PLANCK'S CONSTANT

LED Type

AP2343-001 Planck's, using characteristics of 7x LEDs

Description:

The traditional apparatus for determining Planck's Constant has always been the "Photoelectric Effect Apparatus". Light of various wavelengths was aimed into a photo-tube with a light sensitive cathode. When the Photons strike the cathode surface, their energy is transferred to electrons which are released from the cathode surface. Their motion through the tube to the anode was stopped by a small reverse voltage applied to the anode. The magnitude of this voltage to completely stop the electron flow is a measurement of the energy level of the most excited electrons.

The wonderful experiment proves that the wavelength of light determines the energy in the photons … not the amount of light.

When the frequency of the various light beams was plotted against the voltage level of the electrons for each beam, a straight line graph was discovered. The value of the slope of this graph is known as Planck's Constant.

In this more simple instrument, the voltage is carefully measured that causes 2 microamps to flow through each selected LED. The wavelength of each LED is marked on the front panel. The wavelength must be converted to frequency and this can be plotted against the "breakover voltage" that causes the 2uA to flow. At this very low current, the LEDs are JUST at the point of conduction.

Length: 120mm	Width: 100mm	Height: 60mm	Weight: 150g

Instructions for Use:

The operating instructions can be seen on the rear face of the instrument.

1) Connect a battery or Power Supply to the sockets marked "Input". Voltage can be between 9 and 12 Volts AC or DC. The instrument's 4mm safety banana plug INPUT terminals are marked + and -, but will convert the AC power to DC for the experiment. Reverse polarity connection will not damage the instrument.
2) Set a digital meter to a DC range of about 200uA. Connect to the "A" terminals.
3) Set a digital meter to a DC range of about 20 volts. Connect to the "V" terminals.
4) Set the rotary LED selector switch to select the 465 nanometer wavelength LED.
5) Starting at the "min" position, increase the voltage applied to the LED until the current through the LED reads 2uA on the digital meter set to microamps.

IMPORTANT NOTE:: it is good practice NOT to stare at LED light up close – particularly the shorter wavelengths (higher frequencies) because the light could have some Ultra Violet content which can, over time, damage the retina of the eye.

6) At 2uA through the LED, note and record the voltage applied to the LED by reading the digital meter set to volts.
7) Repeat steps from 4 to 6 after selecting the next LED.
8) When all 7 LEDs have been documented, PLOT THE GRAPH of frequency of the light from the LED (X axis) against the voltage applied (Y axis).

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Help:

Frequency of light is:
Speed of Light / Wavelength. c / λ .

For example, using 465 nm wavelength:
$3x10^8$ metres/second / $465x10^{-9}$ metres.

It should be a single digit number to 2 decimal places x 10^{14} Hz.

Example: for 465 nm wavelength, frequency will be: 6.45×10^{14} Hz

PLANCK'S CONSTANT IS: slope of the graph (change in Volts / change in Frequency) x the value of the charge of an electron ….
Use 1.6×10^{-19} Coulombs.

What value for Planck's Constant did you obtain ?

NOTE: The true value of Planck's Constant is 6.626×10^{-34} Joule Seconds.

A special exercise:
Work through the calculations to prove that the unit of Planck's Constant is Joule Seconds (Js).

Designed and manufactured in Australia