: 30 cm.

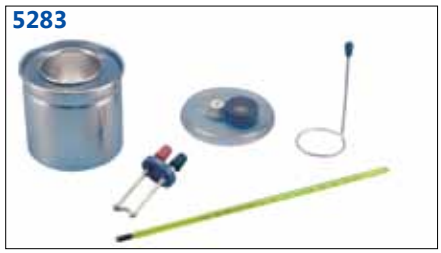
2139 Bi-metallic strip with electric circuit
The heat of the burning candle cause the foil to bend and therefore to close the electric circuit. When this happens, the buzzer rings and the led lights up.

2137 Expansion apparatus for liquids and gases
With this simple apparatus it is possible to determine the thermal expansion coefficient of liquids and of air.

2085 Precision linear expansion apparatus
This apparatus allow to measure with great precision the expansion coefficient of the 3 rods metals (included). It works with the steam produced by the steam generator code 2130.
The item is supplied with dial gauge, thermometer and beaker. Dimensions: 70x10 cm.







2130 Steam generator
To use with linear expansion apparatus. The steam is generated by a gas burner or a heating plate not included (for all the models of gas burners and heating plates, please see section 14 of this catalogue).

6149 Heating plate
To use with steam generator. Power 800W, power supply 230V/50Hz.

2132 Leslie's cube
One face of the cube is white, another one is black; one is polished and one is rough. Exposing different faces of the cube to the thermal radiation, the thermometer measures the different absorbent power of the surfaces.

2079 Linear expansion apparatus
It is particularly suitable for student group exercises; it allows a quite reliable measurement of the linear expansion coefficient. It is supplied with thermometer and beaker.
To obtain steam, we suggest to use the steam generator code 2130. Dimensions: 70x10 cm.

2131 Thermal conductivity apparatus
It is composed of 5 tubes, of different metals, jutting radially out from a central cylinder. If you heat the cylinder on a flame, the pieces of wax placed at the ends of the tubes melt down at different times.

2059 Ingenhousz's case
The item can highlights the different thermal conductivity in different materials. Bars must be covered in paraffin and the metal case must be filled in with hot water.
It is supplied with two candles.

2030 Specific heat kit
This kit enables you to do experiments on the ratio between the heat ΔQ given to a body and ΔT its temperature increase

SUPPLIED EQUIPMENT
- 1 Aluminium cylinder 800 g
- 1 Copper cylinder 800g
- 1 Brass cylinder 800g
- 1 Iron cylinder 800g
- 1 Electric heater 12V
- 1 Base
- 2 Insulated handles
- 1 Thermometer
- 1 Case

2099 Water calorimeter 350 ml
This item is suitable for measuring the specific heat of solid and liquid samples.
It is supplied with thermometer and stirrer. Plastic material packing. High thermal insulation.
Capacity: 350 ml. External dimensions: Ø 130 mm, height 130 mm.

2056 Water calorimeter 1000 ml
It is supplied with thermometer and stirrer and has double aluminium walls insulation from heat.
Dimensions: Ø 150 mm. Height: 150 mm.

5283 Electric calorimeter 200 ml
The item is supplied with two stoppers; one stopper has an electric resistor.
Maximum voltage: 6V. Supplied with thermometer and stirrer. Aluminium packaging.
Capacity 200 ml.

8201 Electric calorimeter 350 ml
It is suitable for the verification of Joule's law; capacity 350 ml. It is supplied with two resistors you can use alone or in series. Maximum working voltage: 6V.
Supplied with stirrer and thermometer.

2036 Set of 4 samples with equal volume
For the measurement of specific heat through water calorimeter up to 350 ml.
They are made of iron, brass, aluminium and PVC.

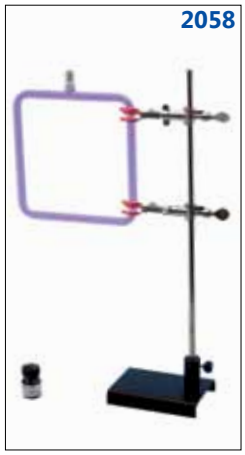
2087 Set of 4 samples with equal mass
For the measurement of specific heat through 1000 ml water calorimeter.
They are made of iron, brass, aluminium and PVC.

5711 **Joule's effect apparatus**
It is a kind of electrical calorimeter with double transparent walls
It is possible to change the resistor without taking off the water.
Working voltage:6V D.C.
Resistors: 5 Ω ; 10 Ω
Capacity: 800ml.

5711

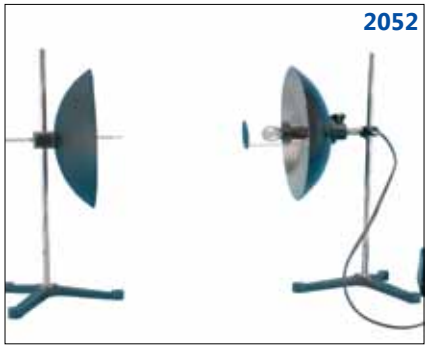
2058 **Convection tube**
Insert water first and then potassium permanganate crystals into the tube through the upper opening.
If you heat up the lower part, the salt depositated at the bottom moves upward, colouring the whole water. The burner is sold separately.

2058.1 **Convection tube**
The previous model but with glass part only.



2055 **Apparatus for the measurement of the mechanical equivalent of heat (Callendar's machine)**
This solid apparatus is composed of a 7 cm long brass calorimetric cylinder with Ø 5 cm and supported by ball bearings. A copper ribbon is rolled around the cylinder and retained by a spring; a 5 kg weight hungs from it. Because of the friction between the ribbon and the cylinder during the rotation the water inside the cylinder warms up. If you measure the work done and the heat produced, it is possible to determine the mechanical equivalent of heat.
The apparatus is supplied with clamps and 1/10 degree digital thermometer .

2134 **Convection sphere**
A glass sphere contains a special mix of liquids. It is enough to hold it in your hand to see amazing convective motions. If you tilt it in a certain way it is possible to observe laminar or turbulent motions.



2052 **Radiation apparatus**
It is composed of two parabolic reflectors.
In the first one there is a 30W light bulb (6V-5A) with its transformer; in the second one there is a thermometer.
Both light bulb and thermometer are placed in the focus point of the reflectors.

2031 **Apparatus for the study of the absorbent and emitting powers of a body**
It is supplied with 3 aluminium bodies. One body is black-black, another is black-white and the last one is white-white. If you expose them to the energetic flux of the light bulb, you can verify how the absorbent power and the emitting power depend on the features of the surface.

2136 **Ruchardt's apparatus**
With this apparatus it is possible to study an adiabatic transformation of a gas. It is composed of a 2000 cm3 conical flask linked hermetically to a glass cylinder with a sealed external piston above it; it can be burdened adding calibrated metal cylinders. Deaden oscillations are generated displacing the piston from its equilibrium position.
The T period of these oscillations is linked to the adiabatic constant of the γ gases according to the following ratio:

$$T = 2\pi \sqrt{\frac{mV}{\gamma p s^2}}$$

2136

5672

Basic level

5672 LIGHT AND ITS PHENOMENA

19 experiments

CONTENTS

1. Dioptric projector
2. Why we do see things
3. Do rays of light really exist?
4. The law of illumination
5. Shadow game
6. The eclipse
7. Light reflection
8. Spherical mirrors reflection
9. When light passes from air into a transparent body
10. When light passes from a transparent body into the air
11. Total reflection
12. Lenses
13. Decomposition of white light
14. Images in flat mirrors
15. Images through lenses
16. The eye and its defects
17. The composed microscope
18. The slide projector

SUPPLIED EQUIPMENT

- 1 One-slit diaphragm
- 1 Four-slit diaphragm
- 1 Arrow diaphragm
- 1 Frosted glass
- 1 Slide
- 1 Half-circle made of methacrylate
- 1 Set of 3 lenses
- 1 Square-pinhole diaphragm
- 1 Plane mirror
- 1 Small plane mirror
- 1 Double mirror arc
- 1 Optical prism
- 1 Spring clamps
- 1 Goniometer
- 1 Battery-holder
- 1 Projector
- 1 Lens-holder with diaphragm-holder
- 1 Lens-holder
- 1 Filter-holder
- 1 White screen
- 1 Transparent screen
- 1 Wooden sphere with stem
- 1 Wooden sphere with string
- 1 Beaker, 250 ml
- 1 Experiment guide

5605

Intermediate level

5605 FUNDAMENTAL PHEMOMENA OF LIGHT

20 experiments

CONTENTS

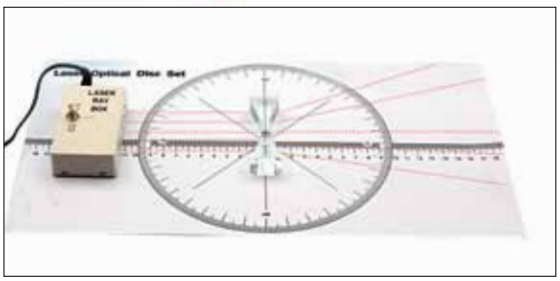
1. Dioptric projector
2. Rectilinear propagation of light
3. Eclypses
4. Lighting law
5. Diffusion of light
6. Reflection of light
7. Spherical mirrors
8. Refraction of light
9. Total reflection
10. Decomposition of white light
11. Lenses
12. Images in flat mirrors
13. Images in converging lenses
14. Conjugate points
15. The eye and its defects
16. Correction of the eye's defects
17. Composed microscope
18. Slide projector

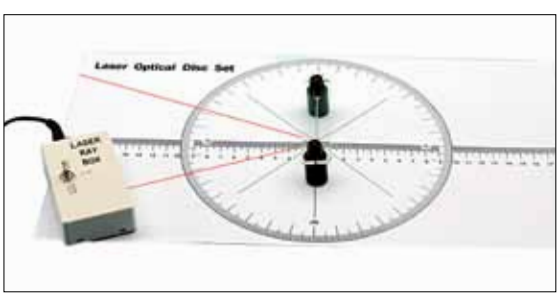
SUPPLIED EQUIPMENT

- 1 100ml Beaker
- 1 Transparent screen
- 1 Wood sphere with thread
- 1 Linear ruler
- 1 Projector
- 1 Diaphragm holder with diaphragms
- 1 Projector power unit
- 1 Base for projector
- 1 Filter-holder
- 1 Red filter
- 1 Green filter
- 1 Blue filter
- 1 Half-transparent screen
- 1 Slide
- 1 Plexiglass half-cylinder
- 1 +10cm lens with lens-holder
- 1 +20cm lens with lens-holder
- 1 -10cm lens with lens-holder
- 3 Bases for lens-holder
- 1 White screen
- 1 Wood sphere with thread
- 1 Screen with squared hole
- 1 Flat mirror
- 1 Small flat mirror
- 1 Double Mirror Arch
- 1 Equilateral Prism
- 1 Spring pinchers
- 1 Paper protractor
- 1 Experiment Guide
- 1 Case

5607

Intermediate level





5607 GEOMETRICAL OPTICS KIT WITH LASER RAY BOX

With this kit you can easily and quickly perform all basic geometrical optics experiments. The laser ray box is endowed with a switch which allows three different beam configurations (1-3-5) The high-quality optic bodies allow you to observe the trajectory of reflected and refracted beams. Because of its good quality/price ratio and because of the number and quality of possible experiments, this kit represents the best solution for geometrical optics experimentation for primary and secondary school.

CONTENTS

1. Reflection in a flat mirror
2. Reflection in a concave mirror.
3. Reflection in a convex mirror.
4. Refraction Law.
5. Measure of the refraction index of a transparent solid.
6. Measure of the refraction index of a transparent liquid.
7. The prism and the total reflection
8. Amici's prism
9. Converging lenses
10. Diverging lenses
11. System of two lenses
12. Galilei's thelescope
13. Kepler's thelescope

SUPPLIED EQUIPMENT

- 1 Laser ray box with power unit
- 1 Changeable geometry mirror
- 1 Optic foil
- 1 Diverging lens
- 1 Converging lens
- 1 Half-circular optic body
- 1 Half-circular tray
- 1 Amici's prism
- 1 Isosceles right-angle prism
- 1 Chart for geometrical optics studies
- 1 Experiment Guide
- 1 Case

5609 GEOMETRICAL OPTICS KIT WITH LASER

VERSION WITH MAGNETIC BOARD

5594 OPTICS

21 experiments

CONTENTS
1. Theory of the mistakes
2. Dioptric projector
3. Propagation and diffusion of light
4. Reflection of the light
5. Refraction of the light
6. Refraction of the light through lenses
7. Refraction of the light through a prism/dispersion
8. Measurement of the focal length of a mirror and of a lens with spherometer
9. Images given by mirrors
10. Images given by lenses
11. Optical instruments

SUPPLIED EQUIPMENT

- 1 250 ml Beaker
- 2 Tripod bases
- 1 Metal rod 50 cm
- 2 Metal rods 75 cm
- 1 Rod with hook
- 3 Double clamps
- 1 Round base
- 1 Square-pivot
- 1 Thread
- 1 Wood stand
- 1 Protractor with pivot
- 1 Wood sphere
- 1 Linear ruler
- 1 Diaphragm with 1 slit
- 1 Diaphragm with 4 slits
- 1 Diaphragm with arrow-slit
- 1 White optical screen
- 1 Dioptric projector
- 1 Flat mirror
- 1 Couple of bases for optical bench
- 1 Couple of stand for optical bench
- 1 Set of 3 lenses
- 1 Optic prism
- 1 Filter holder
- 1 Red filter
- 1 Green filter
- 1 Blue filter
- 1 Transparency
- 1 Plexiglass half-circle
- 1 Spherometer
- 1 Double spheric mirror
- 1 Transformer
- 3 Lens-holders
- 1 Experiment Guide
- 1 Case

5594

Advanced level

5678 GEOMETRICAL OPTICS

27 experiments

CONTENTS
1. Dioptric projector
2. Rectilinear propagation of light
3. The eclipse
4. Moon phases
5. Law of illuminiation
6. Diffusion of light
7. Reflection of light
8. Reflection of light in spherical mirrors
9. Refraction of light
10. Total reflection
11. Decomposition of white light
12. Lenses
13. Images in flat mirrors
14. Images in spherical mirrors
15. Conjugated points in spherical mirrors
16. Images in converging lenses
17. Conjugated points in converging lenses
18. The eye and its defects
19. Correction of the eye defects
20. The composed microscope
21. Slide light source

5678

Demonstrations from the teacher's desk

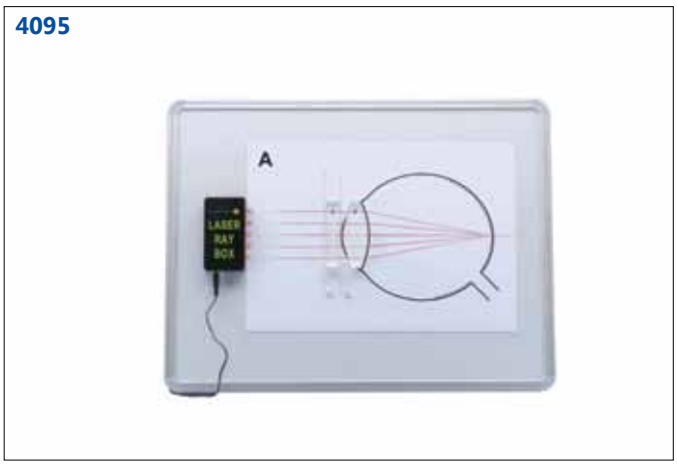
SUPLIED EQUIPMENT

- 1 250 ml Beaker
- 1 Base for projector
- 3 Small bases
- 1 Protractor with pivot
- 1 Linear ruler
- 1 Diaphragm holder with 3 diaphragms
- 1 Dioptric projector
- 1 Flat mirror with base
- 1 Filter-holder
- 1 Red filter
- 1 Green filter
- 1 Blue filter
- 1 Half-transparent slide
- 1 Transparent slide
- 1 Transparency
- 1 Flat mirror
- 1 Plexiglas half-cylinder
- 1 Lens +10 with lens-holder
- 1 Lens +20 with lens-holder
- 1 Lens -10 with lens-holder
- 1 Concave mirror
- 1 Convex mirror
- 1 White optic screen
- 1 Diaphragm with squared hole
- 1 Wood sphere 10 mm with rod
- 1 Wood sphere 30 mm with rod
- 1 Double mirror arch
- 1 Equilateral prism
- 1 Isosceles prism
- 1 Transformer
- 1 Experiment Guide
- 1 Case

4095

Demonstrations from the teacher's desk

4095



4095

4095 GEOMETRICAL OPTICS WITH PENTALASER

VERSION WITH MAGNETIC BOARD AND RED PENTALASER

10 experiments

4215 GEOMETRICAL OPTICS WITH PENTALASER

VERSION WITH MAGNETIC BOARD AND GREEN PENTALASER

10 experiments

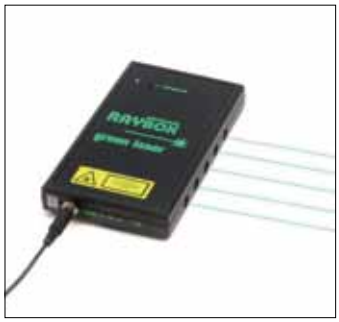
These two collections allow very effective demonstrations of geometrical optics. They include a metallic board with back holder, a series of 6 magnetic plastic-coated tables with assembly schemes, a set of 3 mirrors, a series of 10 Plexiglas optical bodies and a red pentalaser, all equipped with a power supply. Since the components are provided with a magnetic base, experiments can be made both horizontally (by students) and vertically (by teachers), taking advantage of the magnetic board.

CONTENTS

1. The reflection and its laws
2. The reflection in the concave spherical mirrors
3. The reflection in the convex spherical mirrors
4. The refraction and its laws
5. The total reflection
6. The refraction in the prisms
7. The Refraction in convex lenses
8. The Refraction in concave lenses
9. The eye and its defects
10. The optical instruments

MATERIAL SUPPLIED

- 1 5-ray laser generator with power supply
- 1 Magnetic board
- 1 plane mirror
- 1 concave mirror
- 1 Convex Mirror
- 1 plate with parallel sides
- 1 plane-cylindrical lens, diameter 150 mm
- 1 plane-cylindrical lens, diameter 90 mm
- 1 Prism
- 4 biconvex lenses
- 1 biconcave lens
- 1 Plane-concave lens
- 6 Magnetic Boards: A-B-C-D-E-F
- 1 User Guide



5680

Demonstrations from the teacher's desk

5680 WAVE OPTICS

12 experiments

CONTENTS

1. Optic waves
2. Dioptric projector
3. Diode laser
4. Optic waves speed
5. Polychromatic and monochromatic sources
6. Emission spectrum
7. Light diffraction
8. Diffraction through a hole
9. Diffraction through a slit
10. Measurement of λ
11. Interference of light
12. Interference according to Young
13. Diffraction grating
14. Linear polarization
15. Polarized light
16. Polarization by reflection
17. Brewster's anlge

SUPPLIED EQUIPMENT

- 2 Arms out of axis
- 1 Linear ruler
- 1 Dioptric projector
- 1 Cylindical lens
- 1 Trasformer
- 2 Filter-holders
- 3 Coloured filters
- 1 Optical bench
- 1 Dark mirror
- 1 Stand for lenses
- 1 Set of 3 lenses
- 1 White screen
- 1 Kit for spectrum analysis
- 1 Laser with half-conductor
- 1 Adjustable slit
- 1 Diaphragm with hole 2 mm
- 1 Diaphragm with hole 0.4 mm
- 1 Diaphragm with hole 0.2 mm
- 1 Diaphragm with slit
- 1 Diaphragm with double slit
- 1 Diffraction grating 500 lines/mm
- 2 Polarizing filters
- 1 Optic prism
- 1 Horizontal protractor
- 1 Experiment Guide
- 1 Case

4001 **Dioptric light source 6V-5A**
With double chamber and cooling wings. Stand Ø 10 mm. The item is supplied with diaphragms: 1 slit, 4 slits and arrow-shaped slit. It must be powered by transformer code 5052.
Tripod base not included (code 0018).

4006 **Spare light bulb for light sources**
6V - 5A. Concentrated filament. Suitable for projector code 4001.

5052 **Transformer for light sources**
Input: 230V - output: 6V - 5A. The item can power projector code 4001.

4155 **LED light source**
This projector has a white LED as a light source.
It comes with a power supply.

4078 **Concave mirror**
To use for experiments on images in concave mirror and on light reflection. Stand included. Diameter: 110 mm.

4081 **Convex mirror**
To use for experiments on images in convex mirror. Stand included. Diameter: 110 mm.

4077 **Flat mirror**
It shows the simmetry of images. Dimensions: 70x120 mm.

4032 **Optic prism**
The prism is made of a glass with a high refraction index, in order to show the phenomenon of white light's decomposition. Stand included. Dimensions: 10x10x20 cm.

4000 **Rectilinear propagation of light**
This simple apparatus enables you to verify:
- the rectilinear propagation of light;
- the inversion of the image in the darkroom.

4357 **Solar Focometer**
This device allows to measure easily and accurately the focal length of converging and diverging lenses, taking advantage of solar radiations.

4030 **Mirror-like dihedral**
The item proves that the number n of images is determined by the formula:

$$n = \frac{360}{\alpha} - 1$$

where α is the angle created by the mirrors.

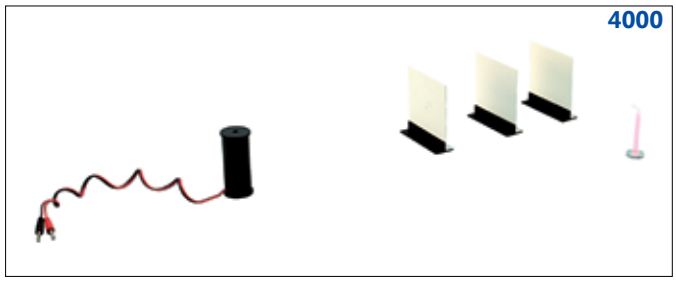
4127 **Extendible periscope**
The item stretches out 15 cm in order to allow the vision beyond an obstacle.
It is made of half-transparent plastic that allows students to understand the functioning principle of this optical instrument.

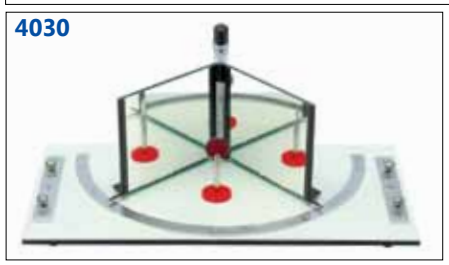
4059 **Lens-holder**
The item supports lenses and circular mirrors.

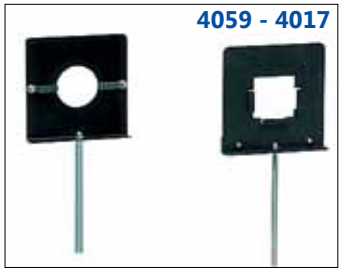
4017 **Filter-holder**
The item supports diaphragms , filters, slides, etc.

4201 **Set of 6 glass lenses**
The item shows the properties of different types of lenses: bi-convex, plane-convex, meniscus-converging, bi-concave, plane-diverging and meniscus-diverging.
Lenses diameter:50 mm.

4133 **Set of 11 optical bodies**
The set comprehends:
2 Bi-convex lenses,
1 Bi-concave lens,
1 Flat mirror,
1 Spheric mirror,
1 Parabolic mirror,
1 Equilateral prism 60°,
1 Rectangular prism 90°-60°-30°,
1 Isosceles prism 45°-45°-90°,
1 Rectangular body,
1 Half-circular body.







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4125

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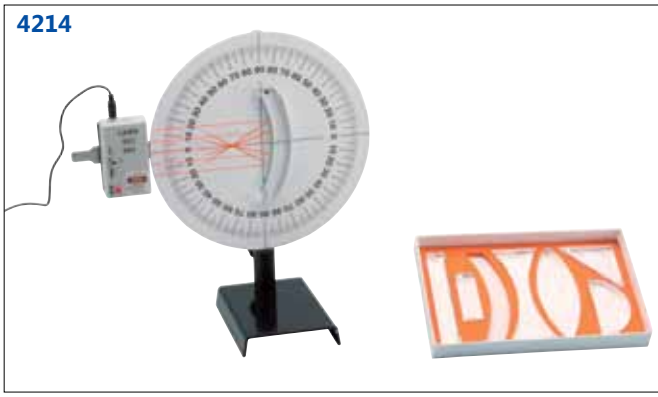


4147 Magic mirror
This item shows the tridimensional virtual image of an object placed inside it.

4061 Concave and convex mirror
Focus+/-10 cm. Diameter 5 cm; to be mounted on lens-holder code 4059.

4060 Set of 3 plexiglass lenses
Focus +6, +10, -10 cm. Diameter 5 cm; to be mounted on lens-holder code 4059.

7035 Operating eye model with light source
With this model it is possible to do experiments on the physical functioning of the eye.
It is made of syntetic materials and lies on a wood base. The eye lens is made of flexible material derivating from silicone oil: it is possible to curve it and to change its focal length with the pressure of the water inside a syringe. Since the distance cornea-retina adjustable, it is possible to show the main defects of sight and the ways to correct them through the use of specifc lenses. The item is supplied with corrective lenses, object of vision and projector with its transformer. Base dimensions: 32x10 cm.

7035.1 Operating eye model without light source
The previous item, without projector.

4125 Digital luxmeter
The item can measure the lighting with an accurancy of ±5%.
Display screen LCD 3 ½. Power supply: battery 12V.
Misure field: from 0 to 50000 lux in four range.
Wavelength field: from 400 to 700 nm.

4214 Hartl's disk with laser ray box
Contents:
- The Laser ray box
- Reflection in spherical mirrors
- Absolute refractive index
- Refraction through an optic prism
- Prisms and the total refraction
- Diverging lenses
- Reflection's Law
- Refraction's Law
- Refraction through a plate
- Total reflection
- Converging lenses

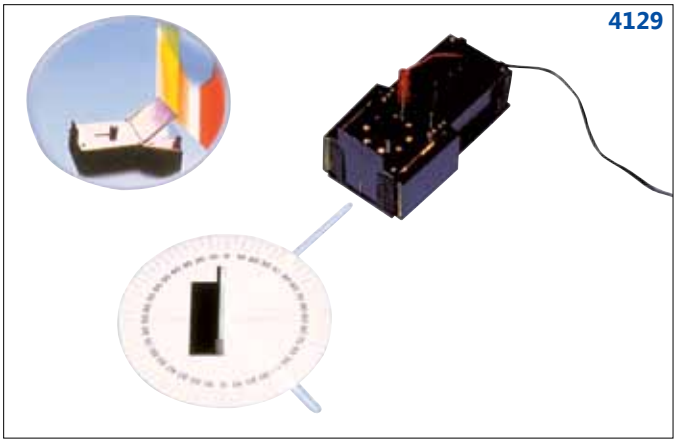
SUPPLIED ITEMS
1 Laser ray box with power-unit
1 Set of magnetic optic bodies
1 Optic disk with stand
1 Basement
1 Case
1 Didactic Guide

4129 Optical ray projector and color mixer
This fundamental item for the study of light phenomena, is composed of a rectangular case (175x90x55 mm) containing a lamp with vertical filament (12V - 36W) placed in the upper part.
A system of cylindrical converging lenses enables you to obtain converging , diverging or parallel light beams.
On the front of the case there are three windows with clasps, whose internal part are mirror-like and endowed with guides for inserting diaphragms and other colour filters.
All equipment is contained in a wood case. Power-unit included.

CONTENTS:
- Law of reflection
- Reflection in the mirrors
- Laws of refraction
- Total reflection
- Refraction in a plate
- Refraction in converging lenses
- Refraction in diverging lenses
- Refraction in prisms
- Dispersion of white light
- Filters
- Primary and secondary colours
- Colours' composition

4129

4129



4095 **Geometrical optics kit with red laser ray box**
This kit allows very effective dimonstrations of geometrical optics. It comprehends a metal blackboard with back support, a series of 6 magnetic film-packed tables with assembly scheme, a series of 3 mirrors, a series of 10 plexiglass optic bodies and the red laser ray box with its power-unit. Since all components have a magnetic base, it is possible to perform experiments in both horizontal (students)and vertical (teacher)way, exploiting the magnetic blackboard.

4215 **Geometrical optics kit with green laser ray box**

4328 **Red Laser Ray Box**
The optic source is composed of 5 parallel laser. Through a smart solution, the light beams from the laser, which have circular section , are turned into linear section rays, i.e. into mono-frequency light blades; these light blades allow the performance of all main geometrical optics experiments.
A switch enable you to select different combinations, from 1 to 5 rays,in order to choose the most suitable configuration for the experiment.

4150 **Green laser ray box**
The item has the same mechanical features of the red laser ray box, but here the laser lights are green.
It is supplied with power-unit.

5607 GEOMETRICAL OPTICS KIT WITH LASER RAY BOX

With this kit all main geometrical optics experiments can be easily and quickly performed. The laser ray box is endowed with a switch with three different light-beam configuration (1-3-5). The high-quality optic bodies enables you to see a neat trajectory of both reflected and refracted lightbeam. Because of a very good quality/price ratio and of the great number and quality of possible experiments, this kit represents the ideal solution for geometrical optics research of secondary and high school classes.

CONTENTS

1. Reflection in a flat mirror
2. Reflection in a concave mirror
3. Reflection in a convex mirror
4. The law of refraction
5. The measurement of the refractive index of a transparent solid.
6. The measurement of the refractive index of a transparent liquid
7. The prism and the total reflection
8. Amici's prism
9. Converging lenses
10. Diverging lenses
11. Two lenses system
12. Galilei's telescope
13. Kepler's telescope

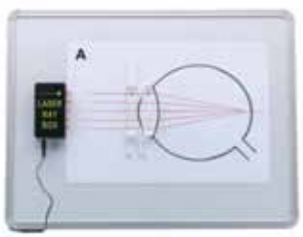
SUPPLIED ITEMS
1 Laser ray box with power-unit
1 Variable geometry mirror
1 Optic plate
1 Diverging lens
1 Converging lens
1 Half-circular optic body
1 Half-circular basin
1 Amici's prism
1 Right isosceles prism
1 Geometrical optics' chart
1 Didactic guide
1 Case

5609 GEOMETRICAL OPTICS KIT WITH LASER

VERSION WITH MAGNETIC BOARD

4095

4095



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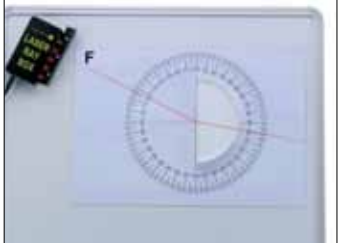

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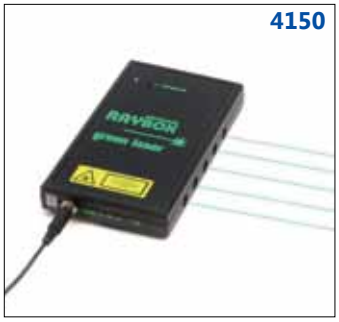

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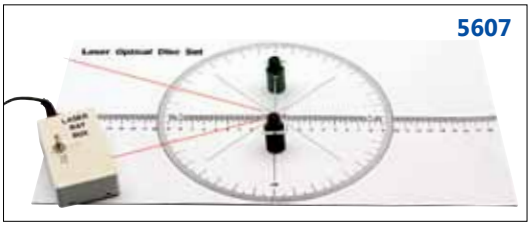

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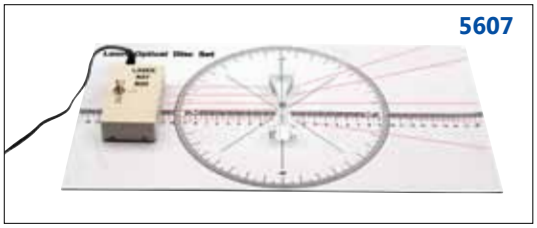

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4321 GEOMETRICAL OPTICS KIT

This item enables you to perform, on an horizontal stand, all phenomena regarding the geometrical aspect of light propagation. The components have been designed to simplify and to speed up the performance.

CONTENTS
- Light diffusion and the concept of radius
- Reflection in a flat mirror
- The optic lever
- Reflection in a spheric mirror
- Concave mirrors' aberration
- Laws of refraction
- The optic plate
- Refraction in a prism
- Measurement of the glass'refractive index through the method of the minimal deviation
- Measurement of the refractive index of liquids
- Total reflection
- Prism and total reflection
- Refraction of lenses
- System of lenses

SUPPLIED ITEMS
- 1 Laser ray box with power-unit
- 1 Basement
- 1 Protractor
- 1 White screen with circular base
- 1 Plexiglass hollow prism
- 1 Little square
- 1 Stand for optic bodies
- 1 Beaker 250ml
- 1 Flat mirror
- 1 Double spheric mirror
- 1 Half-cylinder
- 1 Plate with flat and parallel faces.
- 1 Equilateral prism's section
- 1 Isosceles prism's section
- 1 +6 cm converging lens' section
- 1 +10 cm converging lens' section
- 1 -10 cm diverging lens' section
- 1 Equilateral optic prism
- 1 Experiment Guide
- 1 Case

4329 Optical fibres kit

This educational model allows the observation of a wave guide's behaviour and the measurement of the numeric opening of an optical fibre as the refractive index of the mantle varies (air, water, alcohol).

SUPPLIED ITEMS
- 1 Base with protractor and screen
- 1 Laser diode with turnable stand
- 1 Plexiglass basin
- 1 Plexiglass panelist
- 1 Plexiglass curved silhouette
- 1 Experiment Guide

Optical prism

4016 Plexiglass equilateral prism.
30x30 mm.

4111 Crown glass prism.
Faces dimensions: 32x32 mm.
Angle 90°, n_D = 1,55.

4112 Flint glass prism.
Faces Dimensions: 32x32 mm.
Angle 60°, n_D = 1,67.

4144 Hollow equilateral prism
The item allows the performance of experiments on refractometry of liquids.
Sides dimensions and height: 40 mm.

WAVE OPTICS

4200 Elettric Newton's disk
The item is linked to an electric engine which is powered by voltage of 4-6 Vcc.
It is supplied with 5 disks to show the additive color synthesis.

4048 Hand Newton's disk
If the cranck handle is spined, the disk looks like white because of the light recombination.
Disk diameter: 17 cm.

4510 Benham's disk
This simple and original machine shows the effects of different reply times and image persistence times of retina's photoreceptors. If you light up the disk and make it turn, is it possible to see rings whose colour changes according to the rotatory speed and from person to person.
The item is supplied with stand, battery holder and cables, but without battery.

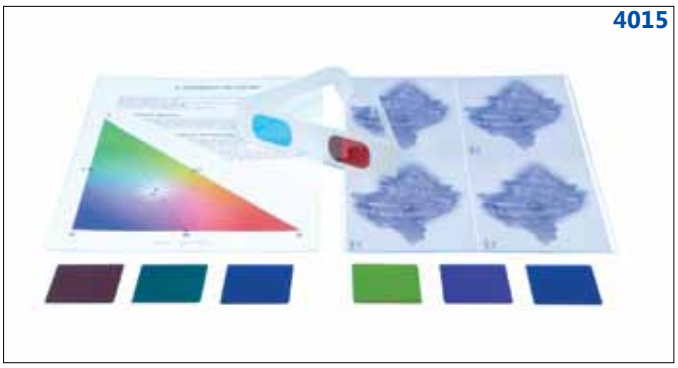
4135 Transparent coloured spades

Six different colours. Superimposing the spades and exposing them to a light source, it is possible to learn the concept of primary and secondary colours. Didactic guide included.

4015 Colours and vision Kit

Item composed of:

- 1 set of 3 primary colour filters;
- 1 chart with colour triangle;
- 1 pair of stereoscopic spectacles.
- 1 set of 3 secondary colour filters;
- 1 chart with 4 stereoscopic figures



4352 Additive colour synthesis apparatus

With this apparatus it is possible to perform the additive colour synthesis of the primary colours : red, green and blue. The apparatus is composed of 3 led projector, whose intensity can be changed with continuity. In this way it is possible to obtain the white colour and all the other colours of the colour triangle

CONTENTS

- Binary colour synthesis; example: red + green = yellow
- The trichromatic coordinates
- Colour reproduction
- Complementary colours
- Colour triangle

SUPPLIED EQUIPMENT

3	led projector: red, green, blue	1	White screen
1	Stand	1	Colour triangle chart
1	Power-unit	1	Case
1	Tripod base		

4353 Subtractive colour synthesis apparatus

The subtractive colour synthesis is the base for colour printing and exploits the method of the chromatic filters in series. This kit enables you to experiment so that, subtracting different chromatic componets from the white light, you can obtain primary colours or their additive synthesis on a white screen. In the printing method, varnishes and inks play the role of the filters.

According to the additive colour synthesis:

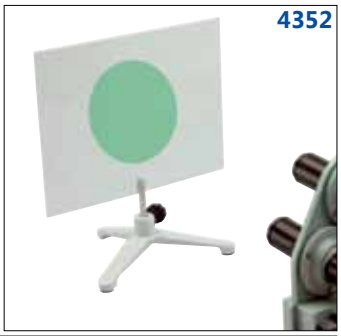
Red + Green = Yellow	R + G = Y
Red + Blue= Magenta	R + B = M
Green + Blue= Cyan	G + B = C
Red + Green + Blue = White	R + G+ B =W

Consequently, if you place before a white light source:

- A yellow filter, you subtract the blue color:	W - B = G
- A magenta filter, you subtract the green color	W - G = M
- A cyan filter, you subtract the red colour	W - R = C
- A yellow filter + a magenta filter + a cyan filter, you subtract blue, green and red colours.	W - B - G- R = N.

SUPPLIED ITEMS

1	White light projector	1	Serie of 3 secondary colour filters
1	Projector's power-unit	5	Bases
3	Filter holders	1	Case
1	White screen		

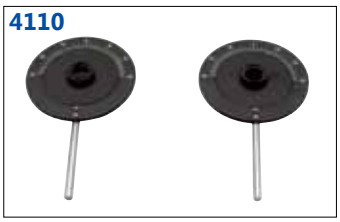


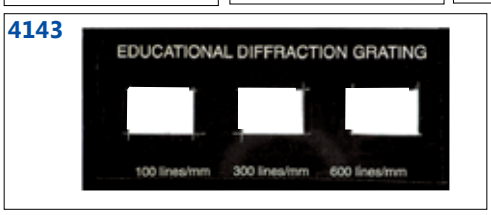
4126 Simple Spectroscope

The item can test the emission and the absorption of spectral radiations.
Model for direct vision

EMX155 Pocket spectroscope

Semi-professional model with Amici's prism and adjustable slit.
It is supplied with cuvette-holder in order to examine absorption spectrums.
An adjustable mirror allows the projection of a referencial spectrum in the eyepiece's field.





4116 **Disks for Newton's rings**
Couple of glass disks; one has plane, parallel faces; the other has a slightly spherical curve. They are superimposed so to produce Newton interference rings, which are monochromatic if you use laser light and become coloured if you use white light. Disk diameter: 55 mm.

4115 **Fresnel's double prism**
Double prism with very small refractive angle, obtained from a whole block of glass. Insert it in a thin light beam and it refracts the beam's two halves, superimposing them to generate interference fringes.

4117 **Polarimetric tube**
The item is made of plexiglass, it is closed at its ends and it has an upper opening where you can pour the liquid under examination. It is possible to show the rotatory power of the solutions' polarizing plane in function of their concentration by using two polarizing filters.

4110 **Couple of polarizing filters**
Screen dimensions: 100 x100 mm; stem diameter: 6 mm. They are supplied with graduated scale.

4207 **Red diode laser device with stand**
Continuous emission device with power-unit. Visible up to 35 m; power: < 1 mW; wavelength : 635 nm. It is supplied with a removable lens which is able to turn the circular section of the ray into a linear one. Jointed stand diameter: 10 mm. Base not included.

4354 **Red diode laser device with magnetic base and lens**
This continuous emission laser device is supplied with lens to obtain a linear ray of light. Moreover base and battery-holder are supplied with magnets in order to be applied to a magnetic blackboard.
Wavelength : approx. 635 mm. Power: 1mW.

4151 **Green diode laser device with stand**
It has a continuous emission; power-unit included. Power: 3mW; wavelength : 532 mm. It is supplied with a lens to obtain a linear trace. Adjustable stand diameter: 10mm.
Base not included.

4335 **Set of 4 interferencial filters**
With a bandwidth of only 10 nm, the measurement precision of the Planck constant increase considerably with the device - code 5409.
The passing wavelengths are:
Red: 636nm; Orange: 589nm, green: 532nm, Blue: 436nm.

4104 **Diaphragm with 1 slit**
On frame 50x50 mm, to be mounted on filter-holder code 4017. Slit's width: 0,1mm.

4105 **Diaphragm with 2 slits**
On frame 50x50 mm, to be mounted on filter-holder code 4017. Slit's width: 0,1 mm.
Pass 0,1 mm.

Diffraction gratings

On frame50x50 mm, to be mounted on filter-holder 4017.
4106 80 lines/mm
4212 500 lines/mm
4213 1000 lines/mm

4143 **Set of 3 diffraction gratings**

4028 **Kirchoff-Bunsen's spectroscope**
The item is mounted on a circular, metal platform, and it is composed of:1 collector with adjustable slit, 1 collector with eyepiece and cross grating, 1 scale-holder collimator with graduated scale.
The collimator's slit is supplied with a small prism which allows you to compare the spectrum of two different sources. While the collimator, endowed with 28 mm achromatic objective, is fixed to the platform, the collector, which is endowed with the same objective, can spin on a alidade mantaining the central directional axis. The scale-holder, adjustable collimator projects the image of the graduated scale in the collector eyepiece through the reflection on one of the prism faces. The latter is an equilateral prism made of highly dispersive material and it is mounted on a central rotating disk. It is supplied with work charts.

4209 **Spectrometer**
This instrument has very good optic and mechanical features which allow the exact measurement of the optical rays' deviation angles; therefore it can determine the refractive index of solids and liquids and the wavelength of monochromatic sources.
Base: made of fire-varnished cast-iron Ø 17,5 cm and divided in 360° with a precision of 1°.
It has two diametrically opposite vernier scale which enables a valuation of 1/10°.
Telescope: it has achromatic objectives with an 178 mm focal length and an eyepiece 15x. Focusing allows a fine regulation. Collimator: endowed with achromatic objective with 178mm focal length and with a steady adjustable slit up to 6 mm. Plane of the prism: it can be adjusted both vertically and horizontally and it is suplied with clamps for the fixing of the diffraction grarting.
Diameter: 80 mm. Equipment: 1 Crown glass equilateral prism 32x32 mm; 1 diffraction grating 500 lines/mm; 1magnifying.

Dimensions: 48x33x33h cm. Weight: 12 Kg.

NEW: Optic fibre spectrophotometer. This tool is able to display the emission (or absorption) spectrum of optical radiation sources and to detect the light intensity according to the wavelength. Ideal for the study of spectral and incandescent sources. With this kit you can obtain the Planck curves of a black body source at different temperatures.

OPERATING PRINCIPLE:

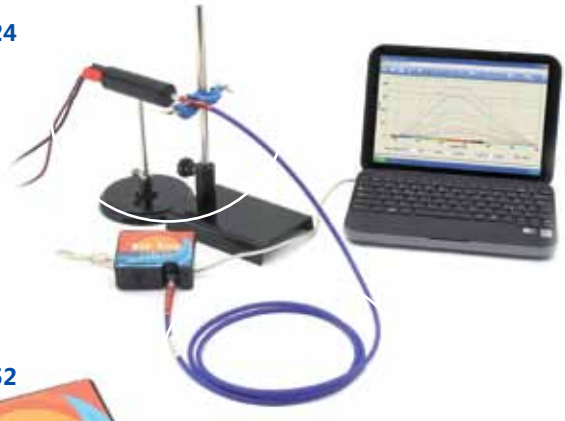
The light signal is brought in through a slit with a diameter of 50 microns and then returned and dispersed, through a system of multiple reflective mirrors, on a CCD matrix grid that contains hundreds of small sensors aligned so that each matrix sensor controls a wavelength. The number of photons hitting each sensor is converted into a voltage signal, which in turn is converted into an intensity value on the Y-axis.

APPLICATIONS IN PHYSICS:

- Analysis of the solar spectrum
- Analysis of optical filters and interferential film
- Reflection of light from coloured surfaces
- Flames analysis
- Analysis of the black body spectrum and the Planck curve
- Fluorescence and Stokes' law
- Analysis of spectral sources (e.g. hydrogen spectrum and Balmer series)
- Comparison between LED and laser emission

HOW TO USE IT: in the **AMADEUS** model an optical fibre connector located on the bottom is used for absorbance measurement, and one placed sideways for fluorescence measurements. In the RED TIDE model these measurements are carried out directly by exposure to the light source.
For more detailed technical information see page 158 on the catalogue.

5724



4152

4152A 4152B

4152 Spectrophotometer RED TIDE

This model is particularly suited when high accuracy is required.
It is powered directly via a USB connection to the PC. For absorbance and transmittance analysis, the cuvette slot is placed directly on the instrument.

4152A Cuvette holder
4152B Optical fibre cable

4153 Spectrophotometer AMADEUS

Model particularly suitable for teaching purposes in Physics. Equipped with separate power supply unit and cuvette holder with two fibre optic connectors. Compared to the RED TIDE, this spectrometer has a lower resolution (approximately 50%) but this feature makes the spectrometric curves "smoother" and therefore allows a more effective approach to teaching. Apart from this, the AMADEUS technical specifications are the same of the RED TIDE model. To perform the spectral analysis of the light source, just get the opening of the optical fibre close to the source.
Complete with fibre optic and cuvette holder.

4153

5724 Accessory Kit for Planck curve

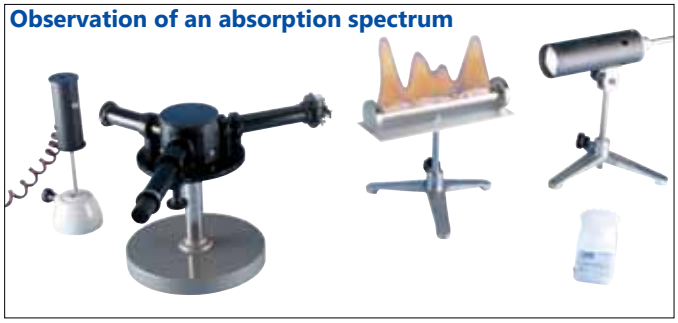
With this kit you can use the RED TIDE or AMADEUS spectrophotometer to derive the Planck curves at different temperatures. The black body source is represented by an incandescent lamp located inside a cylinder with reflecting walls. A DC power supply (not included in the kit) supplies the source with progressive voltage increases.

The spectrophotometer optic fibre placed at the radiation exit detects the spectrum for each temperature value. In the picture the spectra obtained for voltage increases from 2 to 2.2 - 2.4 - 2.6 - 2.8 - 3.0 - 3.2 V are shown.
Notice how the peak moves towards shorter wavelengths as the light intensity rises (Wien's displacement law).

4326

4325

Observation of an absorption spectrum



4326 Light source for spectroscope

When the item is placed in front of a tube with graduated scale, it illuminates the scale , thus allowing the operator to read the wavelength of the spectrum rows.
The base is sold separately (code 0010).

4325 Emission and absorption spectrum rows kit

The item is composed of a burner where you need to place cotton wads drenched in a saturated solution made of alcohol and sodium chloride(included). If you observe the flame with a spectroscope, you recognize the sodium's emission row at 589nm; but if you switch on a projector behind the flame, you see a continous spectrum with sodium absorption row.

4035 Spectrum lamps holder with power unit

The item is composed of a lamp-holder with lamp-shade, whose height is adjustable in order to allow a perfect allignement with the collimator of the spectroscope.

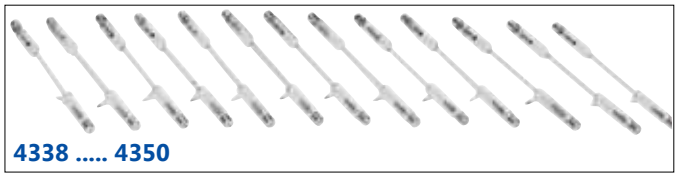
4035

Spectrum lamps

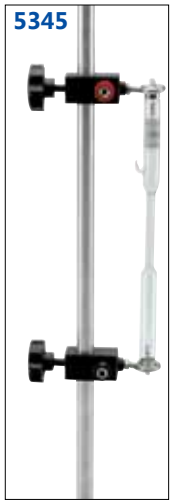
To use with container code 4035; they are the most convenient spectroscopy light source:

- **4051** Cadmium spectrum lamp.
- **4053** Helium spectrum lamp.
- **4054** Mercury spectrum lamp.
- **4056** Sodium spectrum lamp.
- **4057** Neon spectrum lamp.
- **4058** Zinc spectrum lamp.

SPECTRUM LAMPS FOR 4035


4338 4350


4337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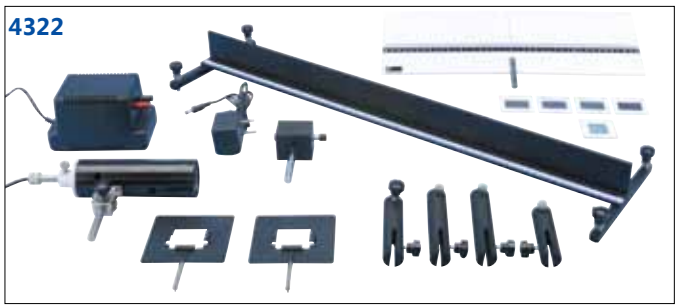
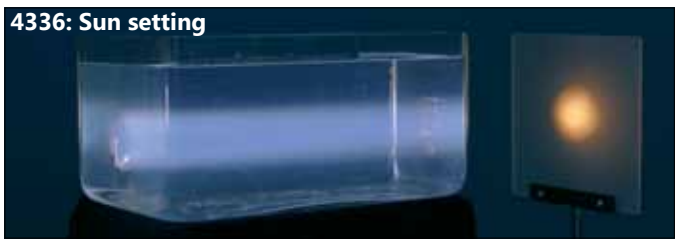

4322


4322 - Measurement of the extension of the visible spectrum


4327 Diffractionfrom a grating


4327


4327 Projection of an hologram


4336: Sun setting


4336

4337 **Spectrum tubes holder with power unit**
Power-unit able to provide electric high voltage, in order to download all spectrum tubes.
Power supply: 220V.

Spectrum tubes for #4337

4338	Oxygen	**4339**	Carbon dioxide
4340	Air	**4341**	Helium
4342	Water Vapour	**4343**	Nitrogen
4344	Neon	**4345**	Argon
4346	Hydrogen	**4347**	Bromine
4348	Mercury	**4349**	Iodine
4350	Krypton		

4123 **Spectrum tubes kit, with power unit**
This kit is composed of the power-unit code 4337 and of 13 spectrum tubes from code 4338 to code 4350.

5345 **Stand for spectrum tubes**
This item is composed of : a base; a vertical, metal stand; a couple of insulated clamps with rod and ring stand. Clamps are suitable for 4mm plugs. Spectrum tubes not included

4120 **Kit for spectral analysis**
This set has been designed to allow students to practice the emission spectroscopic analysis.
It consists of:

1 Portable spectroscope	10 Needles
1 bottle of sodium chloride	1 bottle of potassium chloride
1 Bottle of strontium chloride	1 Bottle of copper chloride
1 bottle of barium chloride	1 bottle of sodium nitrate
1 Bottle of potassium nitrate	1 bottle of strontium nitrate
1 Bottle of copper nitrate	1 Bottle of barium nitrate.

4322 **White light wavelenght measuring apparatus**
This apparatus determines the white light wavelength through the diffraction grating formula.
It is possible to measure the wavelength of both laser radiation and visible radiation.
Contents:
- Measurement of the laser wavelength
- Spectrum of visible light
- Measurement of radiations of the visible light

SUPPLIED ITEMS

1	Optical bench	2	Filter holders
4	Riders	1	Graduated white screen
1	Optic projector	1	Diffraction grating
1	Projector power-unit	3	Coloured filters
1	Diode laser device with power-unit	1	Experiment Guide
1	Slit for projector	1	Case

4327 **Wave optics kit**
A coherent light source (diode laser divice) is exploited to show the priciples of the wave optics: polarization; interference; diffraction and holografy. Components are endowed with a magnetic base, in order to be placed safely on a magnetic blackboard (included).

CONTENTS

- Light's interference	- Interference on a thin plate
- Michelson's interferometer	- Light diffraction
- Circular hole diffraction	- Squared hole diffraction
- Diffraction grating	- Holography
- Light polarization	- Light absorption

4336 **Light diffusion kit**
If you turn into acid a solution containing a sulphur salt, within 10 minutes the sulphur crystals increase progressively. When their dimension become comparable to the light's wav length, light diffusion takes place. According to Rayleigh's explanation,the blue component is deflected much more effectively than the red one, which goes on undisturbed. Thus it is possible to simulate the phenomenon which cause the blue color of the sky and the red-wish color of the Sun and the Moon when they are on the horizon. With the polarizing filter it is also possible to study the polarization of the diffused light.
The optic projector must be bought separately.

SUPPLIED EQUIPMENT

1 Basin	1 Glass stirrer
1 Dropper	1 Half-transparent screen
1 Polarizing filter	

NOT SUPPLIED EQUIPMENT
Whole milk

4202 SMALL OPTICAL BENCH

30 experiments

CONTENTS

1. Dioptric projector
2. Rectilinear propagation of light
3. Eclipses
4. Moon phases
5. Lighting law
6. Diffusion of light
7. Reflection of light
8. Reflection of light into spherical mirrors
9. Refraction of light
10. Refractive index and the colours of light
11. Total reflection
12. Refraction of light through a prism
13. Dispersion of the white light
14. Lenses
15. Images in flat mirrors
16. Images in spherical mirrors
17. Conjugate points of spherical mirrors
18. Images in converging lenses
19. Conjugate points of converging lenses
20. The eye and its defects
21. Correction of the eye defects
22. The compound microscope
23. The slide projector

4202

SUPPLIED EQUIPMENT

- 1 Linear ruler
- 1 Equilateral prism
- 1 Red filter
- 1 Green filter
- 1 Purple filter
- 1 Half-transparent glass
- 1 Slide
- 1 Plexiglass half-cylinder
- 1 Diaphragm with square hole
- 1 Flat mirror
- 1 Small flat mirror
- 1 Isosceles prism
- 1 Optical bench
- 4 Riders
- 1 Dioptric projector
- 1 Diaphragm with slits
- 1 Transformer 12V, 2A
- 1 Converging lens +10
- 1 Converging lens +20
- 1 Diverging lens –10
- 1 Concave mirror +10
- 1 Convex mirror -10
- 1 White screen
- 1 Stand for screen
- 1 Earth-Moon system
- 1 Filter holder
- 1 Protractor
- 1 Transparent slide
- 1 100 ml beaker
- 1 Experiment Guide
- 1 Case

4203 BASIC OPTICAL BENCH

9 experiments

CONTENTS

1. Dioptric projector
2. Rectilinear propagation of light
3. Reflection of light into spherical mirrors
4. Lenses
5. Images in spherical mirrors
6. Images in converging lenses
7. Conjugate points of converging lenses
8. The eye and its defects
9. Correction of the eye defects

4203

SUPPLIED EQUIPMENT

- 1 Optical bench 2 mt
- 4 Riders
- 1 PVC optic projector
- 1 Set of 6 glass lenses
- 1 White screen
- 2 Lens holders
- 2 Alluminium rods
- 1 Concave mirror +10
- 1 Convex mirror -10
- 1 Small case

4080 WAVE AND GEOMETRICAL OPTICS BENCH

With this optical bench, the teacher can perform a great number of quantitative and qualitative experiments on both geometrical and ondulating aspect of optic waves.
This bench is a necessary educational instrument in order to make a lesson a real moment of union between theory and experimental reality, and this because of the quickness of its assembly and the easyness in performing the experiments.

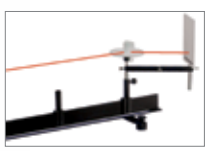
CONTENTS

1. Rectilinear propagation of light and its boundaries
2. Shadow and semidarkness
3. Sun and Moon eclipses
4. Moon phases
5. Irradiation's law
6. Reflection and refraction - the law
7. Total reflection - limit angle
8. Reflection in the mirrors
9. Refraction of the prism-dispersion
10. Limit angle - minimum deviation
11. Refraction into lenses
12. Images in the mirrors
13. Images into lenses
14. Focal distances and conjugate points
15. The eye and its defects
16. Optic instruments
17. Diffraction
18. The interference according to Young
19. Measurement of l
20. Diffraction grating
21. Transversality of the optic waves
22. Polarization
23. Solutions'rotatory power

SUPPLIED EQUIPMENT

- 1 Optical bench with stand
- 1 Dioptric projector
- 1 Transformer
- 1 Diaphragm with 1 slit
- 1 Diaphragm with 4 slits
- 1 Diaphragm with arrow-shaped slit
- 2 Lens holders
- 1 Set of 3 lenses
- 1 Half-transparent slide
- 1 Transparent slide
- 1 Red Filter
- 1 Green filter
- 1 Blue Filter
- 1 Diaphragm with square hole
- 1 Slide
- 1 White screen with graduated scale
- 1 Half-cylindrical lens
- 1 Isosceles prism
- 1 Equilateral prism
- 1 Prism holder
- 1 Optical prism
- 2 Protractors (vertical and horizontal)
- 1 100 ml beaker
- 1 Double spherical mirror
- 1 Flat mirror
- 1 Spherical mirror
- 1 Half-cylinder
- 1 Stand with metal base
- 1 Earth-Moon system
- 1 Diode laser device
- 1 Adjustable slit
- 1 Diaphragm with 1 micrometric slit
- 1 Diaphragm with 2 micrometric slits
- 1 Diffraction grating
- 1 Diaphragm with hole Ø 2 mm
- 1 Diaphragm with hole Ø 0,4 mm
- 1 Diaphragm with hole Ø 0,2 mm
- 2 Slide holders
- 2 Polarizing filters
- 1 Polarimetric tube
- 1 Linear ruler
- 1 Experiment Guide
- 1 Case

4080



5673

Basic level

5673 ELECTRICITY

21 experiments

CONTENTS
1. Knowing electricity
2. Static electricity
3. Protons and electrons
4. Electric forces
5. Electric induction
6. Conductors and insulants
7. The electroscope
8. Let's learn how to use an electro scope
9. Flashes and lightings
10. Electricity on the move
11. Batteries
12. The electric circuit
13. Light bulbs in series and in parallel
14. Transformation of electric power into heat
15. Electric conduction in liquids
16. Electrolysis
17. Magnets
18. Magnetic poles
19. Magnetic effect of the electric current.
20. The electromagnet
21. Electric alarm

SUPPLIED EQUIPMENT
- 1 Bell
- 3 Leads, 30 cm long
- 2 Leads, 60 cm long
- 1 Bottle of copper sulphate
- 1 Bottle of distilled water
- 1 Switch
- 2 Light bulbs with bulb holder
- 1 Linear magnet
- 1 Pair of cloths
- 1 Battery holder
- 2 PVC rods
- 1 Clip with string
- 1 Support stand with hook
- 1 Bipolar module
- 1 Electroscope
- 1 Metal rod
- 1 Thermal module
- 1 Compass
- 1 Coil
- 1 Iron core
- 1 Ringing bell
- 1 Thermometer
- 1 100 ml Beaker
- 1 Glass rods
- 1 Case
- 1 Experiment guide

5606

Intermediate level

5606 ELEMENTARY ELECTRIC PHYSICS

25 experiments

CONTENTS
1. Knowing electricity
2. Static electricity
3. Protons and electrons
4. Electric forces
5. Electric induction
6. Conductors and isulators
7. The electroscope
8. How to use the electroscope
9. Flashes and lightnings
10. Electricity on the move
11. Batteries
12. Electric generator
13. Electric circuit
14. Light bulbs in series and in parallel
15. Electric power
16. Transformation of electric power into heat
17. Electric conduction in liquids
18. Electrolysis
19. Magnets
20. Magnetic poles
21. Magnetic field
22. Ampère's theory
23. Magnetic effect of the electric current
24. The electromagnet
25. Sucking power of a coil

SUPLIED EQUIPMENT
- 1 Skein of thread
- 1 Base
- 1 Clip with thread
- 1 Insulated support with hook
- 1 Couple of iron pivots
- 1 Plexiglas rod
- 2 PVC rods
- 1 Electric generator
- 3 Cables 30 cm
- 2 Cables 60 cm
- 1 Copper sulphate bottle
- 1 Thermal module
- 1 Iron nucleus
- 1 Coil with 400 turns
- 1 Distilled water bottle
- 1 Bipolar module
- 1 Switch
- 2 Lamps with lamp-holder
- 1 Plexiglas plate
- 1 Magnetic needle
- 1 Linear magnet
- 1 Couple of rags
- 1 Iron filings bottle
- 1 Elettroscope
- 1 Iron rod
- 1 Compass
- 1 Thermometer
- 1 Beaker 250 ml
- 1 Test tube with stopper
- 1 Experiment Guide
- 1 Case

5595 ELECTRIC PHYSICS

30 experiments

CONTENTS
1. Theory of the mistakes
2. Simple electrostatic phenomena
3. Electric sources
4. Electric circuit and measuring instruments
5. Use of the universal instrument
6. Ohm's laws
7. The rheostat and the potentiometer
8. The electric circuit with several charges in series
9. The electric circuit with several charges in parallel
10. Electric nets
11. Some methods for measuring the electric resistance
12. Resistance depending on temperature
13. Thermal effect of the electric current
14. Electric conduction into liquids/the electrolysis
15. Simple magnetostatic phenomena
16. The magnetic effect of the electric current
17. Electromagnetic induction
18. The transformer

SUPPLIED EQUIPMENT
- 1 Glass 250 ml
- 1 Conical Flask 100 ml
- 1 Thread
- 1 Couple of pivots
- 1 Linear ruler
- 5 Small round elastic bands
- 1 Dropper
- 1 Electric calorimeter with ther-mometer
- 1 Plexiglass rod
- 2 PVC rods
- 1 Trestle stand
- 1 Switch on base
- 1 Lamp-holder on base
- 1 Lamp
- 4 Cables 30 cm
- 3 Cables 60 cm
- 1 Voltmeter
- 1 Ammeter
- 1 Electrode-holder disk
- 1 Copper electrode
- 1 Double clamp
- 1 Rod with hook
- 1 Metal rod 50 cm
- 1 Tripod base
- 2 Brass electrodes with bolts
- 1 Rod for electroscope
- 1 Tin foil sheet
- 1 Linear magnet
- 1 400 coil spool
- 1 Magnetic needle with pivot
- 1 Rehostat
- 1 Digital multimeter
- 1 Stabilized power-unit
- 4 Resistor-holder bases with resistors
- 1 Aligator clip
- 2 Rods with insulator
- 2 Nickel-chrome wires
- 1 1600 coil spool
- 1 "U"- shaped nucleus with joke and support rod
- 1 Funnel
- 1 Distilled water bottle
- 1 Copper sulphate solution bottle
- 1 Experiment Guide
- 1 Case

5595

Advanced level

5620 ELECTROSTATICS

13 experiments

CONTENTS

1. Electrization
2. Electrostatic induction
3. Leaves electroscope
4. Revelations of the electricity
5. Determination of an electric charge's sign
6. Wimshurst machine
7. Points power
8. Electric whirl
9. Balls' dance
10. Electric feather
11. Electrostatic engine
12. Electrostatic fall of smokes
13. Damages of smoke

SUPPLIED EQUIPMENT

- 1 Round base
- 1 Clip with thread
- 1 Insulated stand with hook
- 1 Candle with candle- holder
- 1 Plexiglass rod
- 2 PVC rods
- 2 Cables 60 cm
- 1 Leaves electroscope
- 2 Alligator clips
- 1 Wimshurst machine
- 1 Universal stand
- 1 Point stand
- 1 Point conductor
- 1 Electric whirl
- 1 Device for balls'dance
- 2 Balls with thread
- 1 Electric feather
- 1 Experiment Guide
- 1 Case
- 1 Smokes falling apparatus
- 1 Electrostatic engine

Demonstration for the teacher's desk

5620

5611 ELECTRODYNAMICS

15 experiments

CONTENTS

1. The electric circuit
2. Ohm's 1st law
3. Ohm's 2nd law
4. Charges in series
5. Charges in parallel
6. Electric nets
7. The rheostat
8. The potentiometer
9. Measurement of a resistance with V-A
10. Measurement of a resistance with a slide-wire bridge
11. Measurement of a resistance with a tester
12. Resistance depending on temperature
13. Thermal efferct of the electric current
14. Electric conduction into liquids
15. The electrolysis

SUPPLIED EQUIPMENT

- 1 Beaker 250 ml
- 1 Linear ruler
- 1 Dropper
- 1 Electric calorimeter with thermometer
- 1 Light bulb
- 1 Electric power-unit
- 2 Cables 30 cm
- 4 Cables 60 cm
- 2 Digital multimeters
- 3 Crocodile clips
- 2 Stands with insulator
- 2 Nickel-Chrome wires
- 1 Disk with copper-brass electrodes
- 1 Switch on base
- 1 Lamp-holder on a base
- 3 Resistors on base
- 1 Rheostat
- 1 Distilled water bottle
- 1 Copper sulphate bottle sol. 10%
- 1 Experiment Guide
- 1 Case

Demonstration for the teacher's desk

5611

5613 ELECTROMAGNETISM

15 experiments

CONTENTS

1. Magnetic actions
2. Earth's magnetism
3. The magnetic field- spectrum
4. Ampère's theory about magnetism
5. Magnetic effect of electric current
6. The electromagnet
7. Interaction between currents and magnets
8. Electric engine
9. Electromagnetic induction
10. Neumann's law
11. Lenz's law

SUPPLIED EQUIPMENT

- 1 Electric power-unit
- 5 Cables 60 cm
- 1 Linear magnet
- 1 Magnetic spectrum device
- 1 Knife switch
- 1 Galvanometer
- 1 Device for electromagnet actions
- 1 Electric engine
- 1 Double induction reel
- 1 Magnetic needle
- 1 Compass
- 1 Test-tube with stopper
- 1 Experiment Guide
- 1 Case

Demonstration for the teacher's desk

5613

5650 ELECTROMAGNETIC INDUCTION

10 experiments

CONTENTS

1. Faraday's experiments
2. Neumann's Law
3. Lenz's Law
4. Alternating currents
5. The alternator
6. The dynamo
7. Direct-current engine
8. The electric transformer

SUPPLIED EQUIPMENT

- 1 Tripod base
- 1 Transformer
- 1 Switch
- 1 Cable 30 cm
- 4 Cable 60 cm
- 1 Linear magnet
- 1 400 coil spool
- 1 1600 coil spool
- 1 Educational Galvanometer
- 1 "U" shaped nucleus with yoke and support-rod
- 1 Digital multimeter
- 1 Engine-dynamo-alternator
- 1 Battery holder
- 1 Experiment Guide
- 1 Case

Demonstration for the teacher's desk

5650

5348

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5321

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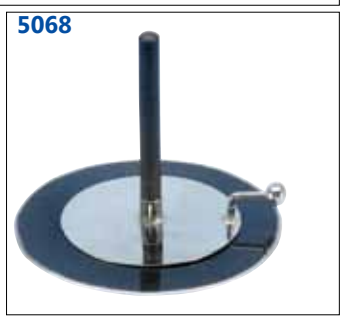
5068



5253

5085

5408

5408

FRICTION RODS
5139 Hard rubber rod
5002 Plexiglass rod
5003 PVC rod
5058 Glass rod

5348 Set of 5 friction rods

The set is composed of 5 electrifiable rods: plexiglass, nylon, hard rubber, glass, hard rubber-brass.
With wool cloth, silk cloth and rod stand.

5280 Electroscope

If you bring an electrified body near the plate of the instrument, the leaf diverges because of the electrostatic repulsion with the rigid stand. With graduated scale. Height: 20 cm.

5321 Set for simple electrostatic experiments

CONTENTS
1. The electrification
2. Two electric charges
3. The electroscope
4. The electric forces
5. The electrostatic induction

SUPPLIED EQUIPMENT
- 2 Plexiglass rods
- 2 PVC rods
- 1 Double electric pendulum with rods stand
- 2 Rags
- 1 Electroscope
- 1 Didactic Guide
- 1 Case

5090 Double electric pendulum

If you bring an electrified body near the instrument, its two balls diverge because they acquire an electric charge of the same sign, due to the electric induction.

5068 Volta's Electrophore

The item is composed of a plexiglass base you can electrify by rubbing it; on this base there is an alluminum disk with insulating handle. If you bring the disk near the electrified base several times, and each time you connect its upper face to the ground , it is possible to store big quantities of electricity on it, to the point that you can obtain electric discharges up to 1 cm long.

5085 Wimshurst's electrostatic machine

The item has two special disks which don't deform over the course of time.
Two Leyda decomposable bottles. Adjustable distributor.
Spark: 50-60 mm. Disks diameter: 400 mm.

5253 Wimshurst's machine

This is an economic, light and handy version.
Disc diameter: 30 cm
Sparkles 25-30 cm long can be obtained.
This generator also allows carrying out the most significant electrostatic experiments.

5408 Electric or hand driven Van de Graaff's generator

The item is powered by a low-voltage engine or by hand. It is able to produce a potential difference up to 300.000 V with 10 cm long sparks. Sphere diameter: 27 cm.

SUPPLIED EQUIPMENT
- 1 Power-unit 3-12V
- 1 Electric whirl
- 1 Sphere with stand
- 1 Electric feather
- 2 Cables100 cm
- 1 Protective spectacles

5404 **Van de Graaff generator's equipment kit**
It is composed of: universal stand; metal sphere with insulating handle; electric whirl; dance of the balls; Faraday's cage; Faraday's well; electrostatic engine; articulated discharger; sparkling panel; electric pendulum; blowing point; electric feather; two crocodile clips; two cables.

5051 **Set of accessories for electrostatic machines**
The set includes: dance of the balls, double electric pendulum, 2 cables, paper plume, blowing point, electric whirl, candle with candle-holder , 2 crocodile clips with stand.

5099 **Electric whirl**
The item can show the dispersive power of the points thanks to the mechanical effect.

5046 **Eletrostatic blower**
The item can show the dispersive power of the points.

5204 **Point-shaped conductor**
Made of nickel-plated brass, it enables you to experiment on charge distribution in insulated conductors.
Length: 220 mm. Height: 300 mm.

5092 **Articulated discharger**
With insulated handle.

5073 **Electrostatic bell ring**
If you connect the apparatus to an electrostatic machine, the pendulum hits the two bells aternatively because of the electric actions Height: 380 mm.

5091 **Spherical conductor**
For experiments on electrization (through contact and through induction), on the potential and charge density in conductors.
Sphere diameter: 100 mm. Height: 370 mm.

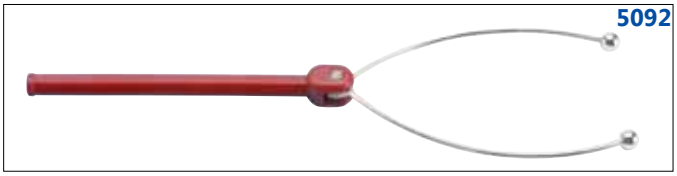
5087 **Coulomb's sphere**
For experiments on electrostatic induction (Faraday's well, for example)
It is supplied with electric spoon.
Sphere diameter: 100 mm. Height: 370 mm.

5070 **Cylindrical conductor**
For experiments on electrization (through contact and through induction), on the potential and charge density of conductors.
Cylinder length: 220 mm.Height: 320 mm.

5071 **Couple of cylindrical conductors**
Being a kind of divisible conductor, this apparatus allows the verification of the electric poles during the phenomenon of the electrostatic induction.

5072 **Cavendish's hemispheres and spherical conductor**
The item can verify that the electric charges in metal conductors are distributed on their surface. If you put the sphere in contact with the hemispheres , the sphere discharges completely.
Sphere diameter 100 mm. Height: 370 mm

5140 **Faraday's cage**
The item is supplied with double electric pendulum, thus allowing the performance of experiments on the electrostatic screen.
Diameter: 120 mm.
Height : 260 cm.



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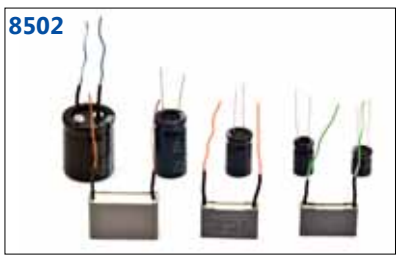
5324

8502



5093

5703

5089 Couple of conductors with electroscope

They have the same function of the previous couple of conductors code 5071, with the advantage of being connected to two leaf electroscope.

5351 Device for showing the flux lines of the electric field

The item is composed of a tray made of transparent material, to be placed on an overhead projector, and of electrodes to be fixed along the rim of the tray. The latter is filled with castor oil ;semolina seeds float on the oil surface. If you connect two electrodes to the poles of the high-voltage generator (code 5324) or to an electrostatic machine, the behaviour of the flux lines of the electric field becomes visible. The item is supplied with 250 ml of castor oil and a bottle of semolina.

5088 Leyda's bottle

Cylindrical condenser for experiments on the electric capacity.
It is supplied with insulated handle to extract the inner framework when the condenser is charged.
Glass height: 130 mm.
Diameter: 60 mm.

5324 Generator 5kVdc

This generator is a necessary instrument to perform quantitative experiments on electrostatics and to feed vacuum tubes. Its use isn't dangerous for the operator because, even in case of a short circuit, the maximum current reachs only 2 mA because of a great output resistance. it is supplied with two highly insulating security cables.
The output voltage is adjustable with continuity up to 5 kVcc.
Built-in digital voltmeter with 3 digits
Fix output 6,3Vca/3A.
Dimensions: 285x220x140 mm.

8502 Set of 10 capacitors

Composed of:

1 ceramic capacitor 2,2 µF;
1 ceramic caacitor10 µF;
2 electrolytic capacitors 1.000 µF ;
1 electrolytic capacitor 4.700 µF;
1 ceramic capacitor 4,7 µF;
1 electrolytic capacitor 470 µF;
2 electrolytic capacitors 2.200 µF;
1 electrolytic capacitor 10.000 µF.

To be used with bases code 5056, sold separately (see page 71), in order to constitute batteries in series and in parallel. Maximum voltage: 25V.

5093 Epino's capacitor

It is a capacitor which allows you to prove that the electric capacity depends on the distance from the framework and on the dielectric material. It can be used to show the flux lines of a uniform electric field too.

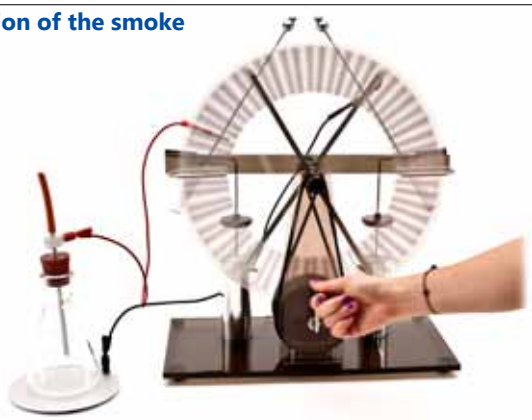
5703 Electrostatic smoke precipitator

The smokes and powders coming out of the chimneys of those mills where toxic substances are used, contribute greatly to air pollution.
With this apparatus you can show how to obtain their elimination. Using a rubber tube, a lighted-up sigarette is put in communication with the inside of the flask.
If you suck out the air using the pump, the flask fills up with smoke. The internal electrode, which is pointed, and the external plate must be connected to an electrostatic machine (we suggest the code 5085).
Switching on the machine, you will notice that , at first, the smoke spins around and then it disappears.
If you repeat this operation several times , the walls become black. Cleaning the flask with a bit of white spirit, the tar contained in the cigarette's smoke melts down, allowing the teacher to show the damage caused to the airways . Instruction guide included.

SUPPLIED EQUIPMENT

1 Flask with stopper
1 Metal disk
1 Pointed electrodes
1 Rubber tube
1 Transparent tube
1 Suction pump
2 Cables
1 Mohr's pincers
1 white spirit bottle

5703 Suction of the smoke



5714 **Electrostatic cell**
An hermetically sealed acrylic case, containing polystyrene tiny balls. When the upper part is rubbed for a long time with a cloth, the electrostaic charge generated makes the balls move, demonstrating the action among charges.
Dimensions: 18x9,5x2cm.

5045 **Electrometer**
The item is able to measure electrostatic potentials up to 5kV. The metal stand has a hole for the grounding. It is supplied with disk condenser, Faraday's well and electric spoon

5380 **Coulombmeter with accessories**
This instrument, equipped with a digital display, allows the measurement of an electric body's charge.

SUPPLIED EQUIPMENT
1 Coulombmeter with display
1 Conducting sphere on isolating support
1 Glass rod
1 Ebonite rod
1 Leyden jar
1 Glove
1 Rag

5721 **Coulombmeter**
For detection and measurement of loads. Useful for a wide range of experiments, such as charging by induction, Faraday's dry ice, Coulomb's law and the capacity of an isolated sphere. Supplied with plate for charging, battery and instructions.
Leakage current: IPA (10pA max). Storage Charge: Battery 9V PP3
Overall size 130x60x90mm - Weight 0.20kg

5381 **Electrostatic engine**
Linking the terminals to an electrostatic machine, the sphere made of insulating material, starts to spin quickly. Instruction guide included.

5714

5045

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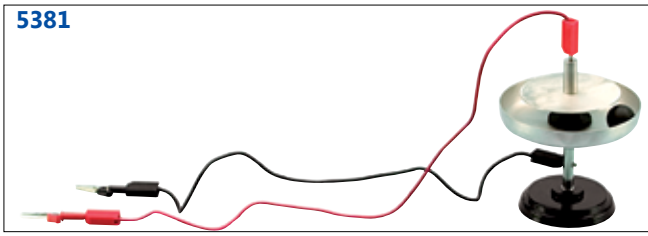
5381



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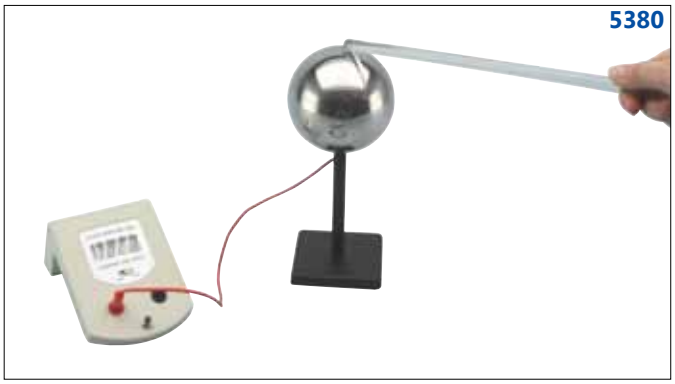


5380

5703 Suction of the smoke

5721

5422

5422 Elementary circuits kit
This kit enables beginners of the study of the electrical physics, to do experiments on the simplest electric circuits.

CONTENTS
1. Lamp with switch
2. Lamps in series
3. Lamps in parallel

SUPPLIED EQUIPMENT
2 Lamps with lamp holder
2 Switches
1 Battery holder
6 Cables

5147

5147 Knife switch
Max. voltage: 12V. Max. current: 5A.

5164

5164 Lamp E10 6V/5W

5271 Lamp E10 6V/5W
Suitable for lamp-holder code 5164.

Connection cables
Diameter: 3 mm. Max. current: 8A. Max. voltage: 24V. Piston pins with transversal hole.

5012 - 5191 - 5076

5012 Length: 30 cm.
5013 Length: 60 cm.
5082 Length: 100 cm.

5191 10 cables with crocodile clips
Length 50 cm. Max. current: 5 A.

5076 Nickel-chrome wire
Length 100 cm. It has terminal piston pins to make test on the Ohm's laws.

Safety cables
Diameter: 4 mm. Max. current: 8A. Max. voltage: 1000V. Metal part with protective retractable sheath in order to avoid accidental contacts. Piston pin with axial hole.
Complying with CEI standard 1010-1.

5160

5160 Length: 25 cm.
5161 Length: 50 cm.
5162 Length: 100 cm.

5325

5325 Rack for cables
24 spaces, it can be fixed to the wall.

5010

5010 Lamp E12 6V-2W
To be used with lamp-holder code 5009.

5063 Connection bushing for cables

5075 Rod with insulator
Height: 10 cm. Foot diameter: 6 mm.

5062 Crocodile clip
With double socket for cables.

5192 Crocodile clip
With insulation, with button.

5063 - 5271 - 5075 - 5062 - 5192

5357 Batteries connection kit
This kit allows the electrical connection to 1 torch battery.
You can also connect two batteries in series and two batteries in parallel.

5357

5009 **Lamp holder E12 on base**
To be used with lamps code 5010.
Dimensions: 100x50x25 mm.

5008 **Switch on base**
Dimensions: 100x50x25 mm.

5136 **Deflector on base**
Dimensions: 100x50x25 mm.

5132 **Rheostat 22 ohm on base**
Dimensions: 100x50x25 mm.

5137 **Inverter on base**
Dimensions: 100x50x25 mm.

5056 **Resistor-holder and condenser-holder base**
Dimensions: 100x50x25 mm.

5156 **Set of 6 nickel-chrome conductors**
The conductors are mounted on a plastic base(125x75 mm) and protected by a plexiglass plate.

1 Resistor 18Ω with Ni-Cr wire;
2 Resistors 18Ω with Ni-Cr wire;
1 Resistor 5Ω with Ni-Cr wire;
2 Resistors 13Ω with Ni-Cr wire.

For experiments on the properties of resistors in series and in parallel. Max. current: 1A.

8503 **Set of 4 metal wire,10 m, Ø 0,3 mm**
Components:

Nickel	0,88 Ohm/m
Costantan	6,98 Ohm/m
Nickel-Chrome	15,14 Ohm/m
Kantal	18,00 Ohm/m

5176 **Series of 10 resistors**
Ohm values: 10 - 12 - 15 - 18 - 22 - 56 - 68 - 100 - 120 - 150. Power: 5W.
To be used with bases code 5056 (sold separately) in order to produce batteries in series and in parallel.

8504 **Ohm laws' table**
To be used with the set of wires code 8503 (see above) in order to take test on Ohm laws.
Dimensions: 500x60 mm.
It is supplied with short-circuit bridge.

5098 **Series of conductors**
For the verification of Ohm's laws.
Composed of:

1 nickel-chrome wire, Ø 1,5 mm;
2 nickel-chrome wire, Ø 0,75 mm;
1 copper wire, Ø 1,5 mm;
1 bridge.

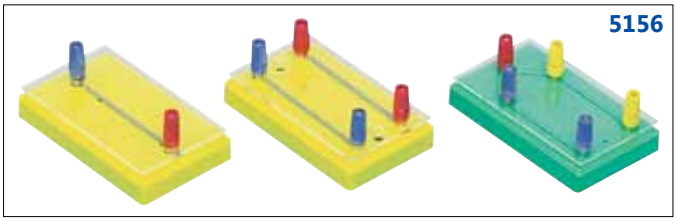
Dimensions: 1000 x 100 mm.

5101 **Slide-wire bridge**
With graduated scale and cursor.
Wire length 100 cm.

5009 - 5008 - 5136

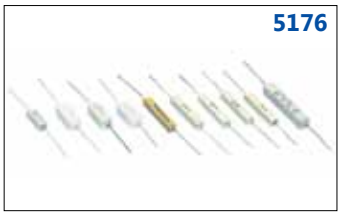
5132 - 5137 - 5056

5156



8503

5176



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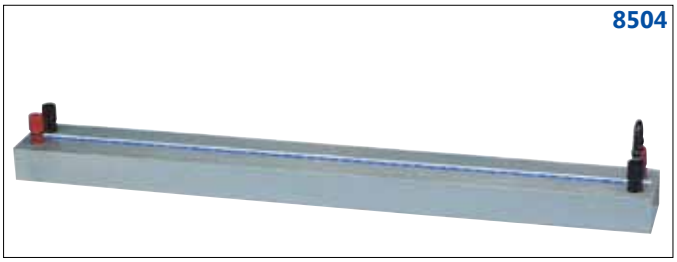

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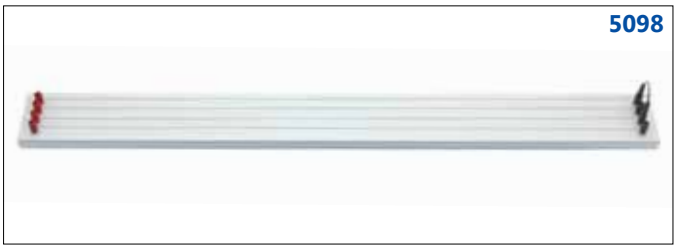

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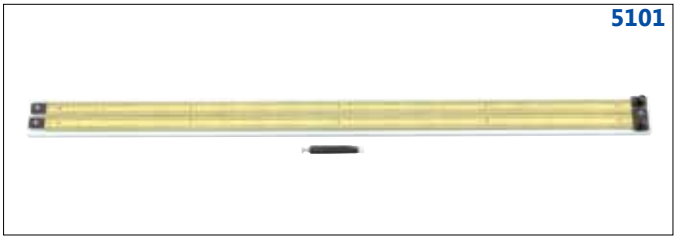


5130

5130 Set for experimets on the electric circuits

To be used with an electric, low-voltage power unit ,which can be adjusted from 0 to 12V.
Supplied with experiment guide. Structure made of varnished metal.
Panel dimensions: 57x33 cm.

CONTENTS

1. The electric circuit
2. The insertion of the switch
3. Current measurement with the ammeter
4. Voltage measurement with the Voltmeter
5. Verification of Ohm's first law
6. Charges in series
7. Charges in parallel
8. Electrical nets

SUPPLIED EQUIPMENT

1 Panel with two instruments	5 Bridges with resistor
10 Bridges with short-circuit	4 Cables 30 cm
2 Bridges with switch	2 Cables 60 cm
2 Bridges with lamp	1 Experiment Guide

5400

5400 Wheatstone's bridge

With the help of the galvanometer code 5158, this small Wheastone bridge enables you to measure a resistance in a simple and quick way. It is supplied with three resistors of comparison with 1% tolerance, which are mounted on three small bridge and with three unknown-value resistors for the trials.
Base dimensions: 130x130 mm. Max. voltage: 2V.

5270

5270 Resistances box

With five decade boxes.
Percentual mistake 0,1%.
Plastic case.
Measurement range: from 0 to 9999,9 Ohm with 1 Ohm step.

5094

Linear armoured rheostats 160 W

They are made of mechanically solid , non-inflammable materials.
The cane which supports the winding is made of special refractory material featuring a high mechanical and heat resistance, the winding is made of oxidized, cooked constantan.
Dimensions: 270x92x163h mm.
Weight 4,8 Kg.

	RESISTANCE (Ω)	MAX. CURRENT (A)
5094	1	13
5095	10	4
5096	100	1,25
5097	1000	0,22

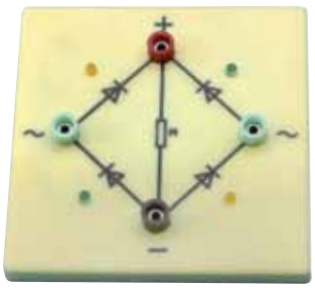
Linear rheostats

For voltage up to 24V.

	RESISTANCE (Ω)	MAX. CURRENT (A)
5218	10	2
5219	50	1,5
5220	200	1

5218

5233



5233 Graetz's bridge

The item is mounted on base 100x100 mm. It can strighten up two half-waves, visualizing the conduction state of the diode through the use of LEDS.

5146

5146 Silica diode on base

The item is mounted on a varnished aluminium base 100x50x25 mm.
It can strighten up a half-wave.

5389

5144 Thermistor NTC on base

The item is mounted on a varnished aluminum base 100x50x25 mm.
Its resistance varies with a negative temperature.

5144

5389 Thermistor PTC on base

The item varies its resistance with a positive temperature.

5133

5133 Photoresistor on base

The item is mounted on a varnished aluminium base 100x50x25 mm.
It varies its resistance in function of the light received.

5712 Board for simple electric citrcuits

This apparatus enables you to create connections in series and parallel between different electrical dipole, such as light bulbs, resistors, condensers, leds, etc. simply through the use of spring connectors.
It includes a small space to store all different components and a battery-holder to insert two AA type batteries.

5332 Modular set for the study of the electric circuits

This modular set enables the performance of many experiments on electrical conduction, reducing to a minimum the use of connecting cables. In this way, besides simplifying the operative production of circuits, their schemes are highlighted.
Assembly table dimensions: 45x33 cm.

15 EXPERIMENTS

CONTENTS

1. Lamp with a sole control.
2. The protective fuse
3. Lamps in series with a sole control
4. Lamps in parallel with a sole control
5. Lamps in parallel with deflector
6. Lamps with double control by means of deflector
7. Lamp with double control with power relay
8. Use of the voltmeter
9. Use of the ammeter
10. Ohm's first law
11. Ohm's second law
12. The rheostat
13. The potentiometer
14. Circuits in series
15. Circuits in parallel

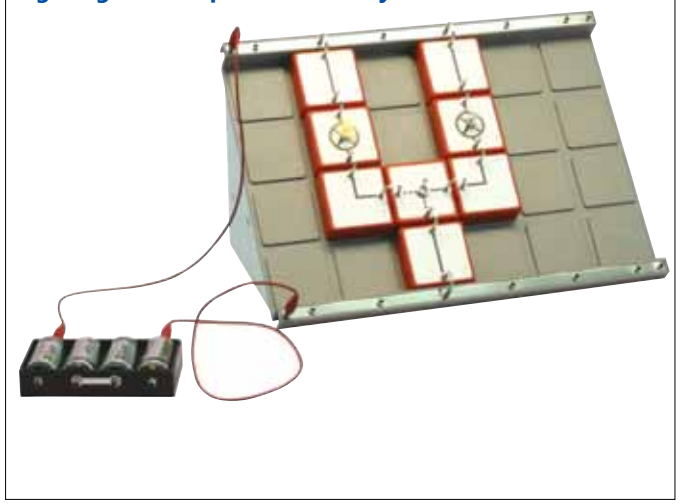
SUPPLIED EQUIPMENT

1	Battery holder	2	lamp holder with lamps	1	Spool of kantal wire
1	Assembly table	2	Deflectors	1	Spool of Nickel-chrome wire
6	flexible cables	2	Resistors	1	Voltmeter
10	Bridges	1	Fuse-holder	1	Ammeter
4	linear conductors	10	Fuses	1	Didactic Guide
1	"T" shaped conductor	4	Universal connector	1	Case
2	"L" shaped conductor	1	Rheostat		
4	Insulators	1	Power relay		

5333 Lectern-like stand for assembly table

For a better view of the circuits assembled on the table.
The above described modular set is not supplied; it must be bought separately.

Lighting of 2 lamps controlled by a deflector

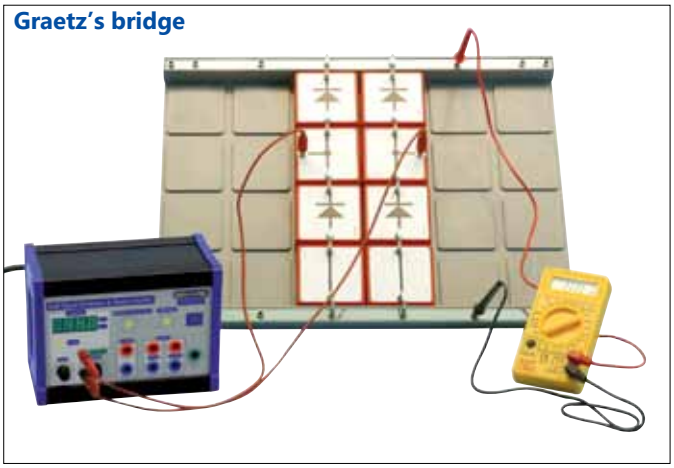


5332

SUPPLIED EQUIPMENT

1	Battery holder	1	Cross conductor
1	Assembly table	1	Light bulb
6	Flexible cables	1	Inductor
16	Bridges	5	Condensers
5	Linear conductors	5	Resistors
2	"T"shaped conductors	1	Potentiometer
1	"L"shaped conductor	4	Silica diodes
6	Universal connectors	1	Photoresistor
2	Testers	1	NTC
1	Deflector	1	Transistor
1	Lamp-holder	1	Didactic Guide
		1	Case

Graetz's bridge



5334

Modular set for the study of basic electronics

This modular set allows the performance of several experiments on electronical principles: from reactive components to semiconductors. The main advantage lies in the minimum use of the connecting cables. In this way, besides simplifying the operative production of circuits, their schemes are highlighted.
Assembly table dimensions: 45x33 cm.

18 EXPERIMENTS

CONTENTS

1. Direct-current condenser
2. Voltage and effective current
3. Alternating-current condenser
4. The capacitive reactance
5. The inductive reactance
6. The RCL circuit-the impendance
7. The low-passing filter
8. The high-passing filter
9. Conductivity of metals and of semiconductors
10. The p-n junction, the diode and the LED
11. The half-wave rectifier
12. The double half-wave rectifier
13. The filtered rectifier
14. The transistor
15. The transistor as switch
16. The transistor as amplifier

5334

NOTICE: FOR THE ALTERNATING CURRENT EXPERIMENTS, IT IS NECESSARY THE USE OF THE FUNCTIONS GENERATOR CODE 5718, TO BE PURCHASED SEPARATELY

5333

5718

5333 Stand for assembly table

For a better view of the circuits assembled on the table. The above described modular set is not supplied; it must be bought separately.

5718 Low-frequency signals generator

It is a generator of precision signals, amplified in power. It can generate sine , square and triangular waves. The frequency of the main generator varies from 0.1 Hz to 100 KHz.
The maximum output power is 4.5 W. Equipped with LED display mentioning the frequency and the output amplitude level.
This instrument is particularly suitable for teaching and for scientific research.

TECHNICAL FEATURES
- 4 ohm output.
- Auxiliary input for the amplifier stage.
- Frequency range: 0.001 Hz - 100 kHz with 0.01% accuracy.
- Wave shape: sine, square and triangular.
- Output power: 4 , 5W on the whole range of frequencies.
- Output width: 17V peak to peak (600ohm output), 8.8 V peak to peak (4ohm output)
- Output attenuator 1x / 0,1X / 0,01X (on the 600ohm output)

5124 **Volta's battery, column type**
It is made of copper and zinc parts, separated by felt disks soaked in an acid solution.
It is supplied with a bottle of acid solution.

5167 **Volta's battery, cups type**
It is composed of 4 voltmeters in series. It is supplied with copper and zinc electrodes, acid solution, cables and a LED assembled on a panel.

5287 **Human battery**
Placing your hand on two of the four metal plates (zinc, lead, aluminium and copper), you create a potential difference between the plates because of the electrical conduction properties of the human body.

This potential difference can be measured through the use of a millimetric voltmeter (not included)
Trying all possible combinations between metals, it is possible to guess the existence of the electrochemical series.

Plates dimensions: 15x23 cm.
Board dimensions: 23x65 cm.

5113 **Apparatus for the electrical conductivity of liquids**
Comprised of 4 bulbs in parallel. The electrolytic liquids must be poured into the four glasses, in which the electrodes are immersed.
With this simple device, the electrolytes solutions can be recognized and the variation of conductivity as a function of the concentration can be studied.

5415 **Electrolytic cell**
Components:
1 Beaker
1 Sulphuric acid 10% bottle
1 Iron Electrode
1 Electrode-holder stand
2 Zinc Electrodes
2 Copper Electrodes
2 Lead Electrodes
2 Cables
2 Carbon Electrodes
1 Copper sulfate solution bottle

CONTENTS
- Electrical conductivity of liquids
- Electrical storage batteries
- The Volta's battery
- The electroplating.

Replacements for electrolytic cell
5415.1 Electrode replacements kit for code 5415.
5043.1 Couple of brass electrodes.
5043.2 Couple of lead electrodes.
5043.3 Couple of copper and zinc electrodes.

Hofmann's voltameter
For verifying Faraday's law.
With graduated tubes and their metal stands. Height: 70 cm Altezza: 70cm.

5102 With carbon electrodes.
100 ml total capacity.
5103 With platinum electrodes.

Replacements for Hofmann's voltameter
5102.1 **Glass part only.**
5165 **Carbon electrodes(couple).**
5166 **Platinum electrodes (couple).**

5251 **Demonstrative voltameter**
Non-graduated tubes, closed with latex small tubes and Mohr's pincers.
Supplied with stand and carbon electrodes.
Glass part heigth: 35 cm.
Total capacity: 60 ml

5167

5287

5113

5415

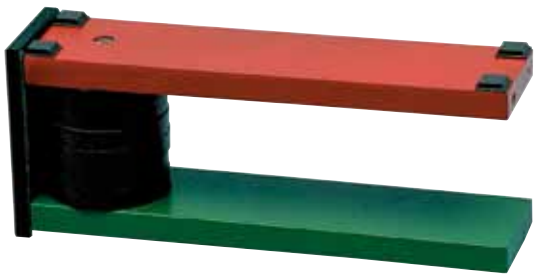
5102

5251

5124

5279 - 5281 - 5206

5173

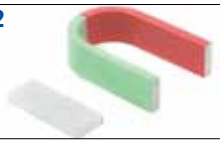


5238 - 5024 - 5169 - 5170

5182

8516

5382



5183

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5105

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5296

5358

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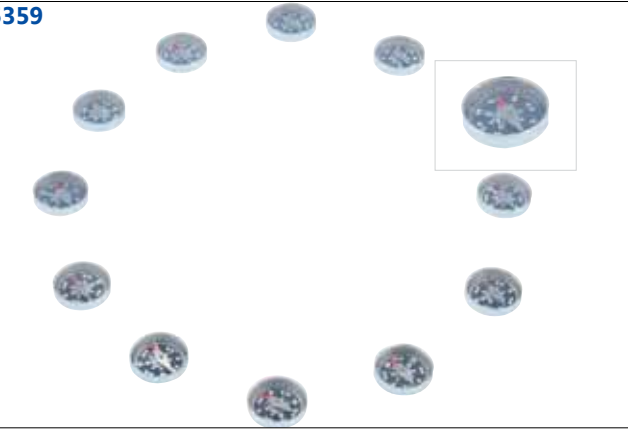


STEEL MAGNETS

5279 **Linear rectangular magnet**
Dimensions: 170x20x10 mm.

5281 **U-shaped magnet**
Dimensions: 55x10x14 mm.

5286 **U-shaped magnet**
Dimensions: 75x16x40 mm.

5173 **U-shaped magnet**
Dimensions: 200x75x45 mm.

5206 **Horseshoe-like magnet**

AL-NI-CO ALLOY MAGNETS

Made of cobalt and nickel alloy, these magnets are able to create magnetic fields much more intense than those created by steel magnets. Moreover, their magnetization lasts for decades.

Linear magnets with round section

5238 Dimensions: 60x6 mm circular, single.
5024 Dimensions: 100x10 mm circular, single.
5169 Dimensions: 150x12 mm circular, single.
5170 Dimensions: 150x12 mm circular, couple.

U-shaped magnets with stand

Dimension in mm

5077	A=19; B=14;	C=8;	D=19; gambo Ø 6mm.
5141	A=29; B=22;	C=11;	D=29; gambo Ø 6mm.

U-shaped magnets without stand

5382 80x52,7x21mm.
5383 130x80,5x30mm.

5182 **Disk magnet**
Made of SINTEROX/F. alloy
Diameter: 18 mm. Thickness: 5 mm.

5183 **Ring magnet**
Made of SINTEROX/D alloy
External diameter: 51 mm.
Internal diameter: 24 mm.
Thickness: 9 mm.

NEODYMIUM MAGNETS

Made of Neodymium- Iron-Boron alloy, these magnets produce an exceptionally intense magnetic field (about 1 Tesla).

8516 **Disk magnet**
Diameter 25mm, height 10 mm.

8517 **Ring magnet**
External diameter: 25mm.
Internal diameter:10mm Height: 10 mm.

MAGNETIC NEEDLES

5105 **Magnetic needle**
It is mounted on a rod 120 mm and base.
Needle length: 75 mm.

5174 **Magnetic needle with protractor**
It is mounted on rod 100 mm and base.
Needle length: 60 mm.

5296 **Set of 10 magnetic needles**
Needle length 30 mm; the neddles allow you to draw the flux lines of a magnetic field.

5358 **Set of 10 magnetic in-box needles**
Diameter 20 mm height 8 mm.

5359 **Set of 12 compasses**
Diameter 25 mm height 6 mm.

5225 **Couple of magnetic needle**
The item can show the interaction between magnetic poles
Needle length: 140 mm. Height: 120 mm.

5225

5141

5250 **Rotating stand for magnets**
It consists of a stand ,rotating on a point, so to highlight the actions between magnetic poles.

5125 **Magnetic forces apparatus**
This item allows you to visualize the remote action of magnetic forces. With two ring magnets.

5259 **Magnetic forces apparatus**
This item allows you to visualize the remote action of magnetic forces. With two bar magnets.

6154 **Iron filings bottle 25 c.c.**

5027 **Apparatus for visualizing the magnetic spectrum**
Components:

1 "U"shaped magnet
1 Plexiglass plate
1 Circular base
1 Iron filings bottle

5293 **Magnetoscopes**
Part 1
It is composed of a transparent cube (80x80x80mm) containing a silicon oil solution with iron filings in suspension into it. Inserting the supplied linear magnet in the central hole, the wire-like iron particles line up to the space flux-lines of the field generated by the linear magnet.
Part 2
It is based on the same principle of the previous apparatus; it enables a bidimensional representation of the flux lines both of a linear and"U"-shaped magnet, both supplied as apparatus'equipment. Dimensions 120x60 mm.

5414 **Magnetism kit**
The item can show, in an elementary way, the properties of magnets. It can also discover which substances are not subject to the magnetic force.

5202 **Magnetic probe**
It consists of a small magnet in cardanic suspension, which enables you to outline the behaviour of the flux lines of a magnetic field.

5405 **Magnetoscope**
98 small iron bars, protected by a case, are free to move randomly. Under the action of an external magnetic field (for example, inserting the magnet model in the extendible solenoid code 5178) the bars line up like the magnetic moments of the ferromagnetic bodies' molecule. With magnets code 5024 or code 5286, it can be used to visualize the force lines of a magnetic field. Dimensions 75x150 mm.

5420 **Magnetoscope with needles**
This item is like code 5405, but with 117 magnetic needles which can orient themselves. Dimension: 150x150mm

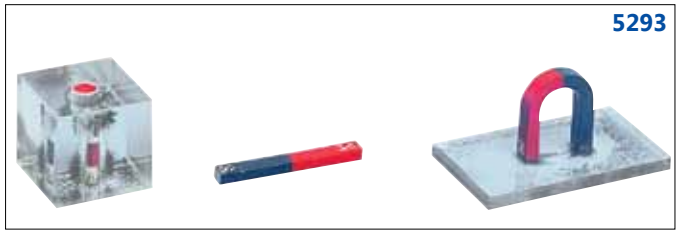
5541 **"Play and learn" kit**
You can learn the properties of magnetic bodies enjoying yourself. It is composed of:

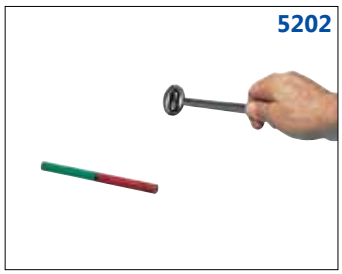
1 Magnetic spade
1 Horseshoe magnet
10 Magnetic balls
50 Magnetic clips
24 Coloured magnetic tokens
1 Didactic guide
1 Magnets stand

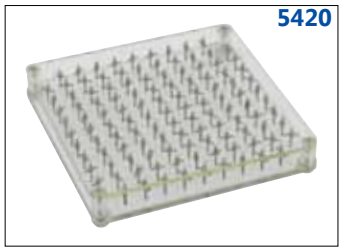
5322 **Set of accessories for experiments on magnetism**

POSSIBLE EXPERIMENTS
1. The magnet
2. Two magnetic poles
3. The compass
4. Magnetic forces
5. Magnetic induction
6. The magnetic spectrum

SUPPLIED EQUIPMENT
2 Magnetic needles
2 Linear alloy-made magnets
1 "U"-shaped steel magnet with stand
1 Plexiglass plate
1 Rotating stand
1 Iron filings bottle
1 Compass
1 Experiment guide
1 Case







5411

5231

5135

18/E

5171

5307

5118

5411 Unimag
With this set of magnets and balls you can build objects and geometrical figures useful to stimulate the creativity of the students.

5231 Precision compass
Diameter: 100 mm. With wind rose.

5135 Big didactic compass
Thanks to its dimensions it can be seen from far away
Diameter: 200 mm.

18/E Simple compass
Diameter: 45 mm.

5171 Walk compass
It has aligning sight and magnifying glass. Case made of shock-proof, synthetic material. Suspended dial with phosphoric indications. Dial diameter: 55 mm.

5307 Magnetometer
It can measure , with great precision, the intensity of a magnetic field in a determined point, knowing the value of the component Ht of Earth's magnetic field. Diameter: 100 mm.

5118 Inclination and declination needle
It is usefull to study the properties of the magnetic field in every part of the world.
With latitude indicator.
Dimensions: 170x170x220h mm.

5369 One-stage magnetic cannon
The magnetic field of a permanet magnet decreases quickly as distance increases.
The sphere in the charger, is located in the field of a powerful neodymium magnet; therefore it is abtracted by a force which increases quickly as the sphere's distance from the magnet decreases. Once delivered, its potential energy turns into kinetic energy. During the collision against the magnet, the collision wave passes through the magnet and the first sphere on its left, reaching the second or the third sphere(the bullet). The latter, being far away, is weakly abtracted by the magnet, and therefore, gains a speed greater than the one of the colliding sphere.
From the energetic point of view, the work done for resetting the system for the following test, produces the energy released during every collision. Cannon length: 40 cm.

5370 Three-stage magnetic cannon
With 3 magnets and 10 spheres. Track length: 100 cm.

Magnetic spectrum apparatus
They are made of an aluminium wire resistant to currents from 5-10 A. Spreading the stringy iron filings on the plate of the apparatus , it is possible to visualize the flux lines of the magnetic field.
Dimensions: 180 x 120 x 100h mm.

5106 Rectilinear conductor
5107 Circular coil
5108 Solenoid

5368 Kit of three devices for the magnetic spectra
The three units 5106 - 5107 - 5108 can be purchased in a single kit.

5369

Coupling of magnetic cannon 5369

5106 5107 5108 5368

5370

5356 **Apparatus for visualizing the field of an electromagnet**
It consists of a plastic material plate and of an electromagnet (composed of an inductor and a metal nucleus) which must be placed under the plate. The item is supplied with a bottle of iron filings and an allen screw to assemble the electromagnet. Maximum voltage: 6 V.

5026 **400 coil reel, 1A**

5078 **1600 coil reel, 1A**

5185 **2 Ohm resistance**
Whenever the use of current of high intensity current necessary, we suggest the use of the power-unit code 5230. If you don't have it, it is possible to use an average low-voltage Dc source, for example a cell or a battery, provided that you insert a resistance in series which is able to lessen the current intensity.

6154 **Iron filings bottle 25 cc**

8510 **Inductor**
Features in alternating current 1 kHz:
L=0,22 H, R= 56 Ohm between two extreme poles;
L= 58 mH, R= 24 Ohm between an extremity and the intermediate pole
Features in direct current:
R= 0,6 Ohm between two extreme poles , R= 0,3 Ohm between an extremity and the intermediate pole.

5110 **Linear Oersted apparatus**
The item can show the magnetic effect of electric current flowing in a linear conductor. With magnetic needle.

5109 **Circular Oersted apparatus**
The item can show the magnetic effect of the electric current flowing in a circular conductor. With magnetic needle

5122 **Oersted apparatus with two needle**
The item can show the magnetic effect of the electric current flowing in a circular conductor through the use of 2 magnetic needles.

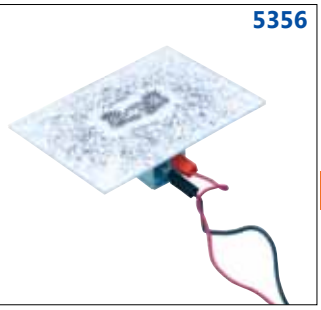
5274 **Horseshoe-shaped electromagnet**
With anchor and stand.
Voltage: 6 - 12 Vcc o ca. Height: 30 cm.

5186 **Electric alarm model**
It can show the functioning principle of an electric alarm.
Panel dimensions: 20x22 cm. Voltage: 4 - 6 Vcc.

5178 **Extensible solenoid**
This item allows the study of the magnetic field generated by a solenoid, because it is possible to vary the coil number per length measure unit. Once the magnetic needle has been positioned toward the earthly field and the solenoid has been positioned in a perpendicular direction, the tangent of the needle's deviation angle is proportional to the intensity of the magnetic field and, therefore, to the intensity of the electric current and to the number of coil per length measure unit.
To be used with generator code 5230 or to be powered through a battery in series with resistance code 5185. Dimensions: 63x15x20h cm.

5356

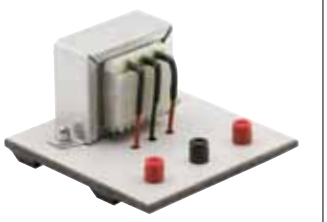
5356



5026 - 5078

5185 - 6154

8510



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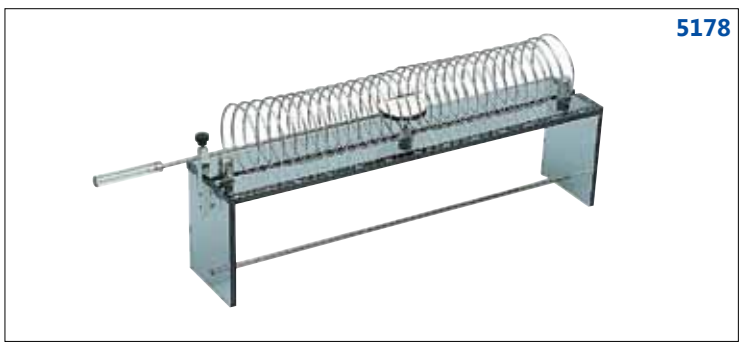

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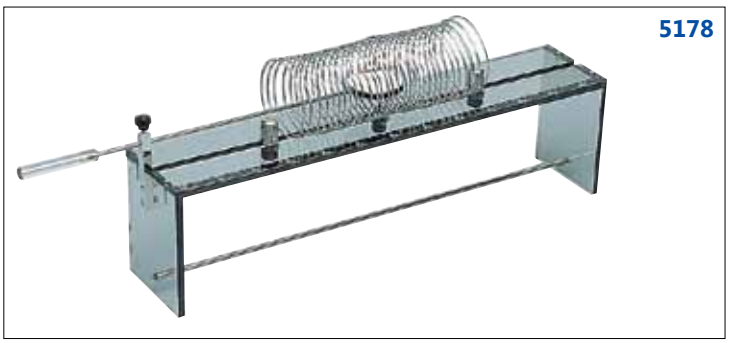

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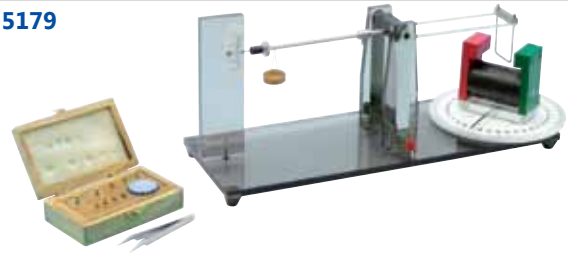

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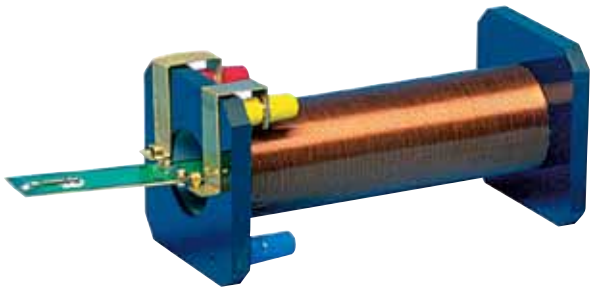


5252 Teslameter

Equipped with a sensor for measuring magnetic fields on three axes and digital 3.5 LCD data logger with three ranges:

0-20 microtesla
0-200 microtesla
0-2000 microtesla
Replaceable sensor head. 9V DC power supply
Axis-selection keys X, Y, Z; HOLD button to hold the measure.

5184 Electromagnetic actions kit

With this apparatus it is possible to experiment on currents-magnets and currents - currents interactions.

Components:
1 Frame
1 Rectangular reel
1 Linear magnet
1 "U"shaped magnet
2 Cables 60 cm
1 "U"conductor
1 Magnetic needle

5177 Apparatus for the verification of Ampère's law

It consists of two metal tracks where a cylindrical aluminium bar can roll while positioned in order to be immersed in the field of a permanent magnet. Allowing the current to flow in the aluminium bar through the use of generator (code 5230) or of a battery in series to the resistance (code 5185), the bar is solicited by a force whose direction is determined through the rule of "the left hand", Tracks length: circa 50 cm.

5179 Electromagnetic scale

One of the two arms of the scale ends with a rectangular alluminum coil whose base measures 4 cm, immersed in the field of a powerfull permanent magnet. The other arm has two sliding masses , which allow the item to obtain the equilibrium at rest.
Allowing the current to flow through the use of apparatus code 5230, or through the use of a battery in series with resistance code 5185 a force F appears between the magnetic field B and the electric current I, whose value is given by Ampere law:

$$F = B \cdot l \cdot i \cdot \sin \alpha$$

where l is the length of the conductor and α is the angle created between the conductor and the magnetic field. So it is possible to verify that the intensity of that force reaches its maximum when $\alpha=900°$ and it is void when $\alpha=0°$.
Using the apparatus code 5127, the value I of the electric current can be read directly on the built-in ammeter and, therefore, it is possible to deduce the permanent magnet's induction value B.
The experiment can be repeated replacing the permanent magnet with the solenoid, whose data sheets are included in this item.In this way it is possible to verify the ratio which gives the value of the magnetic field inside a solenoid.
Scale sensibility: 10 mg.
Dimensions: 45x17x22 cm.

Components:
1 Scale
1 Solenoid
1 Permanent magnet
1 Weight box 200 g with gram's fractions

5288 Apparatus for the electrodynamic actions

This apparatus consists of a solenoid containing a linear conductor positioned perpendicularly to the flux lines .Being possible to balance the electrodynamic interaction force, it is possible to perform quantitative experiments too.

Dimensions: 200x90x90 mm.
Internal diameter: 38 mm.

ELECTROMAGNETISM

5121 **Apparatus for the interaction between magnets and currents**
If you allow the current to flow in the reel, it is possible to highlight the force working between the magnet
and the reel. With deflector.

5308 **Tangents'compass**
Classic instrument for the measurement of the intensity of the magnetic field generated by a solenoid. If you know the coils number, you can deduce the intensity of the circulating current. Three reels with 2, 50 and 500 coils, diameter 185 mm.


5121


5308

ELECTRICAL CONDUCTION

5128 **Faraday's experiments kit**
With this kit it is possible to perform the fundamental experiments on electromagnetic induction.
Components:

SUPPLIED EQUIPMENT	
1 Battery	2Cables 60cm
1 Switch	3 Cables 30 cm
1 Galvanometer	2 Alligator clips
1 Magnet linear	1 Experiment guide
1 Double spool	1 Small box

5119 **Double reel for induced currents**
This item enables you to perform the most important experiments of Faraday on electromagnetic induction. The closure or the opening of the primary solenoid , its movement or that of its iron nucleus, produce induced currents in the secondary solenoid; these currents can be highlighted with the galvanometer code 5047.
Primary number of coils: 200. Secondary number of coils: 500x2.
Work voltage: 6 - 10V. Dimensions: Ø85x230h mm.

5273 **Double reel for induced currents**
This item is like the previous one, but smaller.
Primary number of coils: 200. Secondary number of coils: 500.
Work voltage: 6 - 10V. Dimensions: 65x65 mm

5120 **Waltenhofen pendulum**
If you allow two aluminium sectors, one whole and the other cut, to oscillate with the excited magnet, you can see that the oscillation slows down more quickly in the first instance, because of the parasitic currents.

5285 **Apparatus for the verification of Lenz's law**
This simple apparatus allows the verification of Lenz law in a simple way. If you insert a linear magnet into the non-interrupted ring, the ring is rejected , while it is attracted during the extraction of the magnet; this fact proves that the induced currents' direction is always opposite to the one of what has generated them.
The same thing doesn't happen with the interrupted ring.

5207 **Ruhmkorff's reel**
For 80 mm long sparks; power supply :6-12Vcc. It is supplied with automatic switch.

5803 **Alternator-motor model**
This item can prove the possible transformations of energy: from electric energy into mechanical one; from mechanical into electric and from electric into luminous energy.
Work voltage: 4 - 9Vcc. Dimensions: 230 x 150 mm.

5393 **Couple of hand-functioning dynamos**
They are contained into a transparent case, in order to let you see how electromagnetic induction can be exploited to produce electric energy. Moreover it is possible to verify the dynamo's principle of reversibility.

5393.1 **Manually operated dynamo**
Part of item 5393, which can be purchased separately

5128

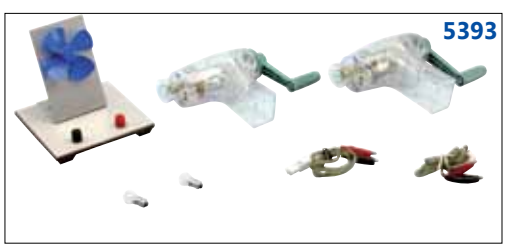

5119


5273


5120


5285

5207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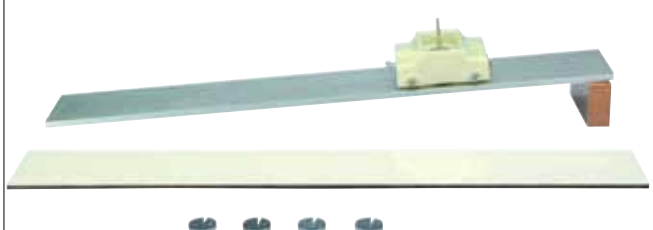
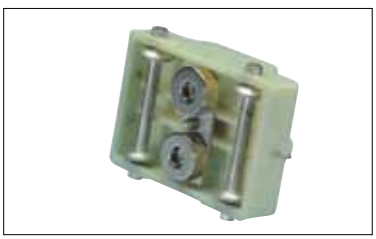




5419 **Alternator-engine model**

By turning the handle, the magnet rotates inside the coil, inducing an electric current which turns on the LEDs. Dimension: 205x125x25mm.

5713 **Apparatus for the verification of the electromagnetic induction's laws**

If you keep the magnet at a stand, the LEDs remain turned off.
When the magnet is brought near or moved away, the LEDs turn on, showing that the reel is housing an induced current.
Leaving the magnet in the reel, you can see the magnet oscillating because of the interaction between the magnet's magnetic field and the induced current's magnetic field, following Lenz law.
Dimensions: 120x95x105 mm

5114 **Modular transformer**

It consists of a nucleus made of laminated ferromagnetic material which can be divided in two parts (one is "U" shaped, the other linear) in order to replace the reels.
Max. applied voltage: 6Vca.

CONTENTS

1. The electromagnetic induction
2. Verification of Neumann's law
3. Verification of Lenz's law
4. Transformation of the alternating voltages
5. Transformation of the alternating currents
6. The auto - transformer
7. Thomson's ring
8. The induction oven

SUPPLIED EQUIPMENT

- 1 Tripod base
- 1 "U"shaped nucleus made of laminated iron
- 1 Closure joke
- 1 Support rod
- 1 Reel with 1600 coils
- 1 Reel with 400 coils
- 1 Reel 50 coils
- 1 Aluminium ring
- 1 Melting pot with handle

1342 **Apparatus for the verification of the electromagnetic induction's law and of the principle of action-reaction**

Inside the aluminium tube, a magnet falls with uniform motion and the motion's speed depends on the magnet's weight.The explanation is the following: during the fall of the magnet, the aluminum tube is linked to a variable magnetic flux and therefore it house induced currents whose directions, according to Lenz's law, are opposite to what has generated them, i.e. the magnet's motion, in this case. The consequence is that the latter , in the beginning phase, falls with uniformly accelerated motion because it's moved by a vertical force whose intensity is equal to the difference between its weight P and the electromagnetic force F. This force is proportional and opposed to the speed of the fall, i.e. it is a viscous force: F = - kv. The moment the magnet reaches the sped v_0 so that $P - kv_0 = 0$, its motion becomes uniform with speed v_0.
Thanks to the principle of action and reaction, the magnet reacts on the tube with an equal and opposite force and, therefore, during the fall with uniform motion of the magnet, the spring scale measures a force with an intensity equal to the sum of the tube's and the magnet's weights.

SUPPLIED EQUIPMENT

- 1 Metal rod
- 1 Table clamp
- 2 Clamps
- 1 Rod with hook
- 1 Spring scale
- 1 Aluminium tube 50 cm
- 1 Tube's guide
- 1 Couple of neodymium magnets with stand
- 1 Rope
- 4 Weights 10 g

5424 **Electromagnetic Fall**

A free-falling magnet going through coils produces an induced voltage that lets the LEDs turn on. The production of light energy is obtained at the expense of the kinetic energy of the magnet, which slows down when passing through the coils.
If you make a dynamic comparison with an identical magnet, falling down simultaneously along a tube without coils, it can be seen that the latter always comes down first.

SUPPLIED EQUIPMENT

- 1 Alluminium plank 600x80 mm
- 1 Plastic laminate plank 600x80 mm
- 1 Wood block 100x50x25 mm
- 1 Low-friction trolley supplied with two powerfull neodymium magnets
- 4 Weights 20 g

5327 **Uniform motion trolley**

Along the inclined plane made of plastic laminate, the motion of the trolley is uniformly accelerated; along the aluminium inclined plane, the motion is uniform because of the electromagnetic brake previously described.

5263 Set for the study of electromagnetic waves

By performing these experiments within the microwave spectrum, whose wavelength is 2.7 cm, it becomes easier for students to understand the analogy with the light waves theory.

5263

CONTENTS
1. The reflection
2. The refraction
3. The prism deviation
4. The diffraction
5. The stationary waves
6. The polarization
7. The absorption and the refractive index

CHARACTERISTICS OF THE MICROWAVE TRANSMITTER

Frequency range: 11±1.1GHz
Output power: ≥10mW
Modulation input signal: 1KHz off-on music
Modulation output signal: ≥ 1Vpp
Power: 220 ± 22V 50Hz

CHARACTERISTICS OF THE RECEIVER WITH AMPLIFIER

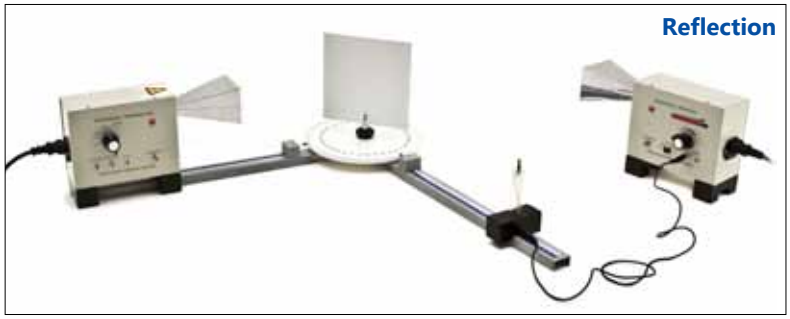
Amplifier Gain: ≥ 60dB
Power: 220 ± 22V 50Hz
Power consumption: ≤ 5W

MATERIAL PROVIDED

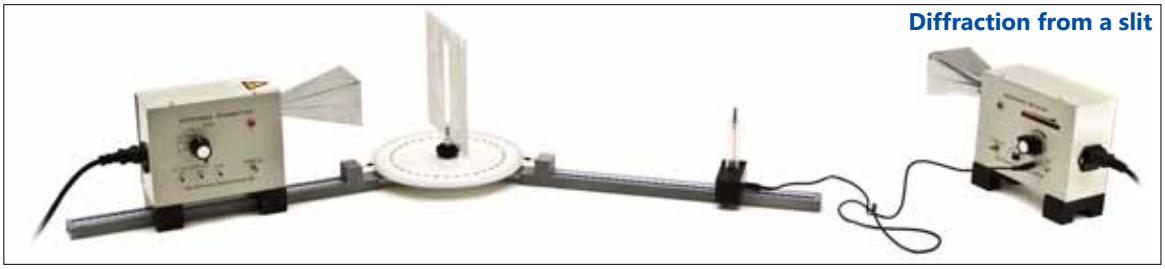
1 Microwave transmitter
1 Microwave receiver with amplifier
1 Receiver - dipole antenna
1 Connecting cable receiver
5 Metal Screens
1 Paraffin prism
1 Alignment system equipped with a goniometer
1 Vaschetta in plexiglass
1 Polystyrene panel
1 Linear rule
1 Goniometr with pin
1 Plate holder straddle clip

Absorption

Reflection



Diffraction from a slit



5354 Electromagnetic field meter

With this instrument, the field generated by high or medium voltage lines, by transformers, by industrial devices or by household appliances, can be measured in Gauss or Tesla measure units.

Range:	200 milligauss or 20 microtesla
Sensitivity:	0,1 milligauss or 0,01 microtesla
Band broadness:	from 30 to 300hz
Precision:	± 4% at net frequency
Power supply:	9V battery
Dimensions:	131x70x25 mm

5354

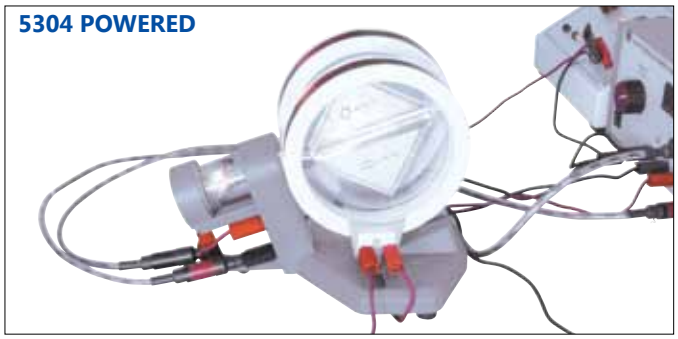
5367

5367 Plasma sphere

Glass sphere Ø 20 cm, containing a rarefacted gas mixture.
The central electrode has an alternating voltage of 10.000 volt; for this reason it creates electric discharges which spread toward the outside. If you move your finger close to the surface, the discharges concentrate in proximity of your finger because of the conductivity of the human body. So the sphere can be used to distiguish conducting objects from insulating objects.
It can be used to prove the existence and the nature of electromagnetic waves, too. In fact, a neon tube moving close to the sphere lights up because of the energy carried by the electromagnetic waves. If you interpose a paper sheet, the phenomenon goes on ,because the waves pass through it. But if you interpose a sheet of conducting metal, such as aluminium, the waves are screened and the phenomenon stops.

5304

5304 POWERED



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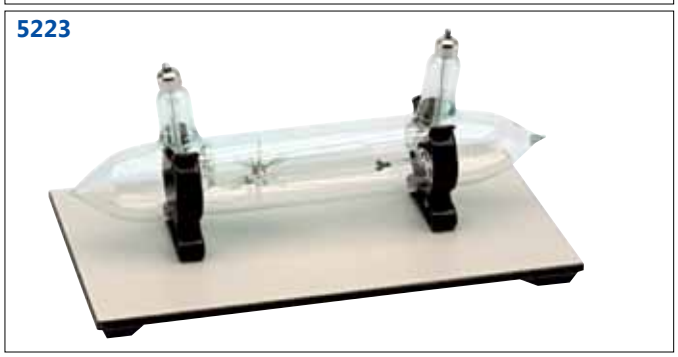


5224

5304 Apparatus for the measurement of the e/m ratio

The main part cosists of a hot cathode Thomson's tube, whose filament must be feeded with a voltage of 6,3Vac and whose anode must be fed with a voltage of 1500-5000Vdc. The beam of electrons produced is deflected by an electric field produced by a generator of medium voltage and by magnetic field created by two Helmholtz reels.The measure of the electron specific charge can be determined with a percent mistake of 5% .

POSSIBLE EXPERIMENTS
1. Nature of the cathode rays
2. Electric and magnetic deflection
3. Evaluation of the ratio e/m with a grom percentage less than 5%

For the power supply of the apparatus, it is necessary to purchase the following (or similar) generators:

5292 Medium voltage power-unit
0 - 250 Vdc with output 0 - 30 Vdc (see page 228).

5324 High voltage generator
100-5KV Vcc with output da 6,3 Vca (see page. 228).

5222 Cathode ray tube for the magnetic deflection
In this tube a white, fluorescent screen, opportunely inclined, allows you to visualize the deflection of a beam of electrons produced by a magnet. We suggest the use of the "U" shaped magnet code 5173.

5223 Cathode ray tube with whirl
This tube enables you to show the mechanical effects of the cathode rays. In fact a small, fluorescent whirl , which can rotate with little friction, starts spinning the moment the cathode ray beam hits it.

5224 Malta cross tube
With this tube it is possible to prove that the cathode rays spread in a straight line.
A Malta cross- like metal screen can be placed so as to intercept the cathode ray beam, producing a shadow zone on the screen which satisfies the laws of rectilinear propagation.

NOTE
The tubes - code 5222-5223-5224 - can be powered by the Ruhmkorff coil (code 5207) or by the 5kVcc generator (code 5324)

5409 Apparatus for the measurement of Planck's constant

The item has 5 narrow-band filters.
Digital instruments.
Power unit: 230Vac.
Dimensions: 500x150x240 mm.

With this apparatus, the determination of the fundamental constant of quantum physics, h, is obtained using Einstein's explanation of the photoelectric effect. When an electromagnetic radiation hits on certain metal surfaces, such as the photoelectric cell's apparatus cathode, some electrons are emitted. They are endowed with a kinetic energy K and, therefore, they are able to reach the cell's anode and to produce a feeble current. According to Einstein equation, the value of this kinetic energy is:

$$K = h f - L_e$$

where h is Planck's constant, f is the frequency of the incident light and Le is the extraction work that, as the name indicates, represents the minimal energy applied to the electron in order to extract it from the metal. If now we apply a voltage with proper polarity to the cell, the voltage creates an electric field that slows down the electrons. When the current running into the circuit is close to zero, it means that the electrons that reach the anode are only those with maximum kinetic energy , barely enough to pass the potential barrier,

$$K = e V_{ai}$$

In this condition, the voltage applied to the cell stops all electrons, and this is why it is called interdicting potential Vai. In other words, the kinetic energy obtained from the electrons through the photoelectric effect, is perfectly balanced by the energy of the applied electric field.

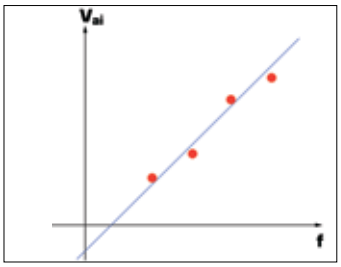
In this limit case, the equivalence between the two previous expressions is valid:

$$h f - L_e = e V_{ai}$$

hence

$$h = \frac{e V_{ai} + L_e}{f}$$

Thus it is enough to have some voltage values in correspondence of different optic filters (five filters in this apparatus) to obtain the straight line pictured beside, whose slope represents h/e.

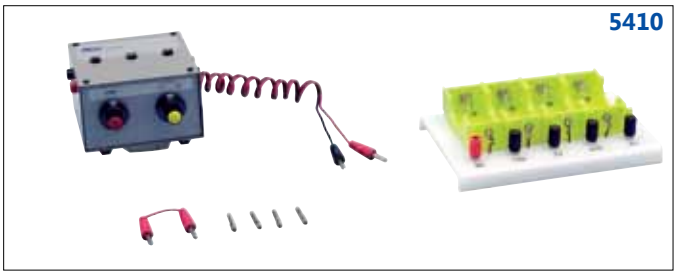


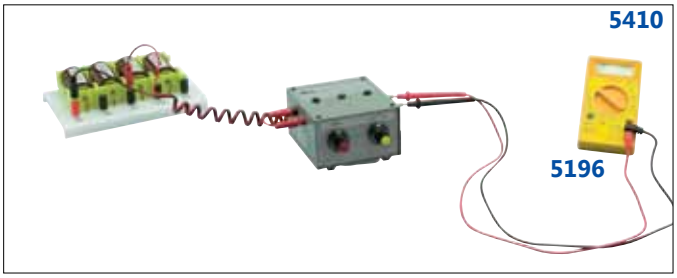
5410 Kit for the measurement of Planck's constant

The measurement of Plack's constant can be obtained also exploiting the quantum properties of the LED diodes. If a LED diode is directly polarized, it starts emitting light the moment the potential energy eVs, produced by the electrons, is enough to make them pass from the conduction band to the valence band (Energy gap). As consequence of this energy gap , every electron emits one photon of energy.

$$hf = eVs$$

If you know the potential Vs in correspondence of which the LED starts emitting a weak light , it is possible to go back to the value of h.3 LED are supplied, red green and blue, in order to verify that the higher the energy gap is, the more intense the emitted light frequency becomes.





5392 Kit for the measurement of the wavelength of a LED light.

The light emitted by a LED, is not monochromatic; it covers a small frequency band.
If you want to measure Planck's constant with a LED , it is necessary to know this band's medium frequency, which is easy to measure with this kit that exploits the diffraction grating.

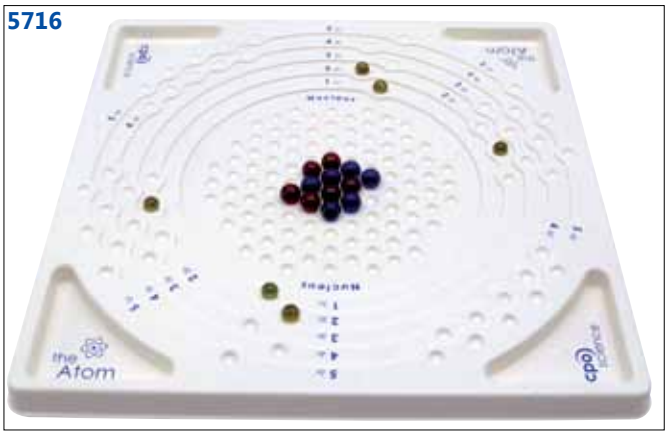
SUPPLIED EQUIPMENT

1	Linear ruler	1	Tripod base
1	LED projector with power unit	3	Bases
1	Lens +10 with lens holder	1	White screen
1	Filter holder	1	Case
1	Diffraction grating 500l/mm	1	Didactic guide

WARNING
In the order, please specify the LED colour of required.

CARBON ATOM

5716



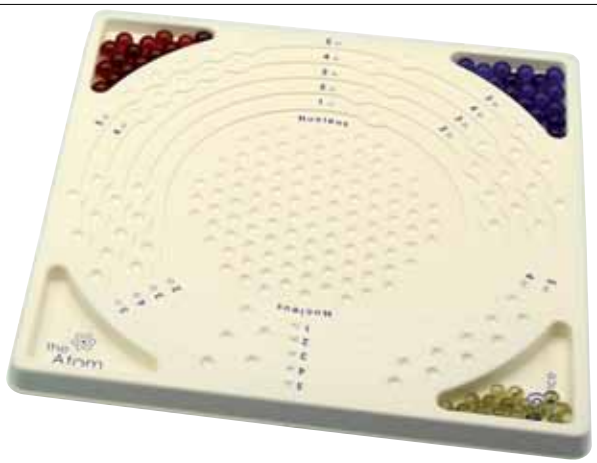
5716

Atom model

This model helps students to understand the atom, since it allows them to build different atoms, using coloured marbles representing protons, neutrons and electrons. The hollows on the table are placed so to correspond to the energetic layers of the orbits s, p, d.
So, it is possible to understand the chemical bonds, the isotopes, the emission spectrums and other atom-related concepts.

Dimensions: 475x475 mm.

5716



5413

5413 SET FOR THE STUDY OF SOLID STATE PHYSICS

Since when, in 1948, the American physicists H. Brattain, J.Bardeen and W. Shockley discovered the transistor effect, the electronic technology has seen an amazing development. The technology world is everyday more and more dominated by semiconductors, and the energetic future of mankind is tightly linked to them. But the functioning of the devices which employ the semiconductors is based on the principles of quantum physics, whose fundamental notions are normally included in the educational curriculum of high schools. This set has been designed to make easier for students to grasp concepts which are not that intuitive.
It consists of a series of explanation charts to be applied on a magnetic blackboard and of magnetic tokens representing ions, electrons and gaps. The interactive feature of the set allows the teacher to simulate some processes of interaction between photons and matter, showing the passages from a situation to the following one.

CONTENTS

1. Atom's energetic levels
2. The crystal lattice in the metals
3. The energy bands
4. Bands allowed and blocked
5. Insulators, conductors and semiconductors
6. The ohm conductor
7. The PTC thermistor
8. The NTC thermistor
9. The photo resistor
10. Doped semiconductors
11. The junction diode
12. The LED
13. Measurement of Planck constant
14. LED reversibility
15. The photovoltaic cell
16. The solar panels

EQUIPMENT SUPPLIED

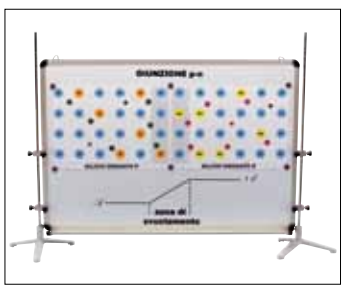
1 PTC Thermistor on a base	1 Photovoltaic panel
1 NTC Thermistor on abase	1 Resistor-holder base
1 Photoresistor on a base	1 10W 7W resistor
1 Silicon diode on a base	1 1 KW 1/2 W resistor
1 Red LED on a base	1 100W 1/2W resistor
1 Green LED on a base	1 Set of 11 tables
2 Digital multimeters	1 Set of magnetic tokens
1 Red Filter	1 equipment Case
1 Green Filter	1 tables Case
1 Blue Filter	1 Experiments guide

NOTICE
It is necessary to use a low-voltage regulated power supply in order to perform the experiments.
We recommend the instrument code 5360.

5413 - N-DOPED SILICA

5413 - P - DOPED SILICA

5413 - P-N JUNCTION



SECTION 3

INDEX

THE ENERGETIC MATTER
Over the last few years, the energetic matter has become a very important issue. The need of replacing the traditional energetic sources with alternative sources arises.
This section of the catalogue present items that allows to test the different ways of converting energy.

TECHNIQUE AND ENERGY

POWER HOUSE - GREEN ESSENTIALS

5394

5394 **Power House**

To live in a sustainable way, we must use the Earth resources at a rate at which they can be restored, so as to allow future generations to live the way we did. With this kit you can learn the alternative and sustainable energy forms by carrying out some experiments and building energy-related models. Thirty among the most significant experiments and the ten most important construction projects of the Power House kit are presented in this new Green Essentials edition.

The ten building projects include: the energy home itself, a greenhouse, a solar cells set, a passive solar collector, a solar oven, an air conditioner, a refrigerating cell, an hydrometer, a battery with lemon and a wind power generator.

Experiment with the heating, cooling and insulation of house and greenhouse. Test methods on passive solar collection by a solar collector. Fit a set of solar panels to explore actively the solar energy with the photovoltaic. Build a model of refrigerating cell and air conditioner to learn the heat transfer. Experiment with a battery with lemon to find out the storage energy. Set up a wind turbine to generate electricity from the wind.

By performing the experiments, you will read the diary of a group of young explorers who learn to live a sustainable life on an island. To survive, they must implement real versions of the projects that you are doing with the kit. Suited for an age of 10 or more.

SUPPLIED ITEMS

- 1 Wooden dowel pole
- 1 Wooden skewers
- 1 Bottle of wood glue
- 1 Light emitting diode (LED)
- 1 Solar cell
- 1 Battery holder
- 1 Electric motor/generator
- 1 Bag with 5 rubber bands
- 1 Bag with 8 connector clips
- 1 Rotor, 2 blades
- 1 Bag of wires:
  - 4 Red 340 mm,
  - 4 Black 340 mm,
  - 1 Red 300mm,
  - 1 Black 300 mm,
  - 1 Red 160 mm,
  - 1 Black 160 mm,
  - 3 Red 100 mm,
  - 3 Black 100 mm.
- 1 Fan propeller, 4 blades
- 1 Plastic wheel
- 1 Black plastic bottle with cap (solar collector tank)
- 1 Thermometer (-10 a + 110°C)
- 1 Measuring beaker
- 1 Sand paper
- 1 Bag of zinc washers
- 1 Copper wire
- 1 Set of 9 styrofoamhause parts:
  - Base plate,
  - 4 Outer walls, inner wall
  - 2 Roof pieces and a circular cover for the refrigerator
  - Transparent plastic greenhouse sheet
  - Set of die-cut cardboard pieces
- 1 Piece of black paper
- 1 Iron core

CONTENTS

WIND POWER

SOLAR ENERGY

INTRODUCTION

In this section we present several equipments, easy to use and highly effective, related to the issue of renewable energies.
How to get energy from the sun through solar cells or from hydrogen thanks to PEM cells, or simply from the wind.
These energy resources are destined to replace the traditional ones such as coal and oil.
These devices can easily be assembled and allow to understand the physical and chemical principles upon which the production of renewable energy is based.

HZ11

HZ11 **H2Go Delux**
Hydrogen cars with fuel station powered by solar panel and REMOTELY CONTROLLED.

HZ03 **H-Racer**
Hydrogen cars with fuel station powered by solar panel.

HZ06 **H-Racer 2.0**
Versione radiocomandata del modello H-Racer.

HZ04 **Hydrocar**
Car kit with reversible cell and autonomous motion, displacement sensor and flashing LEDs.

HZ12 **Ecoracer - Solar racer**
Didactic set with remotely controlled micro car, powered by electric energy produced by taking advantage of solar energy. The Solar Ecoracer set includes a small photovoltaic panel which provides the generated energy directly to a "fuel station" especially designed for recharging the small Ecoracer electric car. Remote control with forward, reverse, left and right motion, which can be used to recharge the car by connecting it by cable to the station in case of lack of sufficient light.

HZ13 **Ecoracer - Wind racer**
As the Ecoracer - Solar racer model, with the difference that the energy required is produced by a wind turbine. Remote control with forward, reverse, left and right motion, which can be used to recharge the car by connecting it by cable to the station in case of lack of sufficient wind.

HZ04

HZ03

HZ12

HZ13

HZ14 **Ecoracer - Water racer**
As the Ecoracer - Solar racer model, with the difference that the energy required is produced by a fuel cell powered by hydrogen obtained from water. The fuel cell can work both as an electrolyzer and as an energy generator. The set comes with the same remote control of the other Ecoracer models.

HZ02 **Solar Hydrogen generation Kit**
The ideal set for demonstrations and to begin to approach, having fun, the world of hydrogen and clean energy.

HZ09 **Renewable Energy Education Set**
The most complete set for the study of renewable energy. It allows to understand how you can get clean energy from the sun, the wind and the water, all in one kit equipped with all the necessary components for experiments.

HZ05 **Bio Energy Discovery Kit**
Energy from ethanol. The more compact demonstration kit on the market.
It generates electricity using ethanol without noise and combustion. It can work for days, showing the power of the new generation of fuel cells..

HZ08 **Hydro-Wind Kit**
Capture the wind power! With this kit you can use the energy produced by a wind generator to power a fuel and hydrogen cell.

HZ01 **Fuel Cell Car Science Kit**
This set uses a reversible fuel cell that combines electrolysis and energy production in a single device. Look at the hydrogen and oxygen forming in two transparent containers containing water. The car moves autonomously and automatically changes direction when meeting an obstacle.

HZ10 **WindPitch Education Kit**
Miniature wind turbine designed to assess how different quantities, sizes and blade angles influence the amount of energy produced. This kit contains 4 different models of blades, a special 3-phase AC alternator and a small device equipped with a LED voltmeter and a module for the reproduction of musical sounds.

HZ07 **Renewable Energy Monitor**
Monitoring device with LCD display, designed to detect via a PC the performances of all fuel cells and demonstration kits. Possibility to evaluate real-time voltage, current, power, resistance and even kit rotation speed with miniature wind turbines. The tool also works with battery power, can be used with or without a PC and away from electric energy sources.

5423 **Wind device**
Blowing on the blades, a LED turns on to show that wind power has transformed into electric energy.

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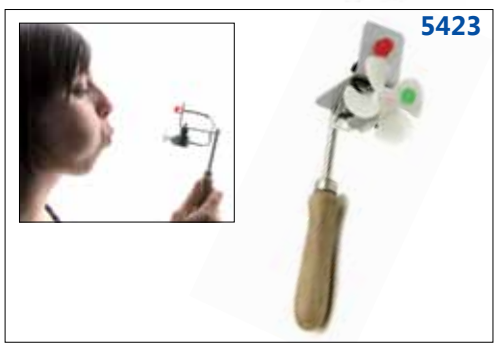

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MECHANIC ⟷ ELECTRICAL

5314 Hydraulic turbine
This model of hydraulic turbine permits to demonstrate the conversion of potential hydraulic power in electrical power, without using water sources.
It is fitted with an immersion pump which takes the water from the small basin and throws it against the turbine blades generating a continuous cycle. A voltmeter measures the voltage at the clamps of the dynamo and the electrical power produced can switch on a LED or make a small electric motor fitted with blade rotate.
The pump needs a continuous 12 V voltage.
The use of power supply cod. 5011 (not supplied with the instrument) is suggested.

5315 Wind turbine model
Used to demonstrate the conversion of wind kinetic energy into electrical power. Exposing the turbine to the wind, the movement power is transmitted to a small generator that transfoms it in electric power. Size: 25x25x30 cm.

5417 Wind turbine model with air generator
Turning the crank handle the fan begins to turn making the wind turbine rotate and the electric power switch on the LED.

5316 Air generator
Thanks to this generator it is possible to make work the wind turbine even in the absence of wind.

5320 Dynamo model
This simple model allows you to demonstrate how to convert mechanical power in electrical power.
Size: 25x25x23 cm.

5276 Small electrical motor
Supplied in an assembly kit. Working with 3-6 Vdc voltage.
Suitable to develop practical capacities of students and make them understand how works an electrical motor.
Size: 12x7x10 cm.

5803 Alternator-motor model
To demonstrate the possible conversions of energy: from electrical into mechanical;from mechanical into electrical and from electrical into luminous. Working voltage: 4-9 Vcc.
Size: 230x150 mm.

5419 Alternator-motor model
As the previous model, but in this one it is the magnet inside the bobbin which turns and works as an inductor.

THERMAL ⟶ MECHANICAL

2133 **Stirling motor (hot air)**
Stirling cycle motor, designed to work using a thermal gap lower than 20°C.
It has to be exposed to the Sun or to a 100W lamp to make it work. At steady state the rotation speed is 30-60 turns a minute. This item can be used to understand how a completely ecological motor: in fact it uses only light power and air power.
The maximum possible rendering is equal to Carnot rendering.

2071 **Two-stroke engine**
Operating section of a two-stroke engine with carburettor. Turn the crank handle, the spark of the candle coincides with the switch on of a light bulb powered by a 4,5 volt battery.
Size: 180x120x300 hmm.

2101 **Four-stroke engine**
Operating section of a four-stroke internal combustion engine made from aluminium alloy.
In evidence: the carburettor, the valves, the candles, the piston and the connecting rod.
Acting on the crank handle, the switch on of the light bulb simulates the spark of the candle.
Size: 180x120x300h mm.

2102 **Diesel engine**
Operating section of a Diesel four-stroke internal combustion engine, in aluminium alloy. In evidence:
injection device, pump, piston and connecting rod.
Size: 180x120x300h mm.

ELECTRICAL ⟷ THERMAL

5350 **Thermoelectric generator**
The sensitive part of this item consists of a Peltier cell. It is in contact on one side with a small aluminium wing to be immersed in hot water, on the other side with a small basin to be filled with ice and cold water. Due to the Seebeck effect, the difference in temperature produces a difference in potential that is noticeable at the terminals, this difference can make a small electric motor work: applying a difference in potential to the terminals (max 12V), due to Peltier effect, a great difference in temperature is set between the two faces of the ceramic block.

5374 **Peltier's cell**
It consists of 144 doped silicon bars, serial-connected and close in a ceramic block.
Maximum applicable: 12V.

RADIANT ⟶ THERMAL

2000 **Solar water heater**
It is a model of the domestic use devices. Thanks to this item you can heat water by means of sun radiant power. An immersion pump, working at 12 Vcc, make the water circulate in the heating coil of the solar panel.
After a few minutes it is possible to notice an increase in temperature.
It is supplied with a transformer.

RADIANT ⟶ ELECTRICAL ⟶ MECHANICAL

5319 **Model of solar vehicle**
This model gets the electric power from the solar panel.
When it is exposed to the sun it starts to move autonomously.

5318 **Photovoltaic panel**
Exposing the panel to the sun you will get the transformation of solar power into electrical power thanks to which the motor starts to rotate, or a light bulb switches on.
Supplied with experiments guide.
Size: 25x25x20 cm.

5395 **Model for demonstrating the transformation of solar energy into mechanical energy**
By exposing the photovoltaic cell to the sun, the small motor on whose axis a fan is applied starts rotating.


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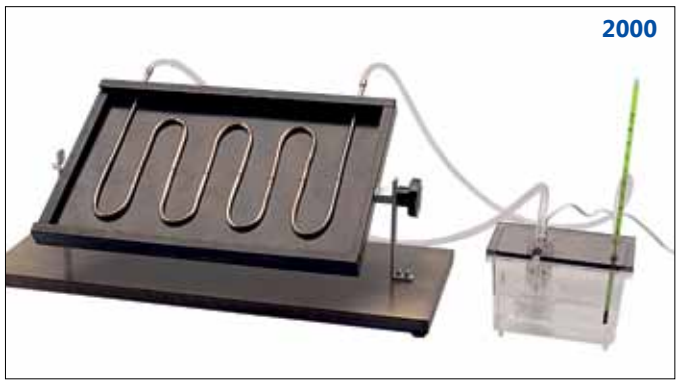
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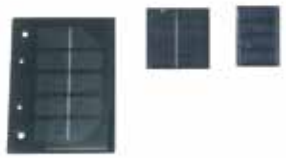

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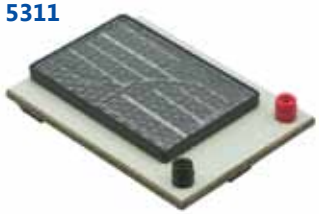

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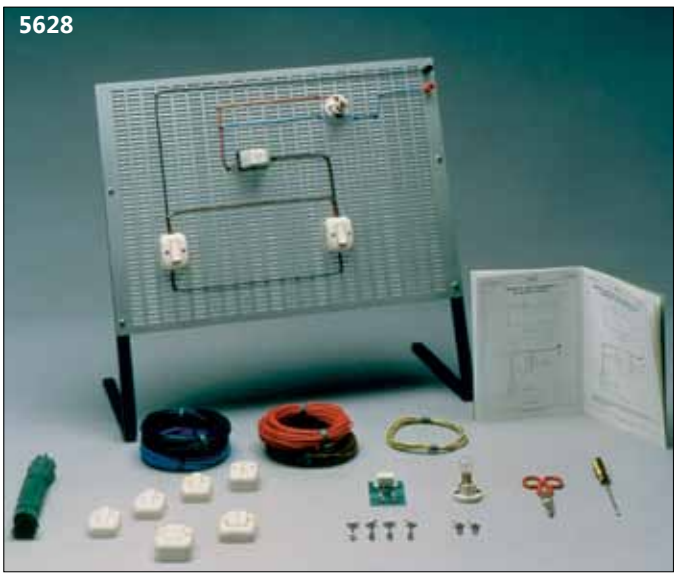

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RADIANT ⟶ ELECTRICAL ⟶ MECHANICAL

5317 Solar energy motor

Exposing the item to the sun, the panels convert solar energy into electrical power which can be used to make the disk rotating.
Size: 100x120 mm.

Photovoltaic panels

5386 Size: 13x10 cm.
5387 Size: 6x6 cm.
5388 Size: 4x6 cm.

5311 Photovoltaic panel with base

Suitable for rendering measurements. Panel size: 10x6,5 cm.

ELECTRICAL ENERGY AT HOME

5628 Electricity at home

FEASABLE CIRCUITS
1. Light system driven by a unique switch.
2. Light system with two serial lamps driven by a unique switch.
3. Light system driven by a unique switch and socket.
4. Light system with two parallel lamps driven by a commutator.
5. Light system driven from two switches with diverters.
6. Light system driven by two switches with interruption power relay.
7. Light system driven by three switches.
8. Alarm system with two switches

SUPPLIED ITEMS

1	Aluminium panel fitted with clamps for power supply	1	Commutator	4	Screws M3 20 mm
2	Metallic supports for panel, fitted with screws and wing nuts	2	Lamp-holder	20m	Blue cable Ø 0,75 mm
1	Switch	2	Lamps	20m	Brown cable Ø 0,75mm
2	Diverters	1	Power interruption relay	20m	Black cable Ø 0,75 mm
1	Inverters	1	Alarm	20m	Red cable Ø 0,75 mm
2	Buttons	1	Screwdriver	2m	Yellow-green cable
1	Socket	1	Electrician scissors	10	Wing nuts M3
		1	Set of devices to fix wires	1	Plastic holder
		6	Screws M3 30 mm	1	Experiments guide

5412 Fuel cell with separable devices

This item permits to do measurements concerning conversion of light power into electrical energy.
The light energy produced by a 75 W lamp(similar to solar energy) is converted into electrical power by a photovoltaic panel.
This electrical energy is used to separate, thanks to a PEM electrolytic cell, (Proton Exchange Membrane) water molecules in the constituent components (with an increase in chemical potential energy contained in hydrogen and oxygen gases).
The two gases are mixed again through a PEM fuel cell, producing water and electric energy again, which is used to operate a fan (mechanical energy) by a small electric motor.
The two PEM cells are identical and are both used as electro-chemical converters, once in a direction and then in the opposite.

SUPPLIED ITEMS

1	Barrel base	1	PEM fuel cell	2	Taps
1	Projector	1	Small motor with fan	4	Adaptors
1	220V - 75W lamps	2	Bases for distribution	1	Distil water bottle
1	Solar panel	8	Cables	2	Tubes
1	PEM electrolytic cell with tanks	1	Syringue	2	Plugs