

E BALL & RING

Gravesande's, ring mounted in rod with handle, ball with chain. Cold ball passes through the ring but does not pass when heated.

	Ball diam.
P20020/1	19 mm
P20020/2	22 mm
P20020/3	25 mm

**F BALL & RING**

As above, but the ring & the ball with separate handles

	Ball diam.
P20022/1	19 mm
P20022/2	22 mm
P20022/3	25 mm

**G BALL & RING**

As above, but mounted on tripod stand

	Ball diam.
P20023/1	19 mm
P20023/2	22 mm
P20023/3	25 mm

**H BAR & GAUGE**

To illustrate expansion of metal on heating and contraction on cooling, with steel bar of length 100 x 10 mm and plated brass gauge with a cut-out to just accommodate the bar and two holes through which the bar passes when cold.

P20024

I BAR BREAKING APPARATUS

A heavy cast iron stand slotted to carry a stout iron bar, with ten cast iron breaking bars.

P20030

BREAKING BARS

For use with above, pack of 10.

P20032



A LINEAR EXPANSION APPARATUS, MICROMETER SCREW FORM

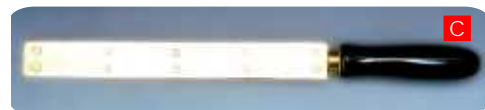
A 500 mm long metal rod is supported in a plated brass tube with three tubules for steam inlet, outlet and thermometer. The tube is mounted on a stand with an adjusting screw at one end and a micrometer screw reading to 0.01 mm on the other, with terminals for connecting a bell or galvanometer to indicate contact. With copper, brass and iron test rods but without thermometer.

P20044**B EXPANSION APPARATUS**

Two cast metal uprights, height 18 cm, fitted with two nickel plated rods supporting expansion bar of length 38 cm. Expansion bar is fixed to one upright and moves a pointer on the other, when heated. With scale reading 0 to 90°, supplied with one each aluminium, brass and iron expansion bars.

P20045**C COMPOUND BAR**

Brass and iron, 200x25 mm, rivetted, with wooden handle.

P20060**D EXPANSION OF LIQUIDS APPARATUS**

To show different liquids have different thermal expansions. Five glass bulb tubes with plastic scales are supported in a galvanised iron water trough by a support frame. Bulbs are of approx. 35 mm diam. with stem of 400 mm length.

P20071**E BULB TUBE**

For above, spare, glass.

P20073**F HOPE'S APPARATUS**

To determine temperature at maximum density of water. Sheet iron cylinder 340x50 mm, trough 100x220mm on a base of diam. 200 mm. approx., with tubules for thermometers but without thermometers or bungs.

P20077

F HYPSONETER, REGNAULT'S

Double walled copper cylinder, 340 x 60 mm, mounted on steam boiler, with thermometer tubule at top and side outlets for manometer and draining.

P20082

**G ABSOLUTE EXPANSION OF MERCURY APPARATUS, DULONG & PETIT**

To determine the co-efficient of absolute expansion of mercury. Glass tubes with vertical limbs contained within glass jackets approx. 460 x 25 mm height x diameter, are closed by bungs and fitted with inlet and outlet tubes. Upper ends of these vertical limbs are angled on emergence from the jackets to produce two short, adjacent limbs placed against a silvered glass scale 0 to 12 cm x 1 mm. Mounted on stand 610 x 230 mm, height x width. Overall height 750 mm approx., supplied without mercury.

P20084

**H CHARLES LAW APPARATUS**

To determine co-efficient of expansion of a gas at constant pressure. A glass U-tube with a bulb and stopcock at one end, the other limb being open. An outlet tube from the bottom of the U-tube passes through a rubber bung and has a stopcock at the end. The stem below the bulb is graduated 3x0.1 ml. An inlet tube with a mohl clip also passes through the bung. A glass water jacket encloses the U tube. All glass parts made of borosilicate glass, requires only 20 ml mercury, which is not included.

P20089

**I CHARLES LAW KIT**

A glass U-tube of 10 mm diam. the shorter limb of which has a stopcock near top and the longer limb can take a plastic tube. A scale is provided and can be attached to the shorter limb. With red indicator oil but without 2000 ml tall form beaker which acts as a reservoir.

P20093

Accessory

Beaker, 2000 ml. tall form

P20095



A CONSTANT VOLUME AIR THERMOMETER

A metal stand fitted with 0-100 cm x 1 mm vertical wooden scale & supporting a mercury reservoir sliding on a metal rod. An air thermometer bulb fitted to a bracket can be attached to the other rod at either of two positions. With U-shaped base. Complete with 1 metre rubber tubing to connect reservoir to the bulb. Without mercury.

P20098**B CONSTANT PRESSURE AIR THERMOMETER**

Jolly's thermometer bulb connected via a 3-way stopcock to mercury tube. Sliding indicator on right hand limb, with reservoir sliding on vertical clamping rod. Metal vessel to surround the bulb. Mounted on wooden stand, height 740 mm. All glass parts except reservoir are made of borosilicate glass.

P20105**C LATENT HEAT OF STEAM APPARATUS**

Consists of a thick brass calorimeter 90 x 65 mm, a bung with steam inlet and outlet tubes, a felt cover and a one litre brass sheet boiler with bung to take the steam tube.

P20120**D CALORIMETER**

Copper, joint-less, rolled rim

P20125/1 75 x 50 mm**P20125/2** 100 x 65 mm**P20125/3** 100 x 75 mm**CALORIMETER**

Aluminium, joint-less, rolled rim

P20135/1 75 x 50 mm**P20135/2** 100 x 65 mm**P20135/3** 100 x 75 mm

supertek

OUTER VESSEL FOR CALORIMETERS

With rolled-on bottom, rolled rim.

P20140/1	Aluminium	90 x 65 mm
P20140/2	Aluminium	115 x 90 mm
P20142/1	Copper	90 x 65 mm
P20142/2	Copper	115 x 90 mm

E CALORIMETER STIRRER

Copper, with insulated handle.

P20145

**F CALORIMETER SET**

Consisting of a jointless copper calorimeter 75x50 mm on rubber supports, spun outer copper vessel of 100x75 mm diam. copper lid for outer vessel with central tubule for thermometer and slit for copper stirrer, with a looped copper stirrer for the inner vessel.

P20152

**G CALORIMETER SET**

Copper calorimeter 75 x 50 mm with felt insulation, outer vessel of 100 x 65 mm size with a plastic lid having holes for thermometer & stirrer. A thermometer holder is fixed to the outer vessel. Complete with stirrer.

P20163 With outer vessel of copper

P20164 With outer vessel of aluminium

**H CALORIMETER, JOULE'S**

Polished aluminium container placed in an outer wooden case with thermometer, plastic top fitted with two terminals for heating coil and a hole for thermometer.

P20172

**I CALORIMETER, JOULE'S**

Nickel plated copper calorimeter of 63 x 63 mm lagged and enclosed in an outer vessel of 80 x 90 mm size, with cover having terminals, a heating coil suitable for 3-6 V supply and holes for thermometer & stirrer. With stirrer but without thermometer.

P20175



A BLOCK CALORIMETER

Metal, for experiments on specific heat of different metals, cylindrical metal blocks 1 kg \pm 2%. Each block has a central hole for a special immersion heater and an offset hole for thermometer.

P20181/1	Aluminium alloy
P20181/2	Mild steel
P20181/3	Copper
P20181/4	Brass

**B IMMERSION HEATER**

For above, sheathed, 12 V, 50 W.

P20185

**C ALUMINIUM CONTAINER**

For use with above, 160 x 100 mm (diam x ht), with carrying handles.

P20189

**D CONTINUOUS FLOW CALORIMETER, CALLENDAR & BARNES**

For electric equivalent of heat of liquids. A glass tube, 360 mm long, containing manganin spiral heating element with screw terminal at each end, is connected to inlet and outlet cylindrical vessels, each having a tubule for thermometer. The inlet system has a long vertical vent tube to allow air bubbles in the incoming water to escape. Mounted on wooden base, but without constant level tank or thermometer,

P20195

**E CONSTANT LEVEL TANK**

A brass vessel of 100 x 75 mm with tubules for water inlet, outlet and overflow. With ring and screw for fixing to a stand.

Supplied without stand
P20197

**SET OF SIX METAL CYLINDERS**

Equal in size, 38 x 9.5 mm, copper, lead, brass, iron, zinc and aluminium.

P20205

F SET OF SIX METAL CYLINDERS

Equal in mass, each being 100 gm, copper, lead, brass, iron, zinc and aluminium, with wooden stand.

P20209

**G METALS**

In rivet or pallet form, for specific heat experiments.

P20214/1 Aluminium 100g

P20214/2 Brass 250g

P20214/3 Copper 250g

P20214/4 Lead shots 500g

P20214/5 Mild steel 500g

**H STEAM HEATER**

Copper cylindrical vessel 180 x 115 mm with steam vent and a vertical tube terminating in chute passing through side of vessel. A brass tube sliding fit in the central tube, with lower angle cut to seal the chute, enables heated material to be transferred to calorimeter without loss of heat.

P20230

**I STEAM BOILER**

Cylindrical, with conical top and short neck for bung, with handle, G.I. sheet.

P20238 Capacity 1000 ml

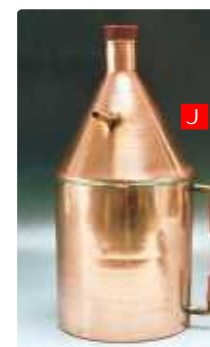
P20240 Capacity 2000 ml

**STEAM BOILER**

Cylindrical spun body, made of copper.

P20245/1 Capacity 1000 ml

P20245/2 Capacity 2000 ml

**J STEAM BOILER**

Cylindrical spun body, made of copper with water level indicator.

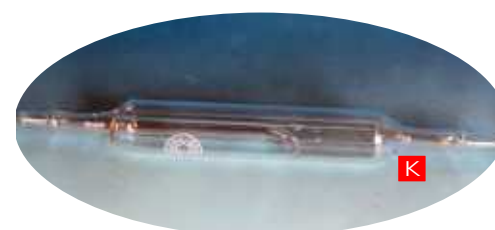
P20250/1 Capacity, 1 litre, with water level indicator

P20250/2 Capacity 2 litre, with water level indicator

K STEAM TRAP

All glass.

P20255



A ELECTRIC KETTLE

Plated brass body with spout, lid and handle. Capacity 1.7 litre approx, rating 1kw with safety cut-off. Complete with 1 metre of 3-core mains cable with connector, for 240 V, 50Hz.

P20260

**B CONDUCTIVITY KIT**

Consisting of 8 rods, one rod each of copper, brass, aluminium, iron, glass of 250 x 3 mm size and one rod each of copper, brass, iron of 250 x 1.5 mm size.

P20266

**C WOOD AND METAL ROD**

200 mm length, to show difference in conductivities of metal and wood.

P20271

**D THERMAL CONDUCTIVITY OF METALS APPARATUS**

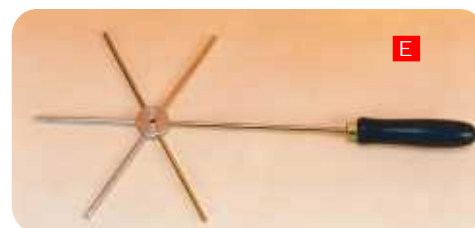
Strips of four different metals fixed on a wooden ring of outer diam. 130 mm and each having a depression for putting wax.

P20275

**E CONDUCTOMETER, FIVE ROD FORM**

For demonstrating the different heat conductivities of five metals by observing the melting of wax.

P20278

**F INGENHOUSZ'S APPARATUS**

To demonstrate different conductivities of different metals. Rods of 5 different metals and wood, fitted along one side of a metal tank.

P20280

G CONDUCTIVITY APPARATUS, EDSER

To demonstrate different thermal conductivities, different metal rods mounted vertically in base of cylindrical vessel 100 x 90 mm height x diameter supported by ring for fitting to a retort stand with three indices.

P20285



H SEARLE'S APPARATUS FOR THERMAL CONDUCTIVITY OF COPPER

Steam heated, with 230 x 25 mm copper bar, with a steam chamber at one end, the other end having a copper coil for cold water with inlet and outlet tubes. With two thermometer pockets. In box with insulated lagging, removable cover, without thermometers.

P20290



I SEARLE'S APPARATUS FOR THERMAL CONDUCTIVITY OF COPPER

As above, but electrically heated with 12 V, 72 W heater element.

P20293



I LEE'S DISC APPARATUS

For poor conductors, 3 cylindrical blocks of aluminium 50 mm diameter 12.5 mm thick, with radial holes for thermometers, are clamped in a wooden frame by a screw, with 2.5 W, 6 V heating element and a set of 3 bad conductor discs.

P20305



J CONVECTION IN WATER APPARATUS

Comprising a 350 x 200 mm approx. rectangle of 18 mm glass tubing, with short funnel at top.

P20316



K CONVECTION OF HEAT IN AIR APPARATUS

Metal box, 230 x 75 x 75 mm, with sliding glass front and two detachable glass chimneys, with one candle holder under left chimney. Supplied without candles.

P20320



L LESLIE CUBE

Consisting of a galvanised iron box of 130 mm sides. The vertical faces are blackened dull, blackened bright, white and polished respectively, with a tubule at top.

P20325

LESLIE CUBE

Brass box of 75 mm side, with tubule at top.
P20327

A THERMOSCOPE, ETHER

For detecting thermal radiations, with one bulb painted matt black, partially evacuated.
P20332 Glass parts only
P20334 Mounted on stand

**B CROOKE'S RADIOMETER**

Set of 4 mica vanes, with one side of each blackened, in a partially exhausted glass bulb, with stand.
P20338

**C CROOK'S RADIOMETER, DOUBLE**

As above but with two sets of mica vanes placed in two separate bulbs, blackened in such a way that rotations are in opposite directions.
P20340

**ENERGY CONVERSION KIT**

To show qualitatively energy conversion from one form of energy to another in different ways. The kit comprises a number of separately available units. All units are mounted on a 160 x 140 mm base and have 4 mm socket terminals where needed.

D LARGE MOTOR / GENERATOR UNIT

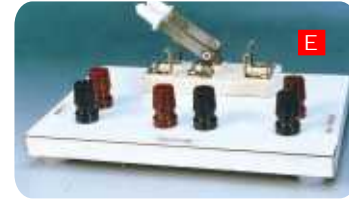
With 2-6 V d.c. motor with a 15 mm diam. 'V' pulley, on base with terminals.
P20370

**SMALL MOTOR / GENERATOR UNIT**

As above, but with 1.5-4.5 V motor.
P20375

E SWITCH UNIT

Double pole double throw knife switch on base with terminals labelled 'Battery', 'Motor', 'Lamp'
P20380

**F LAMP UNIT**

With 3 M.E.S. lamp sockets connected in parallel, on base with terminals, with three lamps of 1,25 V,0.25 A
P20385

**G FLY WHEEL UNIT**

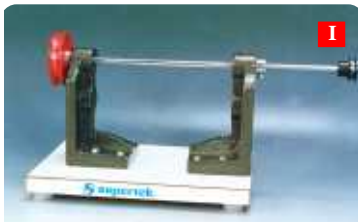
Steel fly wheel 100 mm diam. with pulley 20 mm diam. on shaft held in brackets, mounted on base.
P20390

**H FLY WHEEL UNIT**

Complementary to P20390 having same mass but 50 mm diam, with 20 mm pulley, on base.
P20395

**LINE SHAFT UNIT**

Steel shaft, pulley of 70 mm diam. Shaft overhangs the base to allow a wound up weight to fall down.
P20400

**I SPRING UNIT**

For showing conversion of potential energy stored in twisted rubber to kinetic/electrical energy. Elastic bands are looped & stretched between pulley and support. A crank handle and pulley combined with ratchet stop allows the rubber to be wound up and released to drive a dynamo, supplied without dynamo.
P20405

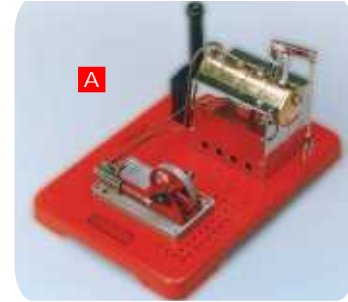
**J FRICTION CALORIMETER UNIT**

Copper calorimeter 60 x 6 mm with integral pulley, 20 mm diam. rotates in a boss, mounted on base. The friction brake consists of corklined jaws on pillar, also mounted on base.
P20415

A STEAM ENGINE UNIT

Working model, with boiler, safety valve, whistle, steam chamber & flywheel, on base, to drive dynamo models etc.

P20420

**B HAND WHEEL DRIVE UNIT**

Converts muscular energy to other forms of energy. 75 mm diam. hand cranked pulley with rubber belt to drive a small pulley of 20 mm diam. to which a drive output pulley is directly attached. Pulley shafts are mounted in bearings on aluminium casting, on standard base.

P20422

**C TURBINE/PUMP UNIT**

With pump chamber fitted with inlet and outlet tubes and impeller linked with pulley of 20 mm diam. Transparent front cover with 'O' ring seal. Inlet is in use when pumping, a short length of tubing with clip closes this inlet during turbine operation, on base.

P20425

**D HEAD OF WATER UNIT**

For use with turbine/pump unit for pumping water to a higher level. Consists of 2 basins, one above the other, each on a support with connecting tubing.

P20430

**E STORAGE BATTERY UNIT**

To demonstrate the principle of lead acid accumulator, glass jar with plastics lid having two 4 mm terminals connected to two lead plates.

P20435

**F WATER TURBINE WITH DYNAMO**

To show conversion of mechanical energy into electrical energy. Turbine with transparent cover, inlet and outlet tubes, directly connected to a dynamo. Fitted on base.

P20445



Models of Engines

Sectional, to enable all moving parts to be seen clearly. Where required, a simple carburettor is depicted in cross section, & a low voltage bulb is used to simulate action of spark plug. Internal passages are suitably coloured to show nature of gases passing through them. All models are of cast alloy and each is fitted on a base .

G TWO STROKE PETROL ENGINE MODEL

Showing internal structure & operating principles of a simple piston air cooled two stroke engine, Mounted on a polished wood base with schematic diagram, overall height 360 mm approx.

P20471



H FOUR STROKE PETROL ENGINE MODEL

Air cooled, four stroke, with operation of valves clearly shown. Mounted on a polished wooden base with schematic diagram, overall height 450 mm approx.

P20475



I FOUR STROKE DIESEL ENGINE MODEL

Four stroke water cooled diesel engine, shows functioning of fuel injection system together with hot coil starting device.

P20480



J MODEL OF STEAM ENGINE

Locomotive design, sectional, the valve and piston mechanism clearly visible through a glass plate with forward and reverse motions, demonstrates working with an air blower or even with mouth blowing.

P20490



K HERO ENGINE

A functional glass model of steam turbine. Comprises a glass bulb 70 mm diameter approx, with side arms bent at right angles. With stand.

P20495

