Inverse Square Law Experiment.

We carried out an Inverse Square Law Experiment using the same, simple, cheap BPW34 based photosensor that we used in our RMS experiments. Details of which can be found in that article.

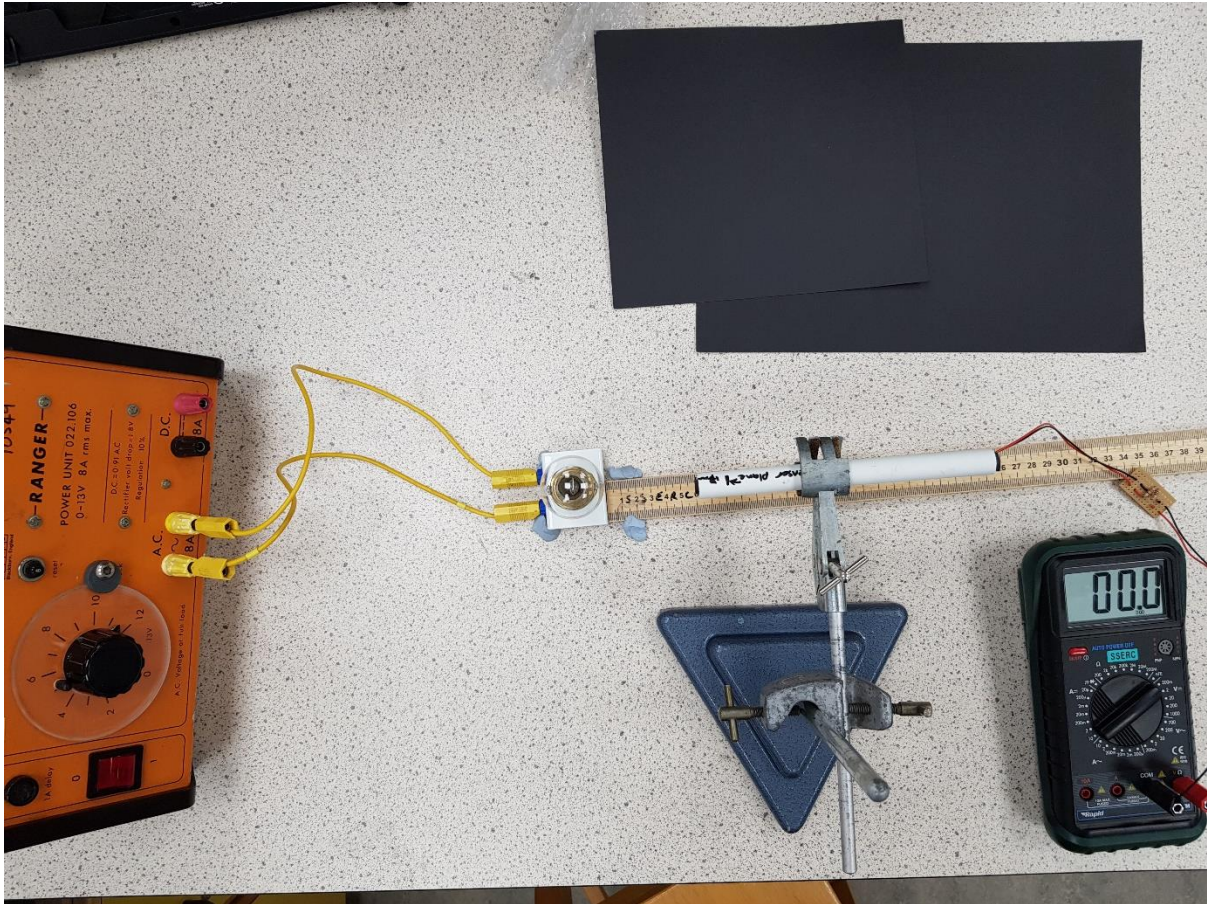We set up the apparatus as shown below (Fig 1).

Fig 1 The experimental set up.

We connected the vertical filament lamp to a 12V supply. The digital multimeter was set to the mV range to measure the value from the BPW34 light sensor. The distance between the lamp holder and the end of the photsensor tube was measured. To this measurement was added 19mm (the distance between the vertical filament and the edge of the lamp holder and 17mm (the distance the light sensor was recessed within the tube). This recess helped prevent any 'off-axis' light from hitting the light sensor but matt black card was also used both behind the lamp at an angle and on the surface of the metre stick at larger distances.

Measurements were taken from 0mm on the metre stick up to 200mm on the metre stick. We found that the sensor was sensitive to brighter light.

Results were entered into a spreadsheet for analysis and shown below (fig 2).

Results

Inverse square law

Distance (mm)	Corrected Distance (mm)	R1 (mV)	R2 (mV)	R3 (mV)	Light meter reading (mV)	Log (CD)	Log (LMR)
0	36	45.1	48.4	45.2	46.2	1.556303	1.664955
50	86	8.7	9.3	9.1	9.0	1.934498	0.955848
100	136	3.2	3.2	3.2	3.2	2.133539	0.50515
150	186	1.6	1.6	1.6	1.6	2.269513	0.20412
200	236	1	1	1	1.0	2.372912	0

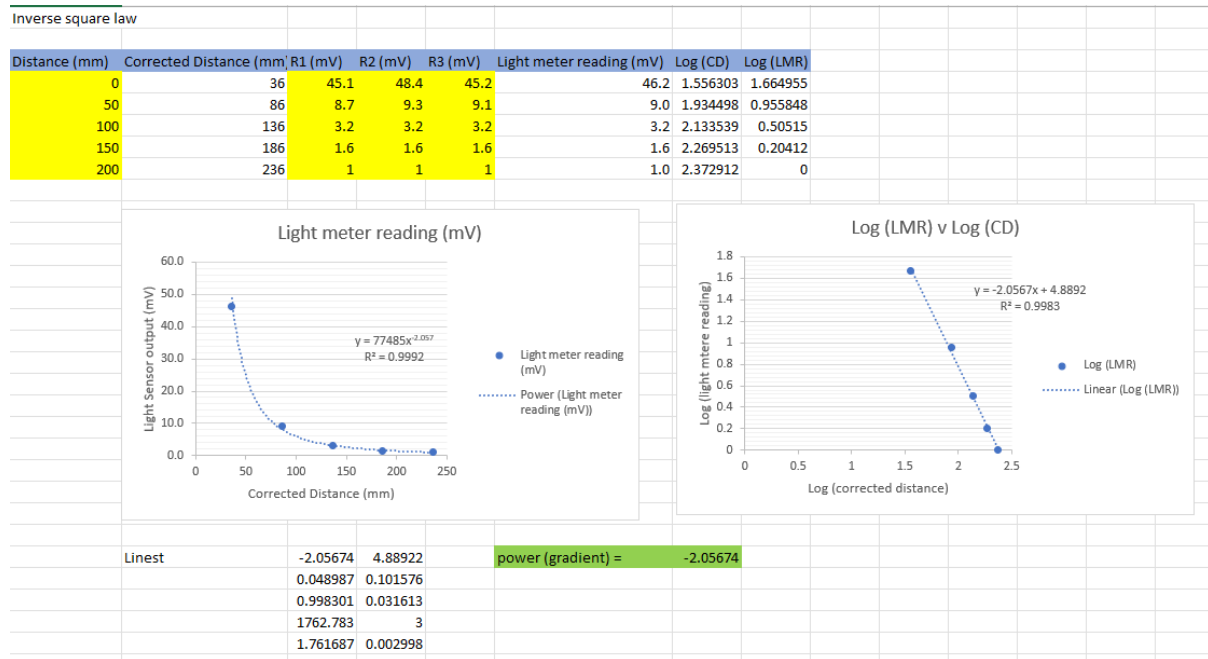| Linest		-2.05674	4.88922		power (gradient) =	-2.05674
		0.048987	0.101576			
		0.998301	0.031613			
		1762.783	3			
		1.761687	0.002998			

Fig 2 Spreadsheet analysis

We plotted the output from the light sensor against the corrected distance (see fig 3 below) and set excel to show a power trendline and equation of best fit.
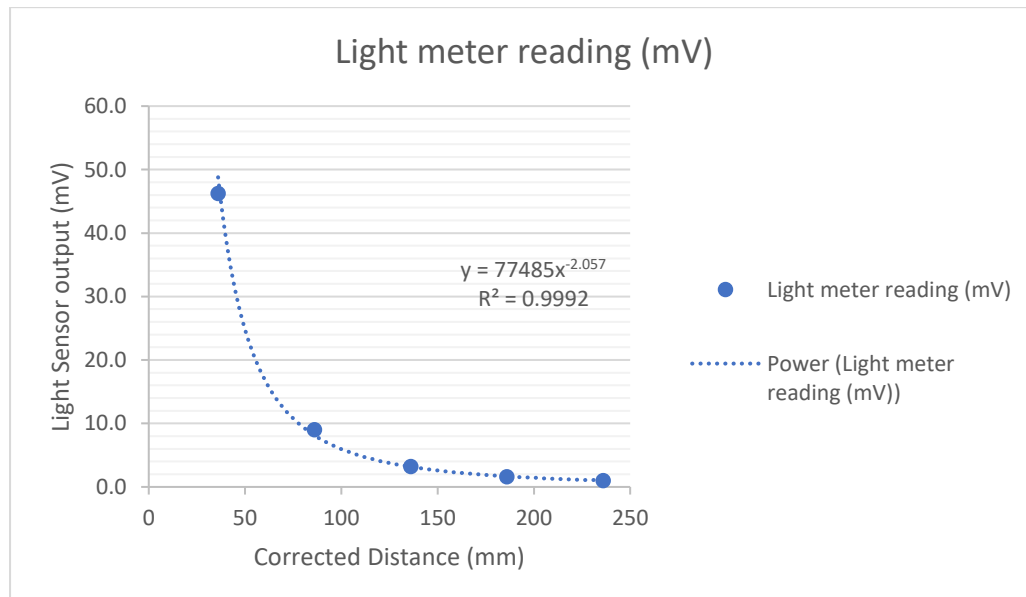

Fig 3 Graph of distance v light sensor output voltage

We also plotted the Logs of these quantities against each other (fig 4) and displayed a linear trendline with equation of best fit.
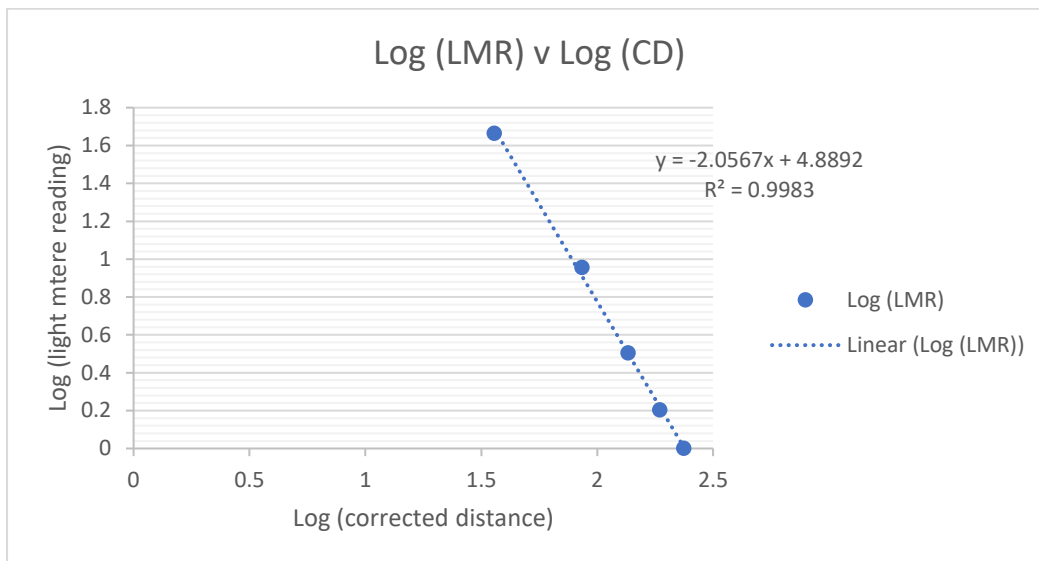

Fig 4 LOG (corrected distance) v LOG (light sensor output voltage)

Excels LINEST function was used to analyse the graph in fig 4 and gave a value of about -2.06 with an error of 0.05.