

simple - fast - safe

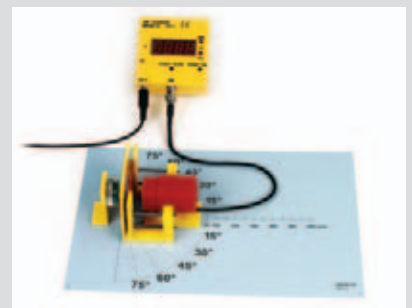
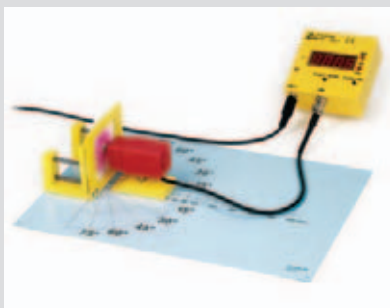


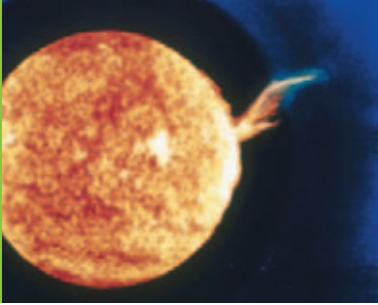
the world of experiments

atomic and nuclear physics



fundamentals
spectral analysis
radioactivity
atomic structures





fundamentals

DR400-ZN Zinc plate, on plug-pin

For demonstrating the photoelectric effect; polished zinc plate with 4-mm plug pin for mounting it directly on the base of electroscopes DE500-1E or, when using "inno" static voltmeter DE722-1H as an indicating device, on screw post DS406-2N inserted into sleeve on plug P3711-4H
Dimensions: 160x110 mm



Experiment: Photoelectric effect

Electron tubes with heated cathodes and accessories

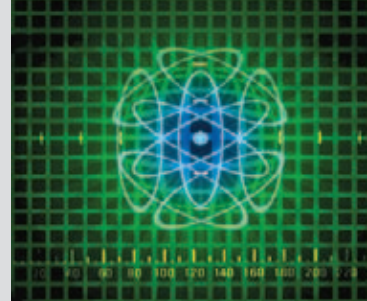
This tube series has been especially developed for students to use in experimentally investigating the properties of electrons as well as many areas of atomic physics. It also offers a stable apparatus set-up in a low position when used with applications in conventional tube technology.

All of the tubes may be used with electron tube mount DR100-1A. It allows clearly structured experiments to be performed on the following topics:

- Thermionic emission
- Linear propagation of electrons in the absence of a field
- Deflection by magnetic and electrical fields
- Wave-particle duality of electrons
- Determining the polarity of electron charges
- Determining the specific charge (e/m)
- Excitation spectrum of inert gases
- Inelastic electron collisions
- Distinguishing between the principle and secondary quantum numbers of atoms in an excited state

While some of the electron tubes are powered by low-voltage electricity, when powering tubes with high-voltage electricity of up to 5 kV, no ionizing radiation occurs outside of the tube, thus eliminating the need for radiation protection!





Student experiment tubes	DR100-1A Electron tube mount	DR100-1B Helmholtz coils	DR100-1C Auxiliary coil	P3171-1A High-voltage power supply 10 kV	P3150-5A Electron tube power supply	DR120-1S Critical potentials tube control unit
DR110-1D Diode	X				X	
DR110-1T Triode	X				X	
DR110-2T Gas triode, helium-filled	X				X	
DR111-1S Maltese cross tube	X	O		X		
DR112-1P Perrin tube	X	X	O	X		
DR115-1E Electron deflection tube	X	X		X		
DR115-2E Electron diffraction tube	X	X		X		
DR117-1L Luminescent tube	X			X		
DR118-1D Double beam tube	X	X			X	
DR120-1H Critical potentials tube	X					X

X = additionally required, O = additionally recommended

DR100-1A Electron tube mount

Mounting device for student experiments, suitable for the entire electron tube series (DR1xx-ff) and matching accessories such as Helmholtz coils (DR100-1B) and the auxiliary coil (DR100-1C); tubes are mounted in a five-pin socket and almost all connections with the tube can be made by means of 4-mm jacks; an integrated cathode protection circuit, which protects the heated cathode against overvoltage, facilitates tube exchange as well as easy and safe tube operation; base plate contains a slot with metric scale for accommodating the Helmholtz coils and allowing coils to be mounted at variable distances of up to 150 mm apart; an additional coil may be attached to the front side of the mount
Dimensions: 130x190x250 mm; weight: 570 g

DR100-1B Helmholtz coils, pair, for electron tubes

Used in electron tube mount DR100-1A for generating magnetic fields in experiments in electron beam deflection; coils may be set up in a Helmholtz configuration or at varying distances apart in order to generate a magnetic field at right angles to the axis of the tube or one tube may be used to generate a coaxial field
Number of turns: 320 each

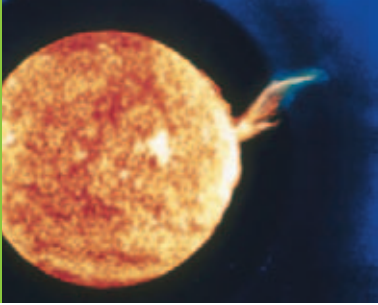
Coil diameter: 138 mm
Max. load: 3000 A/m (12 V DC, 1.0 A; continuous), 4500 A/m (18 V DC, 1.5 A; peak)
Effective resistance: $R = \text{approx. } 6 \text{ Ohm}$
Connection: 4-mm jacks



DR100-1C Auxiliary coil

May be mounted on the electron tube mount between Helmholtz coils to generate a B-field at right angles to the tube axis; using such a field along with Perrin tube DR112-1P, the phenomenon of horizontal cathode ray deflection and, at the same time, the basic principles underlying the cathode ray oscillograph can be demonstrated
Number of turns: 1000

Max. load: 2 A
Effective resistance: $R = \text{approx. } 7.2 \text{ Ohm}$
Connection: 4-mm jacks



fundamentals



DR110-1D Diode (tube-shaped)

For investigating the Edison effect (thermionic emission); used to demonstrate emission current as a function of cathode heat, to record the characteristic curve of a diode and demonstrate its use as a rectifier and to determine specific charge (e/m) by means of the magnetron method (Helmholtz coils DR100-1B required)

Cathode heating voltage: V_h d 7.5 V, I_h d approx. 3 A

Anode voltage: V_a d 300 V

Anode current: typically I_a = approx. 6.0 mA

Additionally required:

DR100-1A Electron tube mount

P3150-5A Electron tube power supply

DR110-1T Triode (tube-shaped)

Used in quantitative investigations of high-vacuum tubes able to be controlled, in tracing the characteristic curve of a triode, in determining the negative polarity of an electron charge, in generating a cathode ray (model of an "electron gun") and in investigating technical applications of the triode as an amplifier and oscillator (with Helmholtz coils DR100-1B)

Cathode heating voltage: V_h d 7.5 V, I_h d 3 A

Anode voltage: V_a d 300 V

Anode current: typically I_a = approx. 1.4 mA

Grid voltage: -300 V d V_g d 300 V

Grid current: typically I_g = approx. 0.9 mA

Additionally required:

DR100-1A Electron tube mount

P3150-5A Electron tube power supply



DR110-2T Gas triode, helium-filled

Used in quantitative investigations of the properties of gas-filled triodes, in tracing the I_a - V_a characteristic curve of a thyatron, in observing self-sustained and controlled discharges and in observing the discontinuous loss of energy by He atoms during inelastic collisions with free electrons

Cathode heating voltage: V_h d 7.5 V, I_h d 3 A

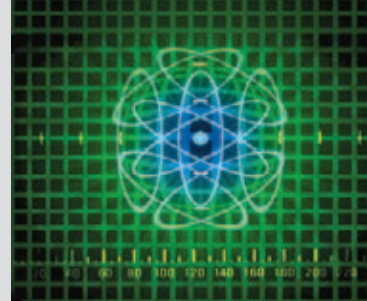
Anode voltage: V_a d 300 V

Grid voltage: -300 V d V_g d 300 V

Additionally required:

DR100-1A Electron tube mount

P3150-5A Electron tube power supply



DR111-1S Maltese cross tube

Possible experiments: demonstrating linear propagation of electron beams in the absence of fields (by projecting the shadow of a Maltese cross onto a fluorescent screen); observing, by way of introduction to electron optics, how magnetic fields produce bundles of rays; comparison of the shadows produced by electron beams and electromagnetic radiation (light) in a magnetic field. A hole in the lower arm of the cross allows the orientation of its shadow, under the influence of a magnetic field, to be identified.

Cathode heating voltage: V_h d 7.5 V, I_h d 1.8 A

Anode voltage: V_a d 5 kV

Anode current: typically $I_a = 150$ A at V_a of 4.0 kV

Additionally required:

DR100-1A Electron tube mount

P3171-1A High-voltage power

supply 10 kV

Recommended accessory:

DR100-1B Helmholtz coils

Variable DC power supply

supply 10 kV



DR112-1P Perrin tube

Possible experiments: demonstration of the negative polarity of electron beams (to this end beams are deflected magnetically and electrically by the Faraday cage, mounted on the side, which is connected to "inno" static voltmeter DE722-1H or an electroscope such as DE500-1E); investigating the behaviour of electron beams in two alternating magnetic fields at right angles to each other (working principle of the cathode ray oscilloscope, Lissjous figures); and estimating specific electron charge (e/m).

A fluorescent screen is mounted at the front end of the tube.

Cathode heating voltage: V_h d 7.5 V, I_h d approx. 0.35 A

Anode voltage: V_a d 5 kV

Anode current: typically $I_a = 150$ A at V_a of 4.5 kV

Beam current: typically $I_a = 4$ A at V_a of 4.5 kV

Deflection voltage: V d 350 V

Additionally required:

DR100-1A Electron tube mount

DR100-1B Helmholtz coils

P3171-1A High-voltage power supply 10 kV

Variable DC power supply

Recommended accessory:

DR100-1C Auxilliary coil



DR115-1E Electron deflection tube (Thomson tube)

For investigating electron beams within electrical and magnetic fields; possible experiments include determining specific charge (e/m) based on compensation of magnetic deflection by electrostatic deflection, determining the radius of curvature of electrons in a magnetic field and estimating electron velocity; a built-in plate capacitor provides electrostatic deflection, while Helmholtz coils DR100-1B (supplied separately) may be used to provide magnetic deflection; the path of the electron beam is made visible by a fluorescent screen (with scale) inclined at 10° to the axis of the beam

Cathode heating voltage: V_h d 7.5 V, I_h d 3 A

Anode voltage: V_a d 5 kV

Anode current: typically $I_a =$ approx. 0.2 A at V_a of 4 kV

Deflection voltage: V d 350 V

Additionally required:

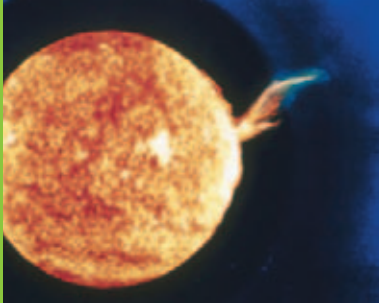
DR100-1A Electron tube mount

DR100-1B Helmholtz coils

P3171-1A High-voltage power supply 10 kV

Variable DC power supply





fundamentals



DR115-2E Electron diffraction tube

Possible experiments: demonstrating the wave properties of electrons by observing interference, visible on the fluorescent screen, resulting from electrons passing through a polycrystalline graphite grid (Debye-Scherrer refraction); determining the wavelength of monochromatic beams at various anode voltages on the basis of the radii of diffraction rings and the spacing of the diffracting graphite planes; confirming the Broglie hypothesis

Cathode heating voltage: V_h d 7 V, I_h d 0.4 A

Anode voltage: V_a d 5 kV

Anode current: typically $I_a = 0.15$ mA at V_a of 4.0 kV

Focusing voltage: V d 50 V

Additionally required:

DR100-1A Electron tube mount

P3171-1A High-voltage power supply 10 kV



DR117-1L Luminescent tube

Used to investigate luminescence occurring during and after projection of electrons at a phosphor anode as well as the excitation of fluorescence and phosphorescence; luminescence may also be observed after ultra-violet light is projected at the phosphor anode

Cathode heating voltage: V_h d 7.5 V, I_h d 1.8 A

Anode voltage: V_a d 5 kV

Anode current: typically $I_a = 150$ A at V_a of 4.0 kV

Additionally required:

DR100-1A Electron tube mount

P3171-1A High-voltage power supply 10 kV



DR118-1D Double beam tube

Helium-filled tube including tangential and axial electron guns; the paths of the electron beams are seen as narrow luminescent beams that become visible when helium atoms are excited by electron collision; used during tangential projection under the influence of a right-angle magnetic field in determining specific charge (e/m) as a function of the beam diameter and in observing electron spiralling in a coaxial magnetic field during axial projection

Cathode heating voltage: V_h d 7 V, I_h d 0.35 A

Anode voltage: V_a d 300 V

Anode current: I_a d 30 mA

Deflection voltage: V d 60 V

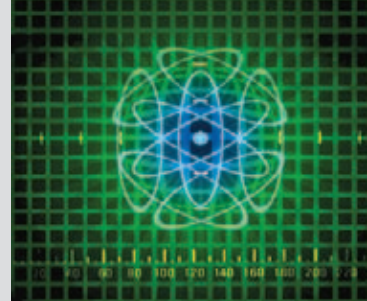
Additionally required:

DR100-1A Electron tube mount

DR100-1B Helmholtz coils

P3171-1A High-voltage power supply 10 kV

P3150-5A Electron tube power supply; variable DC power supply



DR120-1H Critical potentials tube (Hertz tube), helium-filled

For quantitative investigation of inelastic collisions of electrons with atoms of inert gases, determining ionization energy as well as the excitation energy of helium, resolution of the various energy states of the principle and angular momentum quantum numbers and for evidence of meta-stable states; includes shielding, a discharge tube as well as a battery unit for providing collector voltage (battery supplied)

Cathode heating voltage: V_h d 3 V, I_h d 1.3 A

Anode voltage: V_a d 60 V

Anode current: I_a d 10 mA

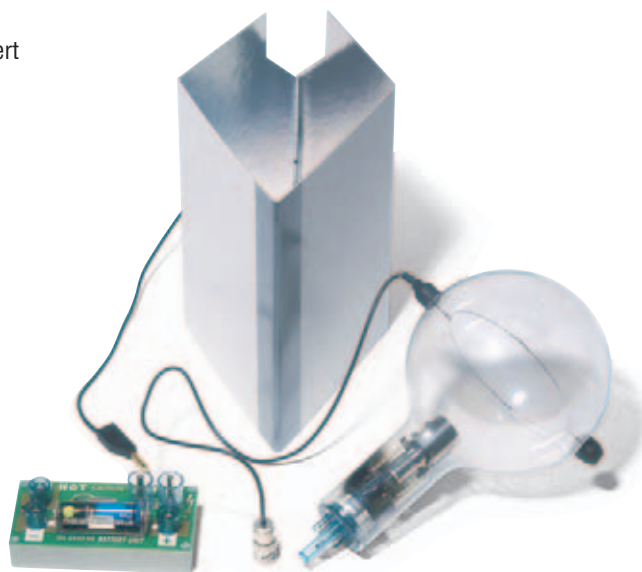
Collector voltage: $V_c = 1.5$ V

Collector current: I_c d 200 pA

Additionally required:

DR100-1A Electron tube mount

DR120-1S Critical potentials tube control unit



DR120-1S Critical potentials tube control unit

Control unit for operating the Hertz critical potentials tube; output for sawtooth acceleration voltage with adjustable upper and lower voltage limits; built-in pico-ammeter amplifier for measuring anode current; a slow sawtooth voltage output (approx. 6 sec per cycle) allows recording of acceleration voltage as a function of anode current using a PC interface or an XY recorder, while a sawtooth voltage output with a repetition frequency of 20 Hz facilitates oscilloscope observations

Input: BNC jack for anode current measurement

Output terminals:

Tube: Sawtooth acceleration voltage, 0-60 V, 20 Hz

Fast: 0-1 V voltage signal, proportional to acceleration voltage, for oscilloscope observation

Slow: 0-1 V voltage signal, proportional to acceleration voltage, for recording data using an XY recorder or a PC interface

Anode current: 0-1 V voltage signal, proportional to anode current (1V/nA)

Power supply: 12 V DC

Dimensions: 170x105x45 mm



DR122-1G Gas discharge tube

For observing phenomena, such as the cathode-glow lamp, positive column and canal rays, associated with electrical discharge in gases as a function of gas pressure and type; a fluorescent screen is found at both ends of the discharge tube; designed to be dismantled; including a needle valve and vacuum hoses Tube may be mounted in the gas discharge tube stand (included)

Length: 280 mm

Polarizing voltage: V d 5 kV

Discharge current: typically $I = 1.2$ mA

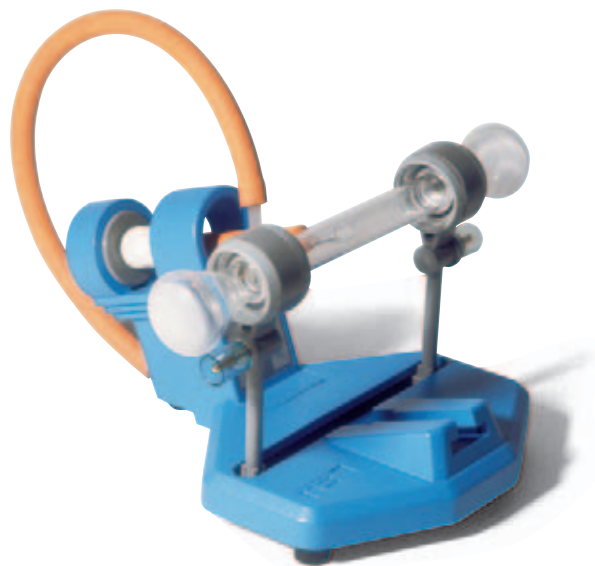
Connection: 4-mm plug-pins

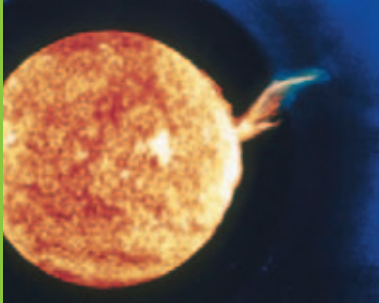
Additionally required:

DR100-1A Electron tube mount

P3171-1A High-voltage power supply 10 kV

DM500-2F Vacuum pump, rotary vane, two-stage





spectral analysis



Spectral lamps

Light sources used when high illumination density and spectral purity are required
Base: Pico 9; operating current: 1 A

DL102-HG Spectral lamp Hg
DL102-NA Spectral lamp Na

Additionally required:

DL102-3G Spectral lamp housing
DL102-3D Spectral lamp power supply



DL102-3G Spectral lamp housing

For housing and operating spectral lamp
DL102-HG or DL102-NA with Pico 9 base

Note: spectral lamp power supply DL102-3D
is required in order to operate the lamp.



DL102-3D Spectral lamp power supply

With choke coil for operating spectral lamp
DL102-HG or DL102-NA with Pico 9 base

Note: spectral lamp housing DL102-3D
is required in order to operate the lamp.



DL103-1M High pressure mercury vapour lamp

Specially designed for investigating the mercury spectrum; note: for operating the lamp, the E27 Terko light bulb socket (DE312-3P) and the spectral lamp power supply (DL102-3D) are required.

DE312-3P Light bulb socket, E27, Terko
E27 ceramic socket; power cord with Terko plug, L=approx. 80 cm; on support: L=160 mm, D=10 mm



Spectral tubes

Used in investigating the line and band spectra of various gases and vapours; operating voltage < 5 kV (no danger of radiation)

DL104-AR Spectral tube Ar
DL104- H2 Spectral tube H2
DL104- HB Spectral tube H2 - Balmer
DL104-HE Spectral tube He
DL102-HG Spectral tube Hg (with argon)
DL104-N2 Spectral tube N2
DL104-NE Spectral tube Ne
DL104-O2 Spectral tube O2

Suitable power supply:

P3171-1A High-voltage power supply, 10 kV, with digital display, "demo"



Experiment set-up:

Observing the sodium spectrum



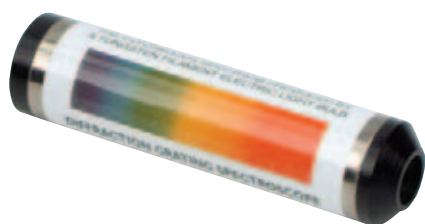
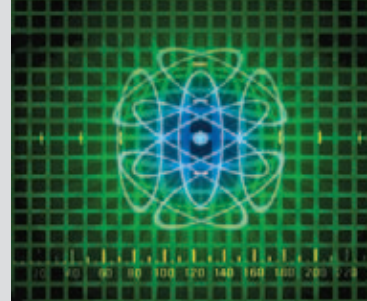
DL105-1H Spectral tube holder

Securely holds spectral tubes DL104-ff and ensures electrical contact

DL104-1A Slitted shade

Black powder-coated aluminium tube; fits over spectral tubes DL104-ff

spectral analysis



DL550-1T Pocket spectroscope

Handheld model for observing spectra in discharge tubes, Fraunhofer lines, flame tests and absorption spectra in liquids; optical system includes a built-in diffraction grating with 600 lines/mm; slit width: 0.2 mm
Dimensions: L=115 mm, D=25 mm



DL512-1S Spectrometer and goniometer

For observing and measuring spectra, for measuring the angle of deflection from prisms and gratings and for determining visible dispersion and the index of refraction; rigidly mounted collimator tube ($f = 150$ mm) with an adjustable slit; swivelling platform ($D=170$ mm) with a set screw; equipped with a scale in 1° graduations from $0-360^\circ$; adjacent vernier scale allows readings with a precision of 0.1° to be taken; telescope with set screw and fine adjustment may be swivelled around the platform; prism table with three levelling screws as well as tapped holes for mounting the holder for prisms or gratings (included); supplied in a wooden case
Dimensions: height: 210 mm; length: 530 mm; weight: 4.5 kg

Additionally required:

DL515-2P Prism, flint glass

Average index of refraction: 1.62; average dispersion: 0.017

DL402-3R Slide with line grating, 600 lines/mm, glass

High-quality grating for quantitative experiments in spectrometry
Grating size: 25x25 mm; dimensions: 50x50 mm



DL512-2G Precision spectrometer and goniometer

For observing and measuring spectra, for measuring the angle of deflection from prisms and gratings and for determining visible dispersion and the index of refraction; rigidly mounted collimator tube ($f = 178$ mm) with an adjustable slit; swivelling platform ($D=150$ mm) with a set screw; precision of readings: $1'$; telescope with set screw and fine adjustment may be swivelled around the platform; rotatable prism table with three levelling screws as well as tapped holes for mounting the holder for prisms or gratings (included); supplied in a wooden case
Dimensions: height: 275 mm; length: 580 mm; weight: 8 kg

Additionally required:

DL515-2P Prism, flint glass

Average index of refraction: 1.62; average dispersion: 0.017

DL402-3R Slide with line grating, 600 lines/mm, glass

High-quality grating for quantitative experiments in spectrometry
Grating size: 25x25 mm; dimensions: 50x50 mm

Accessories for spectral analysis (not shown):

C6830-1A Salts for flame tests

Salts for spectroscopic investigations; set of six test substances in a plastic container: barium chloride, calcium chloride, potassium chloride, lithium chloride, sodium chloride, strontium chloride

C7774-2S Magnesium rods, set

For use in flame tests; 40 magnesium rods, $L=140$ mm

C7129-1P Platinum wire with glass handle

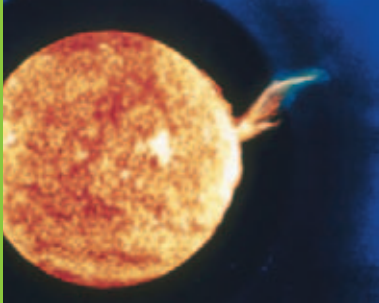
For introducing salts (C6830-1A) into a flame when doing tests; platinum wire with a handle of melted glass around it

C7520-1A Cobalt glass filter, 50x50 mm

For observing flame colouring when testing for sodium or potassium; cobalt glass plate with polished edges, 50x50x2 mm



Experiment: Measuring the spectral lines of the mercury vapour lamp

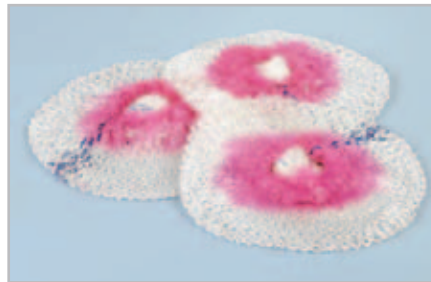


radioactivity



DR270-1S Warning sign, "Radioactivity"

For indicating the hazard when performing experiments with radioactive preparations; plastic panel mounting in plate clamp on support DS404-1M, labelled with symbol and wording
Dimensions: 230x150 mm



DR275-1G Gas mantles, set of 3
For demonstrating natural sources of radioactivity (e.g. potassium chloride); commercially available gas mantles in a transparent plastic bag



DR200-1R Radioactive preparations, set of 3

Sources of radioactivity for investigating the properties of alpha, beta and gamma radiation

Set DR200-1R consisting of:

DR209-PO Po-210 preparation (alpha radiation)

Emits alpha radiation (polonium-210) with activity (A) = 3.7 kBq; half-life: 138.40 days; emits alpha particles with a maximum energy level of 5.305 MeV

DR209-SR Sr-90 preparation (beta radiation)

Emits beta radiation (strontium-90) with activity (A) = 3.7 kBq; nuclide decays to its daughter particle yttrium-90 which emits beta particles with a maximum energy level of 2.27 MeV; the half-life of Sr-90 is 28.9 years, and the Sr-90-Y-90 system also decays at this rate

DR209-CO Co-60 preparation (gamma radiation)

Emits gamma and beta radiation (cobalt-60) with activity (A) = 37 kBq; half-life: 5.258 years; in addition to beta radiation, which is absorbed by the radiation window, it emits gamma rays with an energy level of 1.17 and 1.33 MeV

This source is supplied with two lead-cylinders for protection of gamma radiation



DR200-BK Blue fertilizer, 250 g

Commercially available potassium fertilizer with approx. 20% K₂O; specific activity is 5.14 Bq/g for the K-40 nuclide; 250 g in a plastic bottle with screw-on lid

DR200-KC Potassium chloride, 250 g

This naturally available substance contains the primordial radionuclide K-40, 0.0117 atomic percent of which is present in potassium; specific activity is 16.2 Bq/g for the K-40 nuclide; 250 g in a plastic bottle with screw-on lid

Preparation design:

The radioactive substances, which are glued into plastic discs (D=25 mm, H=5 mm) with a 6-mm hole at centre, are positioned in such a way that they are covered by a thin plastic coating or, in the case of polonium, by an adhesive metal foil in the area from which radioactivity is emitted. The plastic discs themselves are labelled by colour as well as with the radioactive warning symbol and the wording "radioactive material". In addition, details on the type of radiation, activity and the half-life as well as the name of the radionuclide and of the product are given. The plastic discs are embedded in cylindrical acrylic cases (D=30 mm, L=12mm). The acrylic cases have an M6 tapped hole on the back side, allowing them to be screwed onto the magnetic mount for radioactive preparations (DR201-1R).

Recommended accessory:

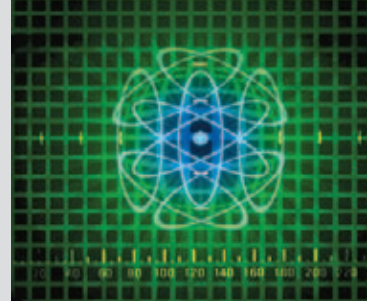
DR201-1R Radioactive preparation mount, magnetic

For vertically mounting preparations DR209-ff in a fixed position; metal bracket with a threaded M6 rod at axis height; base (17x30mm) equipped with two neodymium magnets
Total height = 50 mm; axis height = 35 mm

Preparations DR209-ff have been inspected and approved for school experiments, as attested to by an experts' report. Every delivery is accompanied by a copy of the report as well as of approval of the container design. These accompanying documents must be kept and presented upon request to authorities responsible for inspection. Guidelines and advice for handling, storing and experimenting with these preparations is contained in these documents as well as in radioactivity experiment manual DR990-9SE.

The activity of the individual sources of radiation listed under DR209-ff is within the limits set forth by the regulation on radiation protection. All sources have been tested for tightness by the manufacturer, and thus all of them are without exception "sealed sources".

Prior to delivery, the user (i.e. the particular school or institution with an indication of authorized or responsible persons) must sign the "standard document pursuant to Council Regulation (EEC) No 1493/93" and submit it to the relevant competent authority in the receiving country. You may request this document from us. Sources can only be delivered upon receipt of a duly completed standard document.



DR280-11 Isotope generator

For experiments in measuring half-life using barium isotope Ba-137, having a half-life of 2.6 minutes and thus being ideal for instructional purposes; the isotope generator uses the caesium isotope Cs-137, having a half-life of 30 years, as a parent substance; Ba-137, continuously generated by the parent substance, is bled from it by means of an eluting solution and the resulting gamma rays are measured

Activity: 370 kBq

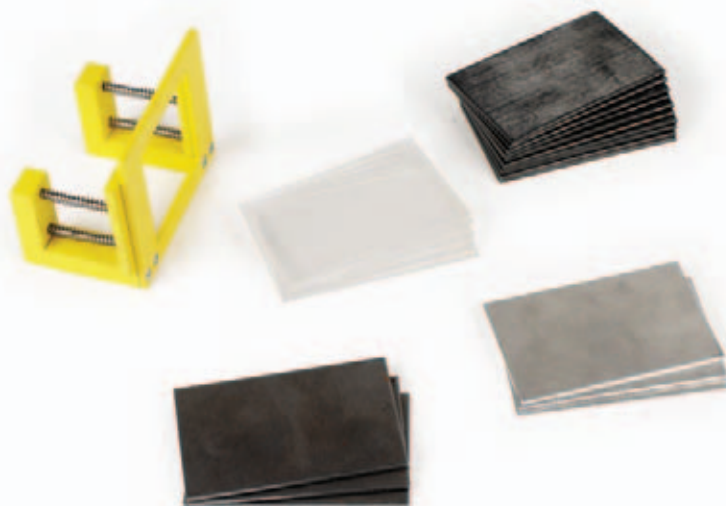
Number of elutions: > 1000

Supplied as a complete set consisting of: isotope chamber, plastic syringe, hose, 10 small steel test plates, sheet with directions, storage box and 250 ml of eluting solution



DR270-1K Storage cabinet for radioactive substances

Steel cabinet for safe storage of radioactive preparations in the lab storage room; steel cabinet, painted yellow, with a cylinder lock, one (fixed) shelf and labelled with the warning symbol
Dimensions: 215x85x287 mm



DR250-1A Radiation absorption plates, set

Plates of various materials for absorbing radiation; materials: 5x acrylic, 10x lead, 3x steel, 3x aluminium
Plate dimensions: 80x50x2 mm each

DR212-1H Absorption plate mount, magnetic

For vertically mounting up to 10 absorption plates either magnetically, on a metal panel, or directly on a lab table; durable and variable metal clamping mount with four springs; max. clamp opening: 23 mm; four neodymium magnets built into the base
Window size: 60x50 mm
Dimensions: width=94 mm, height=70 mm, depth=54 mm

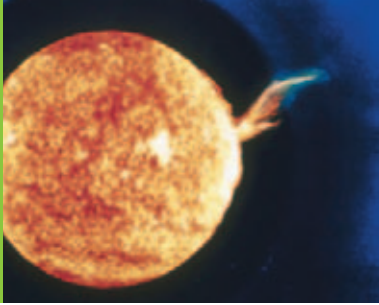


DR310-1W Cloud chamber

Wilson cloud chamber used to make alpha rays visible by means of the traces left in a super-saturated atmosphere; metal plate with a rubber ball mounted on a support (D=10 mm) and a removable transparent plastic chamber; tapped hole to accommodate radioactive pin DR310-2W; accessories included: plastic bottle containing a mixture of methanol and water, pipette
Chamber diameter: 90 mm.

DR310-2W Radioactive pin

Radioactive preparation mounted in a metal pin for use with cloud chamber DR310-1W
Activity: 3.7 kBq (not shown)



radioactivity



DR291-1Z Geiger-Mueller tube on magnetic base

For registering the presence of alpha, beta and gamma rays; tube in a red acrylic case (28x28x60 mm) and mounted on a support rod with a magnetic base (60x30 mm); line marking centre; cord with BNC plug permanently attached; plastic lid to protect the end window

Gas filling: Ne & halogen

End window made of mica, 9.1 mm in diameter

Plateau voltage: approx. 500 V

Dimensions: 30x60x49 mm,

Axis height: 35 mm



DE722-1G Geiger-Mueller counter, "inno"

Demonstration instrument for measuring ionizing radiation; very easy to transport and magnetically mountable; the 26-mm LED display allows precise readings to be taken even at a great distance

Technical data:

Display: 4-digit LED display; digit height 26 mm

Switch: ON-OFF

MODE switch:

- IMP setting: manual start and manual stop
- MAN setting: manual start, one measurement is taken during the interval set on the TIME switch
- AUTO setting: measurement cycle is repeated for the interval set on the TIME switch

TIME switch: for the MAN and AUTO modes a valid measurement interval of

1, 10 or 100 seconds may be selected

SPEAKER switch: switches the speaker on or off

START switch: starts and stops measurement in IMP mode and starts it in MAN mode

GATE LED: indicates counter gate state

Analogue output through a 3.5 mm phone jack (10mV/Hz)

BNC jack for connecting tube DR291-1Z

Power supply: 4 x 1.5 V mignon cells (included) or 5.5-mm hollow DC jack for 6 V/500 mA

external power supply P3120-6N

Case: green ABS plastic with yellow labelling

Dimensions: approx. 160x120x45 mm; weight: approx. 475 g



MB260-1D Geiger-Mueller counter, "compact"

Compact digital instrument for measuring sources of radioactivity; this instrument, with a magnetic base, features a red, 4-digit LED display 13 mm tall, an acoustic signaller, a BNC socket for connecting Geiger-Mueller tube DR291-1Z and two LEDs indicating measuring mode and state

START/STOP measuring mode: measurement started and stopped manually

START 10 s measuring mode: manual start, measurement for 10-seconds

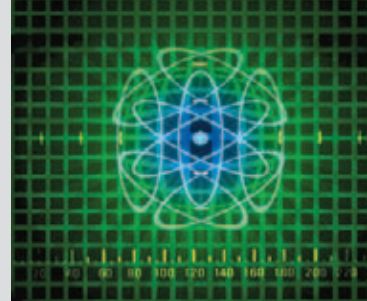
Power supply voltage: 12 V DC through hollow jack, supplied by mains transformer P3130-1P (12V/2A)

Dimensions: 84x84x39 mm

Recommended power supply:

P3130-1P Mains transformer 12V DC/2A

radioactivity



DR260-1D Digitalzähler, universal

Universal digital demonstration counter for measuring time, frequency and pulse rates; display: 7 segment LED display, 6 digits; Digit height 26 mm
 Time measurement: 4 measuring ranges from $10^1 \dots 10^4$ s times the value displayed; measurement can be controlled using any signal source or light gate e.g. P1320-3LR; the two time value inputs may be combined logically in every possible way; adjustable signal threshold of time value inputs using potentiometer; light-emitting diodes for monitoring operation
 Frequency measurement:
 Fully automatic in 4 ranges from $10^1 \dots 10^4$ kHz times the value displayed; signal may be monitored audibly by switching on loudspeaker
 Pulse rate measurement:
 Input for Geiger-Müller tube; anode voltage may be set in 12 steps from 325 to 600 V; measurements scaled down by 1:100 possible; signal may be monitored audibly by switching on loudspeaker
 ABS plastic case with 2 recessed handles
 Dimensions: 260x150x210 mm
 Voltage source: 230 V/50...60 Hz

DR990-1B Radioactivity, basic set



DR212-1H Absorption plate mount, magnetic

DR213-1A Adapter for deflection in radioactive substances

For investigating the behaviour of radiation in a magnetic field; metal mount for positioning button magnets DE407-1A in front of sources DR209-ff; the mount may be plugged directly into the preparation casing

Dimensions: outside D = 35 mm, inside D = 30 mm

DE407-1A Button magnets, pair

Neodymium magnets embedded in plastic cups, D=13 mm, H=5 mm

DR250-1A Radiation absorption plates, set

C3551-2T Test tube, graduated, with sleeves

Thick-walled test tube with graduated scale; two sleeves for securely clamping it into mount DR212-1H; SB14/23 opening; 25 ml volume, D=16 mm, H=160 mm

DM115-1A Lead (tare) weights 250 g

Used as weights for absorption or taring, bead D= approx. 1.5 mm, in plastic bottle, contents 250 g

DR275-1G Gas mantle, set of 3

For demonstrating natural sources of radioactivity (e.g. potassium chloride); commercially available gas mantles in a transparent plastic bag

DR200-BK Blue fertilizer, 250 g

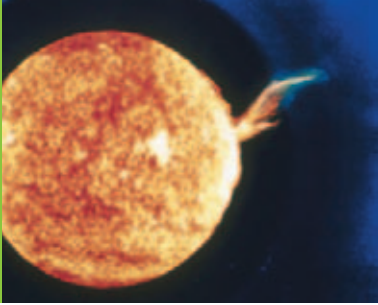
DR200-KC Potassium chloride, 250 g

(Not shown:)

DM810-1H1 Container, plastic, with lid

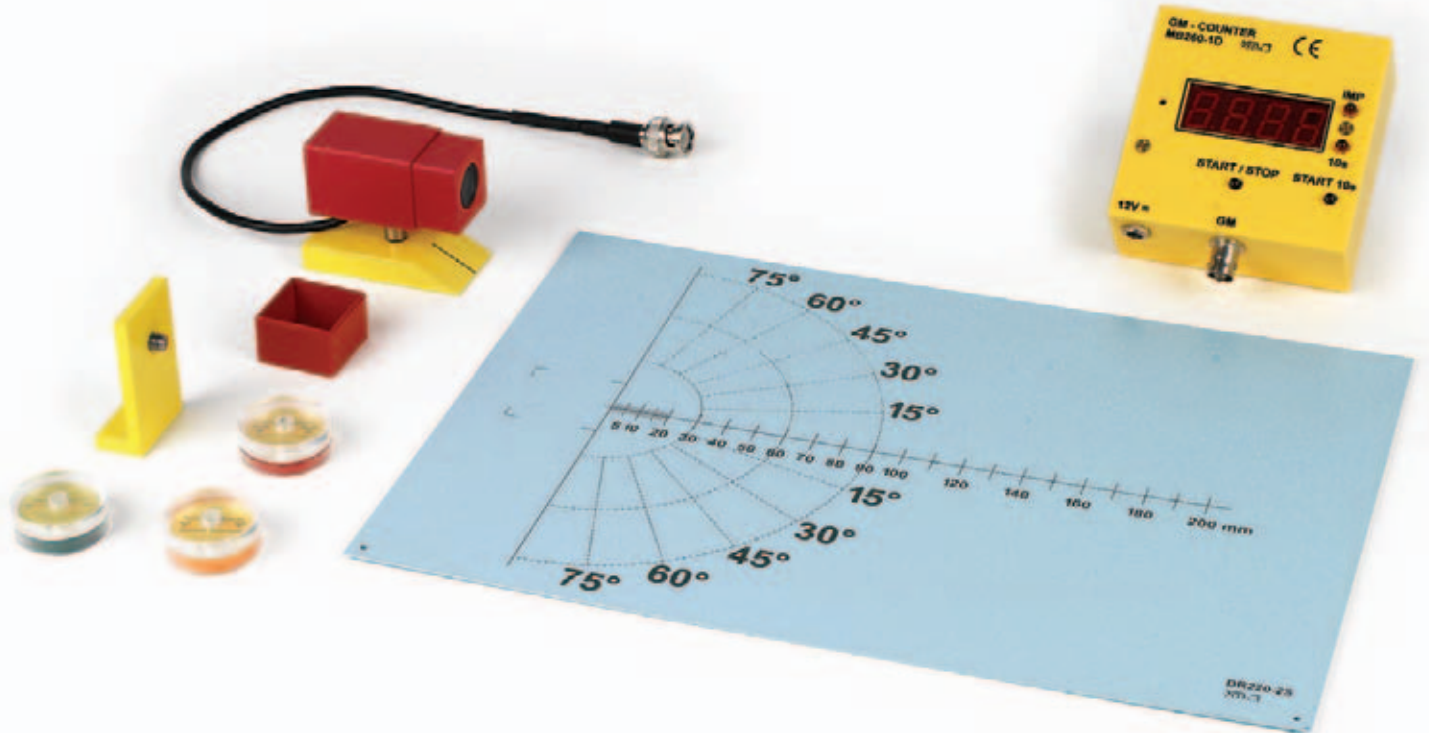
Transparent plastic container with lid forming an airtight seal; dimensions: 50x50x40 mm

C7418-2A Lab knife



radioactivity

DR990-1C Radioactivity, "compact" set

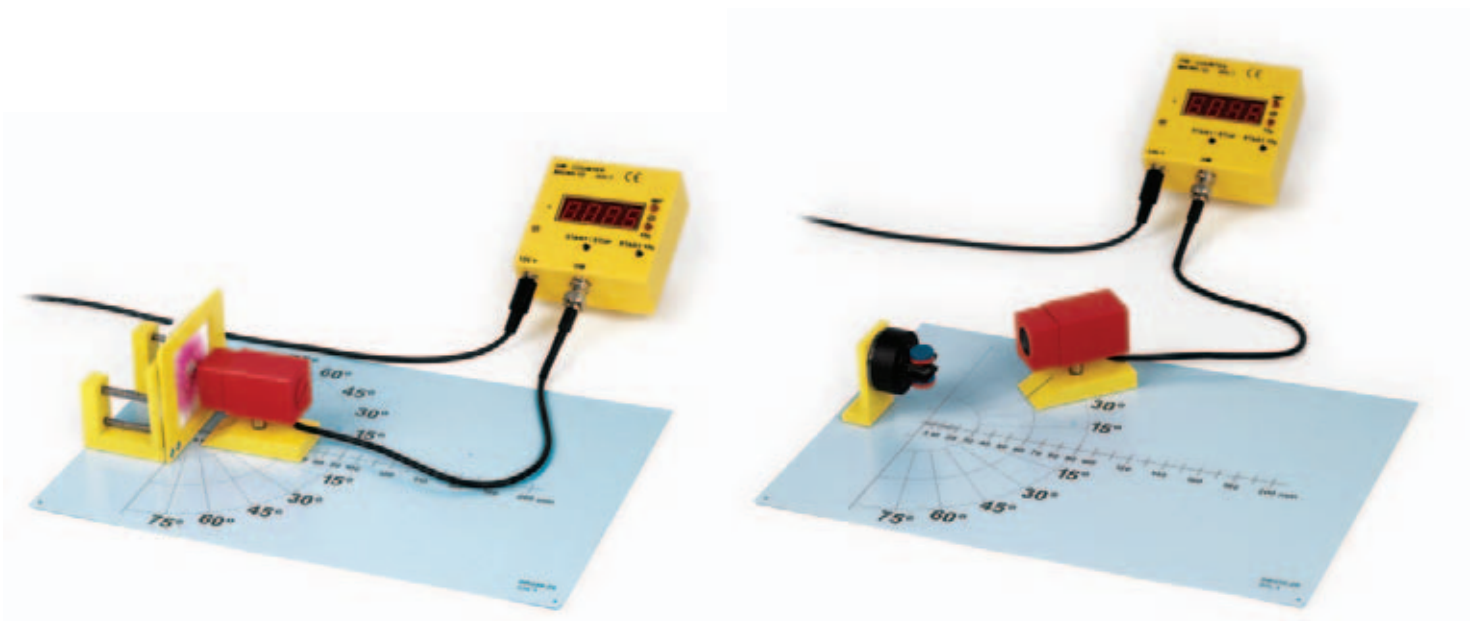


DR210-1P Scale for radioactivity, metal

For use in student radioactivity experiments on the lab table; light-blue powder-coated metal plate printed with a degree scale and a linear scale in mm and cm
Dimensions: 300x210 mm

DR200-1R Radioactive preparations, set

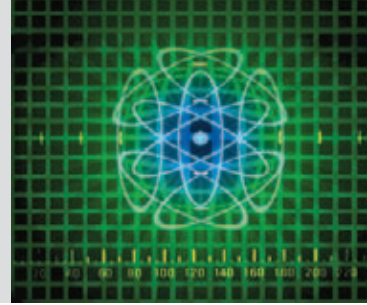
DR201-1R Radioactive preparation mount, magnetic
DR291-1Z Geiger-Mueller tube on magnetic base
MB260-1D Geiger-Mueller counter, "compact"



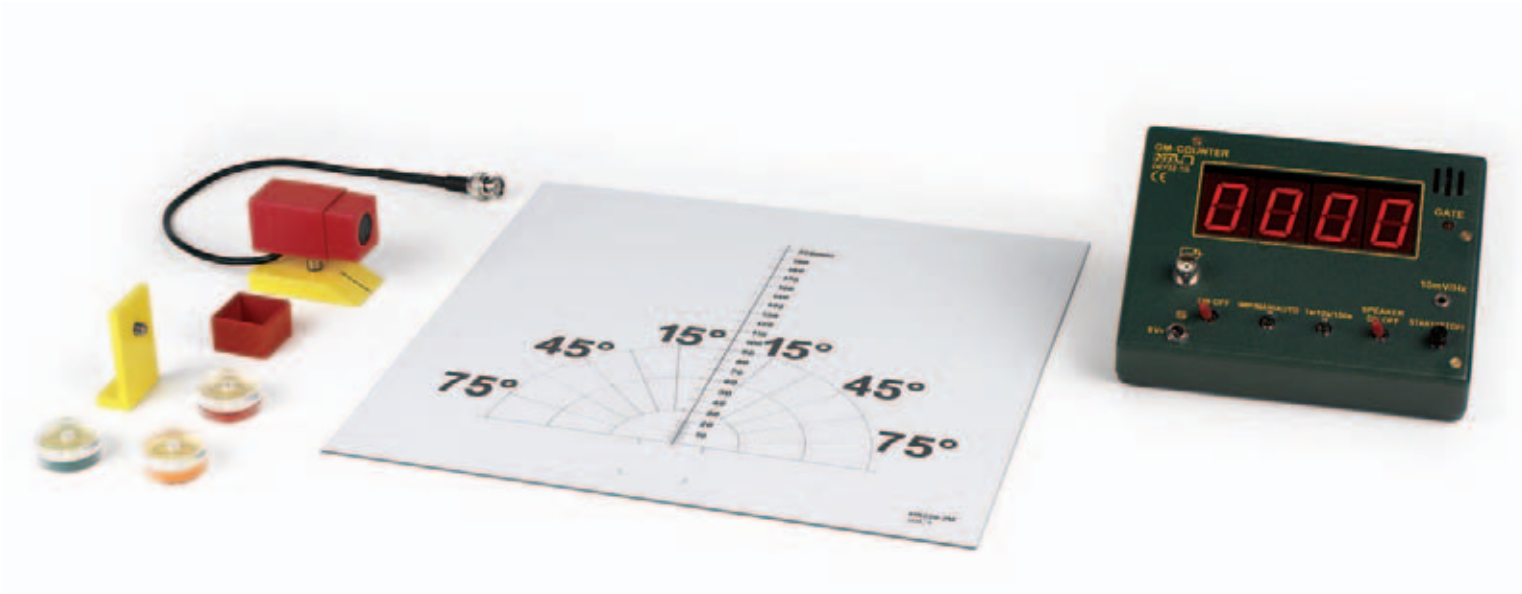
Experiment: Statistical variance in measuring radiation
"compact" system

Experiment: Behaviour of beta rays in a magnetic field
"compact" system

radioactivity



DR990-1D Radioactivity, "inno" set



DR210-1F Foil with scale, for radioactivity, magnetic

For use in radioactivity demonstration experiments on a magnetic panel; Magnetized foil with a white coating and printed with a degree scale and a linear scale in mm and cm; dimensions: 300x300 mm

DR200-1R Radioactive preparations, set

DR201-1R Radioactive preparation mount, magnetic

DR291-1Z Geiger-Mueller tube on magnetic base

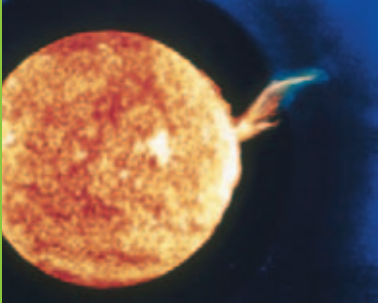
DE722-1G Geiger-Mueller counter, "inno"



Experiment: Beta backscatter, "inno" system



Experiment: Measuring coating thickness, "inno" system



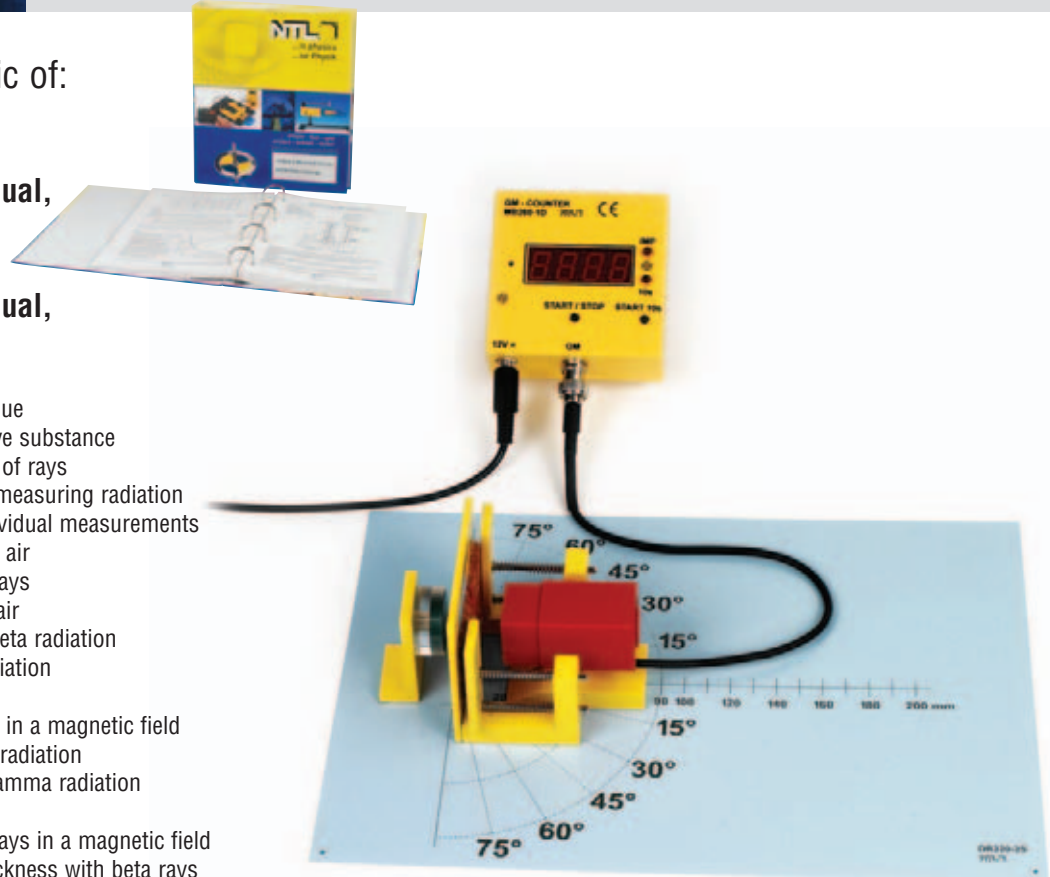
radioactivity

Experiments on the topic of: RADIOACTIVITY

DR990-9S Experiment manual,
"Radioactivity", book b/w

DR990-9C Experiment manual,
"Radioactivity", CD-ROM

- RAI 001 Determining empty value
- RAI 002 Identifying a radioactive substance
- RAI 003 Investigating a bundle of rays
- RAI 004 Statistical variance in measuring radiation
- RAI 005 Statistical error in individual measurements
- RAI 006 Range of alpha rays in air
- RAI 007 Shielding from alpha rays
- RAI 008 Range of beta rays in air
- RAI 009 Exposure to external beta radiation
- RAI 010 Absorption of beta radiation
- RAI 011 Beta backscatter
- RAI 012 Behaviour of beta rays in a magnetic field
- RAI 013 Absorption of gamma radiation
- RAI 014 Absorption curve of gamma radiation
- RAI 015 Inverse square law
- RAI 016 Behaviour of gamma rays in a magnetic field
- RAI 017 Measuring coating thickness with beta rays
- RAI 018 Measuring liquid levels with beta rays

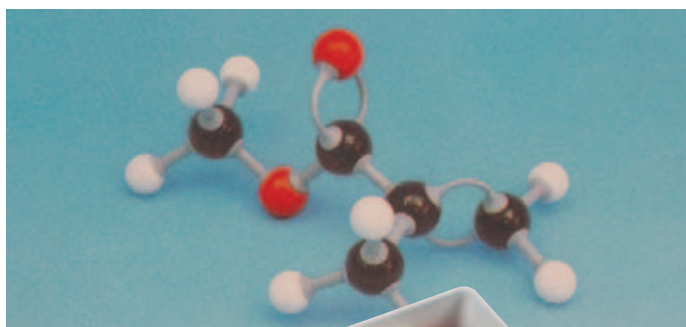
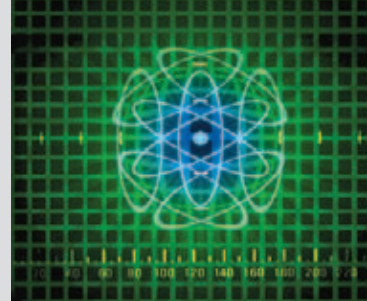


Experiment: Exposure to external beta radiation, "compact" system



Experiment: Absorption curve of gamma radiation, "inno" system

atomic structures



Molecule model sets:

Round models of atoms and connecting pins made of solid plastic, in various colours and sizes; supplied in a plastic box with a lid

C9020-01 Molecule model set 1 (students)

C9020-02 Molecule model set 2 (demo)

Component parts:

C9020-01	C9020-02	Description	Colour	D(mm)
20	40	Hydrogen	White	17
12	24	Carbon	Black	23
-	6	Carbon	Black	23
7	12	Oxygen	Red	23
2	4	Nitrogen	Blue	23
1	1	Sulphur	Yellow	23
-	4	Sulphur	Yellow	23
6	12	Halogen	Green	17
-	2	Metal	Grey	17
-	1	Metal	Grey	20
26	60	Connector	White	Short
25	55	Connector	Grey	Medium
10	25	Connector	Grey	Long
1	1	Tool for removing connectors		
1	1	Storage box, plastic		

Button sets:

Round button models of atoms with caps that may be stuck together; made of solid plastic, in various colours and sizes; supplied in a plastic box with a lid

C9021-01 Atom button building set 1 (students)

C9021-02 Atom button building set 2 (demo)

Component parts:

C9021-01	C9021-02	Description	Colour	D(mm)
9	12	Carbon	Black	34
7	7	Oxygen	Red	34
6	5	Oxygen	Red	34
3	3	Nitrogen	Blue	34
2	2	Sulphur	Yellow	34
-	2	Phosphorus	Light brown	34
4	5	Chlorine	Green	34
-	4	Bromine	Brown	34
8	12	Carbon	Grey	34
-	4	Carbon	Grey	34
-	3	Nitrogen	Blue	34
-	4	Carbon	Black	34
30	46	Hydrogen	White	24
16	24	Caps		
1	1	Storage box, plastic		