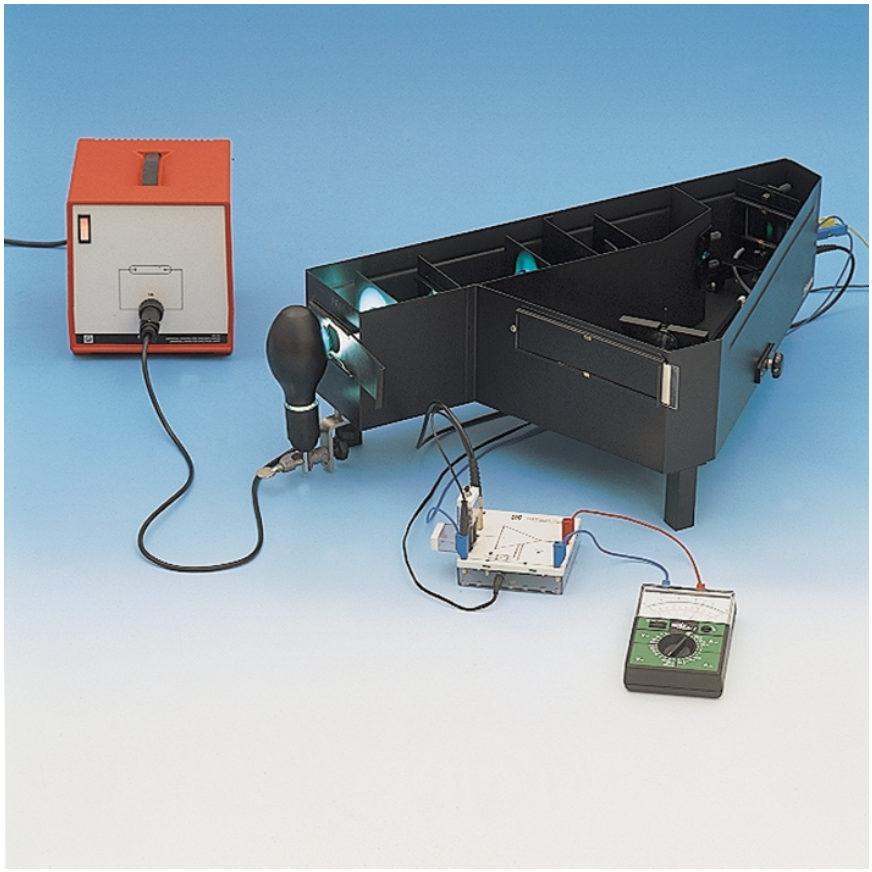
P 6.1.4

Planck's constant

P 6.1.4.1 Determining Planck's constant – measuring with a compact assembly

P 6.1.4.2 Determining Planck's constant – dispersion of wavelengths with a direct-vison prism on the optical bench



Determining Planck's constant – measuring with a compact assembly (P 6.1.4.1)

Cat. No.	Description	P 6.1.4.1	P 6.1.4.2
558 77	Photo cell for determining Planck's constant	1	1
558 79	Compact arrangement for determining Planck's constant	1	
558 791	Supply unit for photo cell		1
451 15	High-pressure mercury lamp	1	1
451 19	Lamp socket E27 on rod for high-pressure mercury lamp		1
460 373	Optics rider, H = 60 mm/W = 50 mm		1
460 380	Cantilever arm		1

When light with the frequency ν falls on the cathode of a photocell, electrons are released. Some of the electrons reach the anode where they generate a current in the external circuit, which is compensated to zero by applying a voltage with opposite sign $U = -U_0$. The applicable relationship

$e \cdot U_0 = h \cdot \nu - W$, *W*: electronic work function

was first used by *R. A. Millikan* to determine Planck's constant *h*.

In the first experiment, a compact arrangement is used to determine *h*, in which the light from a high-pressure mercury vapor lamp is spectrally dispersed in a direct-vision prism. The light of precisely one spectral line at a time falls on the cathode. A capacitor is connected between the cathode and the anode of the photocell which is charged by the anode current, thus generating the opposing voltage *U*. As soon as the opposing voltage reaches the value $-U_0$, the anode current is zero and the charging of the capacitor is finished. U_0 is measured without applying a current by means of an electrometer amplifier.

The second experiment uses an open arrangement on the optical bench. Here as well, the wavelengths of the light are dispersed using a direct-vision prism. The opposing voltage *U* is tapped from a DC voltage source via a voltage divider, and varied until the anode current is compensated precisely to zero. The I-measuring amplifier D is used for conducting sensitive measurements of the anode current.

Cat. No.	Description	P 6.1.4.1	P 6.1.4.2
451 30	Universal choke 230 V, 50 Hz	1	1
532 14	Electrometer amplifier	1	
562 791	Plug-in unit 230V/12 V AC/20 W; with female plug	1	
532 00	I-measuring amplifier D		1
531 120	Multimeter LDanalog 20	1	2
575 24	Screened cable BNC/4 mm	1	
576 74	Rastered socket panel, DIN A4		1
576 86	STE mono cell holder		2
577 93	STE 10-turn potentiometer 1 kΩ, 2 W		1
578 22	STE capacitor 100 pF, 630 V	1	
579 10	STE key switch (n.o.), single-pole	1	
501 48	Set of 10 bridging plugs		1
503 11	Set of 20 batteries 1.5 V (type MONO)		1
460 32	Precision optical bench, standardized cross section, 1 m		1
460 34	Auxiliary bench w. swivel joint, protractor and index bench, 0.5 m		1
460 374	Optics rider, H = 90 mm/W =50 mm		1
460 375	Optics rider, H = 120 mm/W = 50 mm		5
460 02	Lens f = + 50 mm		1
460 08	Lens f = + 150 mm		1
460 14	Adjustable slit		1
460 13	Projection objective, f = + 150 mm		1
466 05	Direct-vision prism		1
466 04	Holder for direct-vision prism		1
502 04	Distribution box	1	
590 011	Clamping plug	2	
500 414	Connection lead, black, 25 cm	1	
500 440	Connection lead, yellow-green, 100 cm	1	
500 444	Connection lead, black, 100 cm		1
501 45	Pair of cables, 50 cm, red and blue	1	2
501 461	Pair of cables, 1 m, black	1	
463 51	Diaphragm with 5 slits		1
577 40	STE resistor 470 Ohm, 1.4 W		1