MATS16302: Magnetism Lab

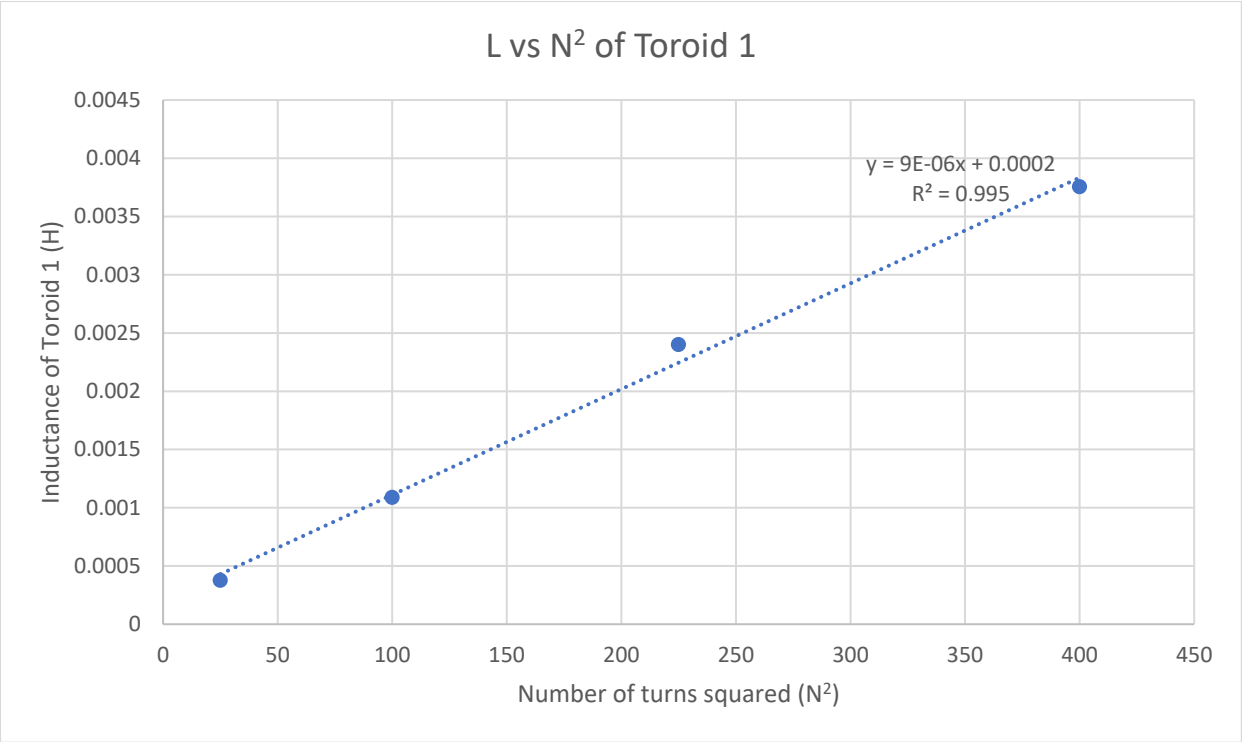
Name – Siddharth Mahala

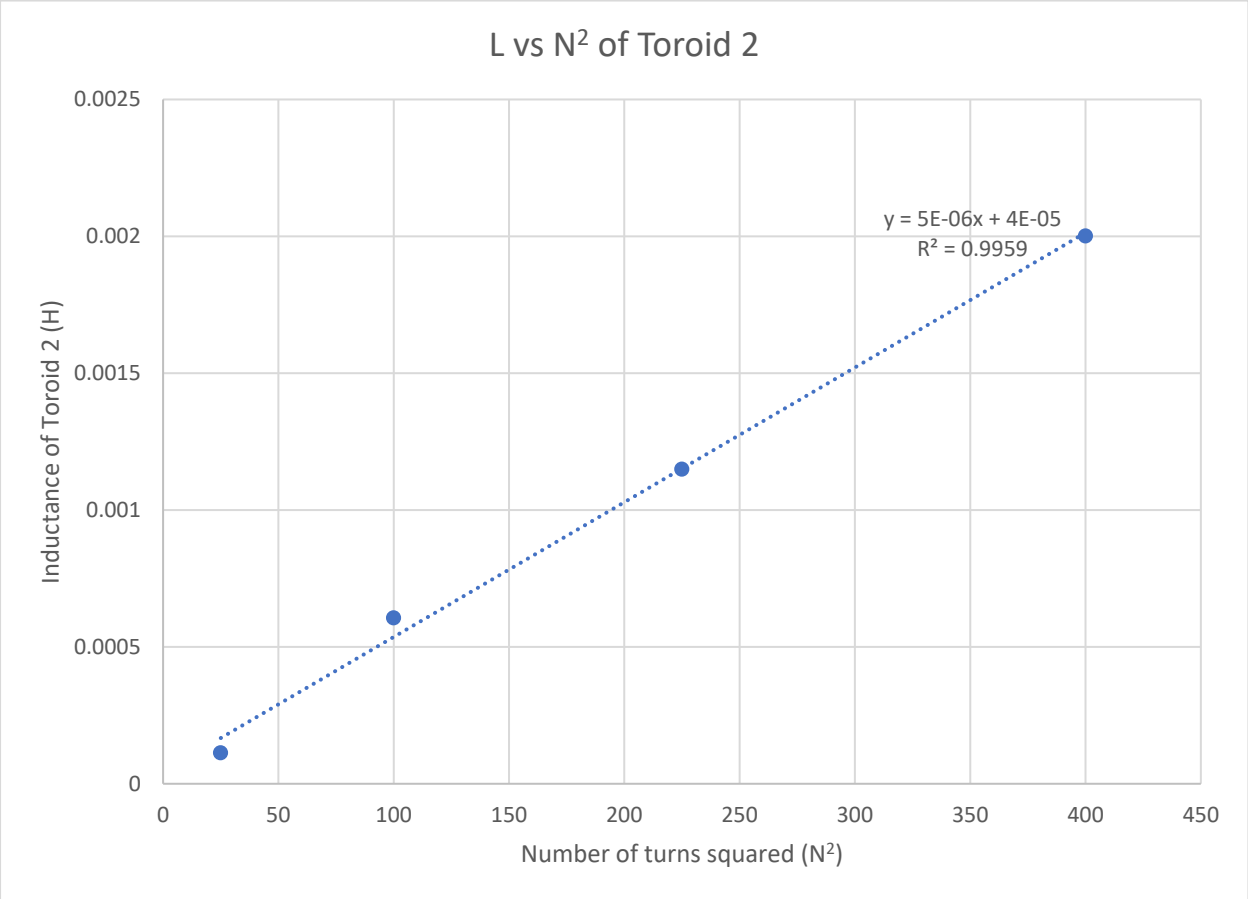
Student ID: 10760105

Answer 1.

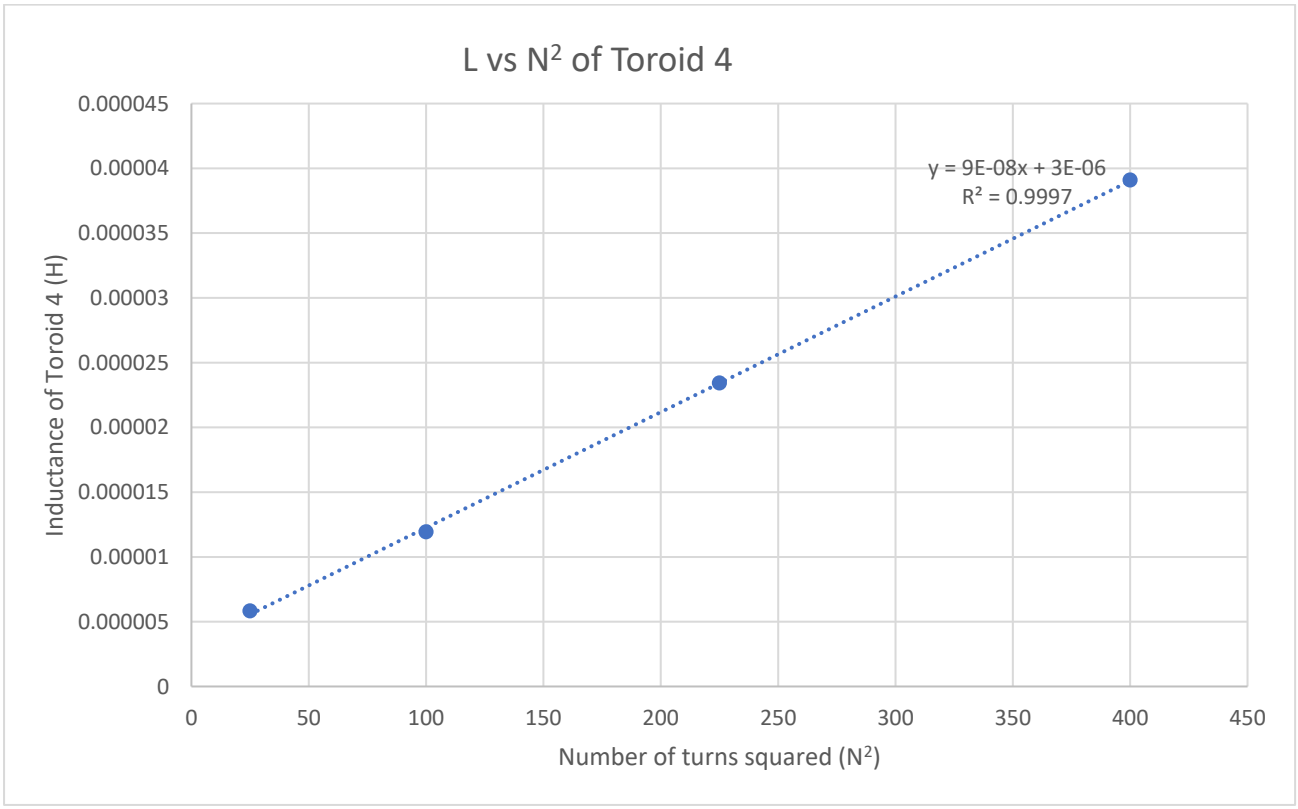
Toroid No	Number of coils	Inductance (mH)	Frequency (kHz)
1	5	0.376	10
1	10	1.088	10
1	15	2.400	10
1	20	3.755	10
2	5	0.113	10
2	10	0.606	10
2	15	1.149	10
2	20	2.001	10
3	5	0.017	100
3	10	0.072	100
3	15	0.158	100
3	20	0.230	100
4	5	0.006	200
4	10	0.012	200
4	15	0.023	200
4	20	0.039	200

Answer 2.


L vs N2 of Toroid 1
y = 9E-06x + 0.0002
R² = 0.995
Inductance of Toroid 1 (H)
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0
50
100
150
200
250
300
350
400
450
Number of turns squared (N2)


L vs N2 of Toroid 2
y = 5E-06x + 4E-05
R² = 0.9959
Inductance of Toroid 2 (H)
0.0025
0.002
0.0015
0.001
0.0005
0
0
50
100
150
200
250
300
350
400
450
Number of turns squared (N2)


L vs N2of Toroid 3
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
Inductance of Toroid 3 (H)
y = 6E-07x + 1E-05
R² = 0.9813
0
50
100
150
200
250
300
350
400
450
Number of turns squared (N²)


L vs N2 of Toroid 4
0.000045
0.00004
0.000035
0.00003
0.000025
0.00002
0.000015
0.00001
0.000005
0
Inductance of Toroid 4 (H)
y = 9E-08x + 3E-06
R² = 0.9997
0
50
100
150
200
250
300
350
400
450
Number of turns squared (N²)

Toroid No	L/N^2 (Slope)	μ_0 (Permittivity of free space in Henry/metre)	Cross-sectional Area (in 10^{-6}m)	Circumference of the coil-l (in m)	μ_r (Relative permeability)= $L \times l / \mu_0 \times A \times N^2$ Unit= Farad/metre
Toroid 1	9.07×10^{-6}	1.26×10^{-6}	48.9	6.02×10^{-2}	8891.00
Toroid 2	4.92×10^{-6}	1.26×10^{-6}	30.9	5.58×10^{-2}	774.39
Toroid 3	5.69×10^{-6}	1.26×10^{-6}	30.9	5.58×10^{-2}	817.28
Toroid 4	8.92×10^{-6}	1.26×10^{-6}	30.9	5.58×10^{-2}	128.22

Answer 3.

The possible sources of error in the calculation of permeability can be :

- There may be an error in the toroid length measurement (physical dimensions of toroid) as they were measured by vernier calliper.
- In this experiment, callipers were used to connect the wires, by which there can be some loss of permeability.
- There can also be an error due to irregular waves on the signal generator as it cannot handle high inductance which results in irregularities in the sine wave i.e., not perfect. (Due to high emf causing interference with the generators)

Answer 4.

Toroids 1 and 2 are soft magnets as their relative permeability is more than 1000 and magnetisation disappears on removal of the external field or as the alternating voltage changes as we change the number of coils which indicates the magnets can be magnetized and demagnetized easily.

Toroids 3 and 4 are hard magnets (ferrites) as their relative permeability is less than 1000 and magnetisation persists in this one.

Answer 5.

When the circuit is broken the gap between the wires act as resistor. While the current in the inductor would not fall directly to zero; it would resist the change in the emf (electromotive force) as described in the Lenz law. The back currents are called Eddy currents which run in the opposite direction to the current. Assuming the break in the circuit is sudden and due to the high voltage and the eddy current there is a spark observed.