Candidate 3 evidence

A.C and D.C Voltage

Aim

To find out the relationship between the peak voltage of an a.c supply and its d.c equivalent voltage.

Underlying Physics

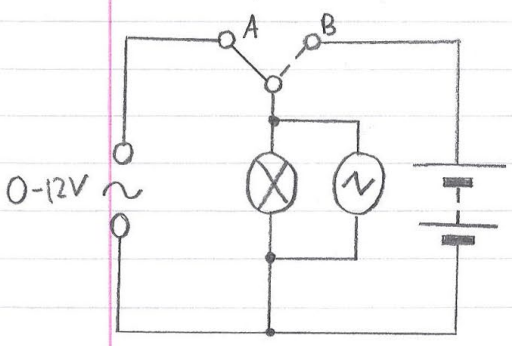
Ref 1

Electricity can flow in two different ways:

- Alternating Current (A.C.) - The electrons move forwards then backwards and alternate between them. This results in the voltage always changing. When observed on an Oscilloscope it has a wave shape.

- Direct Current (D.C) - The electrons only flow forward so have a constant voltage. When DC is observed on an Oscilloscope a straight line is seen.

Method



The D.C. Voltage was measured with a voltmeter. The peak A.C voltage was measured with an oscilloscope in position A.

A.C and D.C Voltage

Results

Number of Cells	d.c. voltage (V)					random uncertainty (V)
	1	2	3	4	mean	
1	1·35	1·34	1·32	1·32	1·33	0·008
2	2·66	2·64	2·61	2·60	2·63	0·02
3	3·70	4·37	4·37	4·38	4·21	0·17
4	4·89	5·70	5·70	5·69	5·50	0·20
5	7·05	7·03	7·05	6·93	7·02	0·03

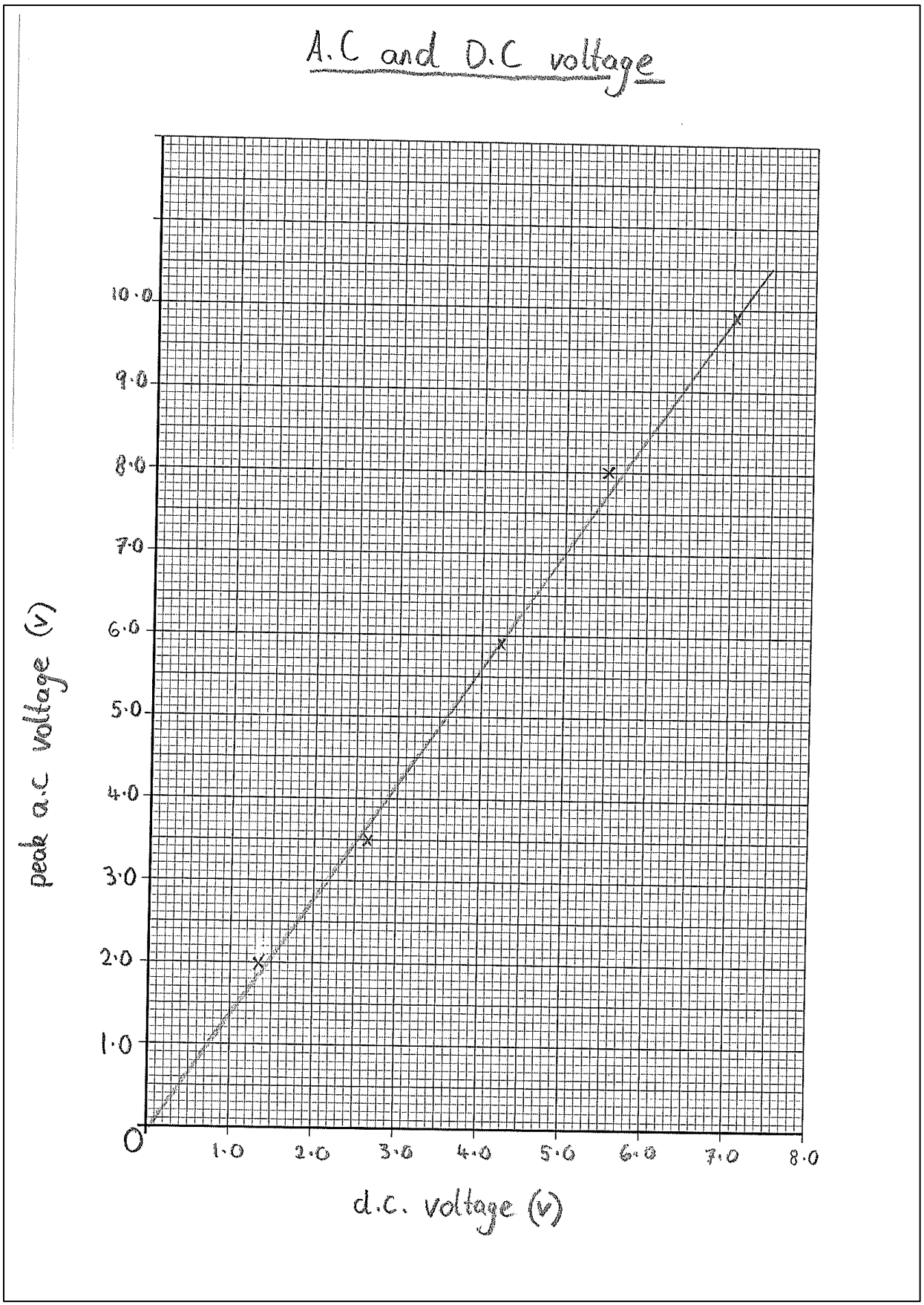
Scale Reading Uncertainty ±0·01V

Number of Cells	peak a.c voltage (V)					random uncertainty (V)
	1	2	3	4	mean	
1	2·0	2·0	2·0	2·0	2·0	0
2	4·0	3·6	3·2	3·3	3·5	0·2
3	4·8	5·9	6·8	6·2	5·9	0·5
4	7·6	8·1	8·1	8·0	8·0	0·1
5	10	10	9·9	9·8	9·9	0·1

$\text{mean} = \frac{4·0 + 3·6 + 3·2 + 3·3}{4}$ $\text{random uncertainty} = \frac{4·0 - 3·2}{4}$

$= 3·5V$ $= 0·2V$

Scale Reading Uncertainty ±0·5V


A.C and D.C voltage
peak a.c voltage (v)
10·0
9·0
8·0
7·0
6·0
5·0
4·0
3·0
2·0
1·0
0
1·0
2·0
3·0
4·0
5·0
6·0
7·0
8·0
d.c. voltage (v)

A.C and D.C voltage

Analysis

(5.0, 7.0) (2.5, 3.5)

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{7.0 - 3.5}{5.0 - 2.5}$

$= 1.4$

The gradient of the graph plotted is 1.4 which shows that the peak a.c voltage is a factor of 1.4 higher than its d.c equivalent.

Second Source

Reference 1

	V_m (volts)	V_{dc} (volts)
lamp 1	12.0	8.5
lamp 2	3.0	2.1
lamp 3	2.0	1.4

$\frac{V_m}{V_{dc}} = \frac{12.0}{8.5}$ $\quad \frac{V_m}{V_{dc}} = \frac{3.0}{2.1}$ $\quad \frac{V_m}{V_{dc}} = \frac{2.0}{1.4}$

$= 1.4$ $\quad = 1.4$ $\quad = 1.4$

A.C and D.C voltage

Conclusion

The peak voltage of an a.c supply is a factor of 1.4 higher than its d.c equivalent voltage.

Evaluation

An LDR could have been used to measure the irradiance of the bulb which would improve the accuracy of the experiment.

The second source didn't have any uncertainties listed so the precision of the experiment is unknown.

The uncertainties of the data collected was higher than 3% for some results so the data was not as precise as it could have been.

Reference 1 - Book

Higher Core Physics Second Edition, Geoff. Cackett, Jim Lowrie, Alastair Steven, Page 91,
ISBN 0 19 914324 2