

# PLANCK'S CONSTANT FROM LEDs

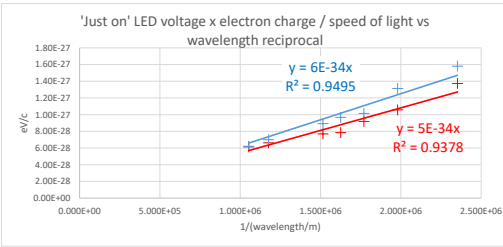
A. French. 10/10/2020. P5 Winchester College.

Record voltage V across LED when it just starts to illuminate.  
eV should equate to the energy hc/lambda of the emitted photons.

speed of light /ms <sup>-1</sup>	2.998E+08
electron charge e /C	1.602E-19

using I, V curves

LED wavelength /nm	V /volts	I /mA	1/lambda (m <sup>-1</sup> )	eV/c	V /volts	eV/c
425	2.57	0.0065	2.353E+06	1.37E-27	2.96	1.58E-27
505	1.98	0.0003	1.980E+06	1.06E-27	2.46	1.31E-27
565	1.72	0.0375	1.770E+06	9.19E-28	1.90	1.02E-27
615	1.47	0.0003	1.626E+06	7.86E-28	1.81	9.67E-28
660	1.44	0.0073	1.515E+06	7.69E-28	1.67	8.92E-28
850	1.24	0.457	1.176E+06	6.63E-28	1.31	7.00E-28
950	1.15	3.35	1.053E+06	6.15E-28	1.17	6.23E-28



$$\frac{hc}{\lambda} = eV$$

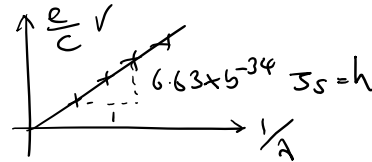
$$\frac{h}{\lambda} = \frac{eV}{c}$$

plot

$$e = 1.602 \times 10^{-19} \text{ C}$$

$$c = 2.998 \times 10^8 \text{ m/s}$$

$$\frac{1}{\lambda} \text{ vs } \frac{eV}{c}$$



Planck's constant:

$$h = 6.63 \times 10^{-34} \text{ Js}$$

Alternative is to plot

V vs V<sub>predicted</sub>

$$V = \frac{hc}{\lambda e}$$

So measured h is:

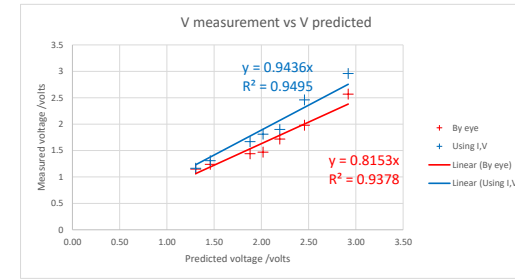
By eye:

Using I, V:

hc/(lambda*e)
2.92
2.46
2.20
2.02
1.88
1.46
1.31

5.41E-34

6.26E-34



LED wavelength /nm	V0 /volts
425	2.96
V /volts	I /mA
2.97	1.04
3.06	2.07
3.12	3.09
3.16	4.01
3.21	5.10
3.23	5.70
3.27	7.06
2.85	0.32
2.90	0.58
2.93	0.75
3.00	1.34
3.08	2.45
3.14	3.53
3.18	4.55

LED wavelength /nm	V0 /volts
505	2.46
V /volts	I /mA
2.47	1.04
2.54	2.01
2.60	3.00
2.64	4.04
2.68	5.03
2.73	6.24
2.75	7.12
2.79	8.33
2.81	9.05
2.81	9.15
2.61	3.45
2.69	5.32
2.71	5.95
2.57	2.47

LED wavelength /nm	V0 /volts
565	1.9
V /volts	I /mA
1.86	1.09
1.89	2.02
1.91	3.02
1.94	4.13
1.95	5.14
1.97	6.15
1.98	7.14
2.00	8.24
2.01	9.11
2.02	10.08
2.04	11.74
2.04	12.15
2.05	12.44
2.04	11.94

LED wavelength /nm	V0 /volts
615	1.81
V /volts	I /mA
1.80	1.06
1.83	2.07
1.86	3.00
1.88	4.05
1.90	5.09
1.92	6.06
1.94	7.11
1.96	8.04
1.98	9.18
1.99	10.19
1.85	3.31
1.83	2.67
1.82	1.86
1.78	0.79

LED wavelength /nm	V0 /volts
660	1.67
V /volts	I /mA
1.65	1.04
1.68	2.09
1.70	3.11
1.72	4.24
1.74	5.32
1.76	6.63
1.77	7.55
1.78	8.51
1.79	9.12
1.80	9.85
1.81	10.67
1.83	12.54
1.84	13.08
1.84	13.13

LED wavelength /nm	V0 /volts
850	1.31
V /volts	I /mA
1.27	1.04
1.30	2.07
1.31	3.09
1.32	3.99
1.33	5.01
1.34	6.12
1.35	7.03
1.35	8.05
1.36	9.24
1.36	10.33
1.37	11.13
1.37	12.41
1.38	14.69
1.38	15.06

LED wavelength /nm	V0 /volts
950	1.165
V /volts	I /mA
1.11	0.95
1.14	1.99
1.16	3.04
1.17	4.03
1.18	5.03
1.18	6.08
1.19	7.09
1.20	8.19
1.20	9.20
1.21	10.09
1.21	11.34
1.22	12.49
1.22	13.13
1.23	14.93

