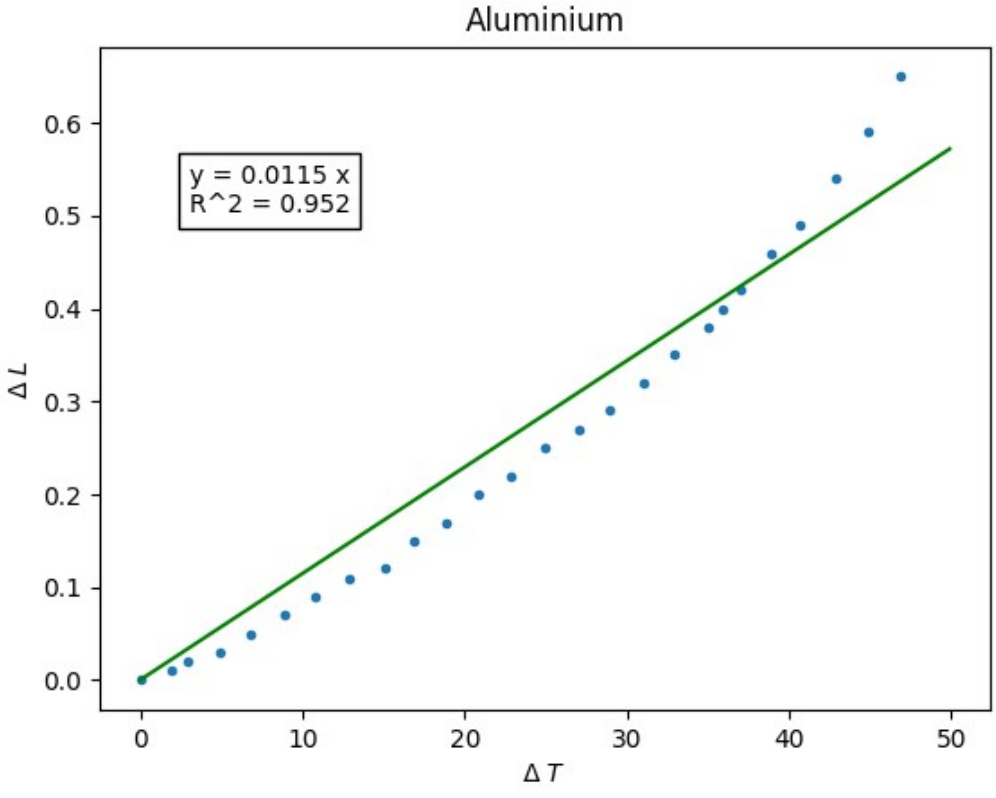
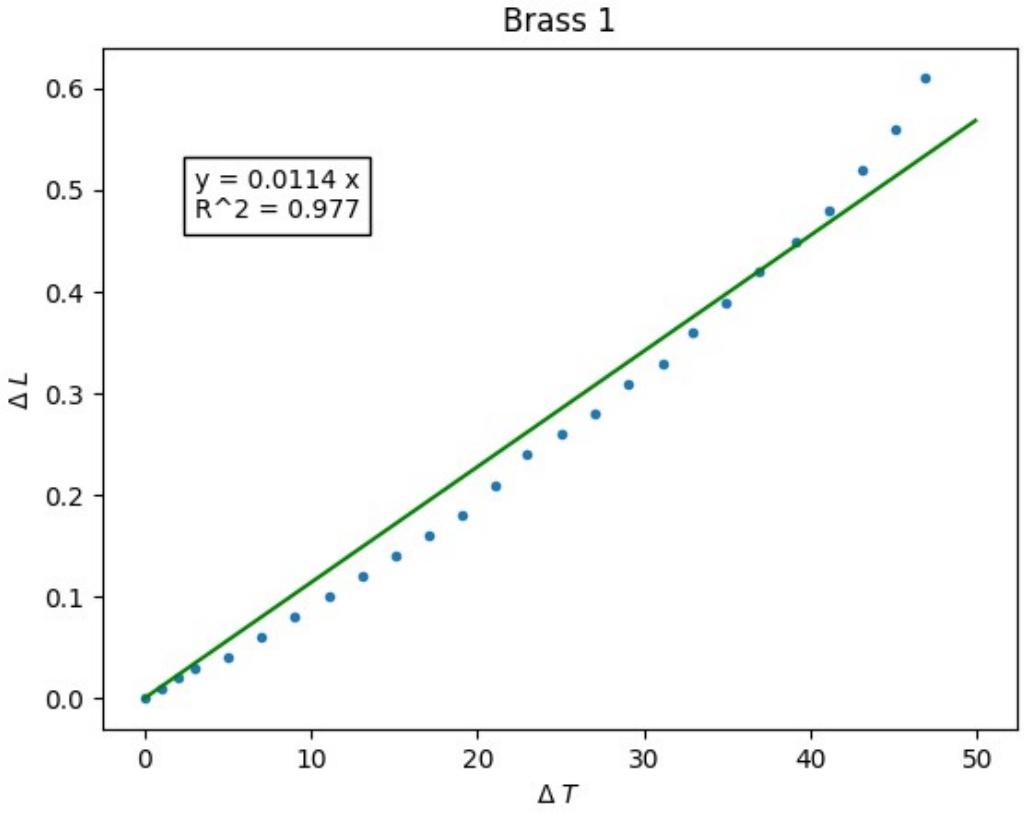
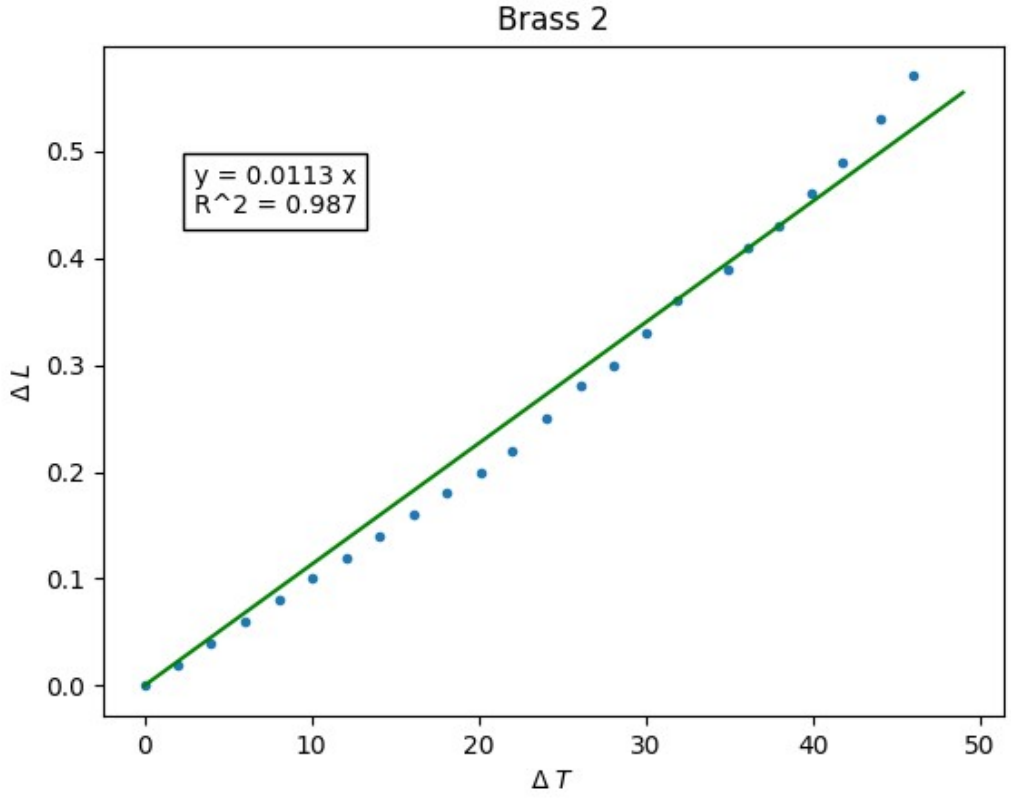
Aluminium		Brass		Brass	
Temp (°C)	**Reading**	**Temp (°C)**	**Reading**	**Temp (°C)**	**Reading**
73.0	5.63	72.9	5.77	75.0	5.76
71.0	5.57	71.1	5.72	73.1	5.72
69.0	5.52	69.1	5.68	70.8	5.68
66.8	5.47	67.1	5.64	68.9	5.65
65.0	5.44	65.1	5.61	67.0	5.62
63.1	5.40	62.9	5.58	65.1	5.60
62.0	5.38	60.9	5.55	63.9	5.58
61.1	5.36	58.9	5.52	60.9	5.55
59.0	5.33	57.1	5.49	59.0	5.52
57.1	5.30	55.0	5.47	57.1	5.49
55.0	5.27	53.0	5.44	55.1	5.47
53.1	5.25	51.1	5.42	53.1	5.44
51.1	5.23	49.0	5.40	51.0	5.41
48.9	5.20	47.1	5.37	49.1	5.39
47.0	5.18	45.1	5.34	47.1	5.37
45.0	5.15	43.1	5.32	45.1	5.35
43.0	5.13	41.1	5.30	43.1	5.33
41.2	5.10	39.1	5.28	41.1	5.31
39.0	5.09	37.1	5.26	39.1	5.29
36.9	5.07	35.0	5.24	37.1	5.27
35.0	5.05	33.0	5.22	35.0	5.25
32.9	5.03	31.0	5.20	33.0	5.23
31.0	5.01	29.0	5.19	31.0	5.21
29.0	5.00	28.0	5.18	**T_0 = 29.0**	**L_0 = 5.19**
28.0	4.99	27.0	5.17		
T_0 = 26.1	**L_0 = 4.98**	**T_0 = 26.0**	**L_0 = 5.16**		




Brass 1
y = 0.0114 x
R^2 = 0.977
Δ L
Δ T
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
10
20
30
40
50


Brass 2
y = 0.0113 x
R^2 = 0.987
Δ L
Δ T
0.0
0.1
0.2
0.3
0.4
0.5
0
10
20
30
40
50

Aluminium			Brass 1			Brass 2		
Δ L	**Δ T**	**α**	**Δ L**	**Δ T**	**α**	**Δ L**	**Δ T**	**α**
0.65	46.9	$(1.974\pm0.031)\times10^{-5}$	0.61	46.9	$(1.855\pm0.031)\times10^{-5}$	0.57	46.0	$(1.768\pm0.031)\times10^{-5}$
0.59	44.9	$(1.872\pm0.032)\times10^{-5}$	0.56	45.1	$(1.771\pm0.032)\times10^{-5}$	0.53	44.1	$(1.714\pm0.032)\times10^{-5}$
0.54	42.9	$(1.793\pm0.033)\times10^{-5}$	0.52	43.1	$(1.721\pm0.033)\times10^{-5}$	0.49	41.8	$(1.672\pm0.034)\times10^{-5}$
0.49	40.7	$(1.715\pm0.035)\times10^{-5}$	0.48	41.1	$(1.666\pm0.035)\times10^{-5}$	0.46	39.9	$(1.645\pm0.036)\times10^{-5}$
0.46	38.9	$(1.685\pm0.037)\times10^{-5}$	0.45	39.1	$(1.642\pm0.037)\times10^{-5}$	0.43	38.0	$(1.614\pm0.038)\times10^{-5}$
0.42	37.0	$(1.617\pm0.039)\times10^{-5}$	0.42	36.9	$(1.624\pm0.039)\times10^{-5}$	0.41	36.1	$(1.620\pm0.040)\times10^{-5}$
0.40	35.9	$(1.587\pm0.040)\times10^{-5}$	0.39	34.9	$(1.594\pm0.041)\times10^{-5}$	0.39	34.9	$(1.594\pm0.041)\times10^{-5}$
0.38	35.0	$(1.547\pm0.041)\times10^{-5}$	0.36	32.9	$(1.561\pm0.043)\times10^{-5}$	0.36	31.9	$(1.610\pm0.045)\times10^{-5}$
0.35	32.9	$(1.515\pm0.043)\times10^{-5}$	0.33	31.1	$(1.514\pm0.046)\times10^{-5}$	0.33	30.0	$(1.569\pm0.048)\times10^{-5}$
0.32	31.0	$(1.470\pm0.046)\times10^{-5}$	0.31	29.0	$(1.525\pm0.049)\times10^{-5}$	0.30	28.1	$(1.523\pm0.051)\times10^{-5}$
0.29	28.9	$(1.429\pm0.049)\times10^{-5}$	0.28	27.0	$(1.479\pm0.053)\times10^{-5}$	0.28	26.1	$(1.530\pm0.055)\times10^{-5}$
0.27	27.0	$(1.425\pm0.053)\times10^{-5}$	0.26	25.1	$(1.478\pm0.057)\times10^{-5}$	0.25	24.1	$(1.480\pm0.059)\times10^{-5}$
0.25	25.0	$(1.425\pm0.057)\times10^{-5}$	0.24	23.0	$(1.489\pm0.062)\times10^{-5}$	0.22	22.0	$(1.427\pm0.065)\times10^{-5}$
0.22	22.8	$(1.375\pm0.063)\times10^{-5}$	0.21	21.1	$(1.420\pm0.068)\times10^{-5}$	0.20	20.1	$(1.419\pm0.071)\times10^{-5}$
0.20	20.9	$(1.363\pm0.068)\times10^{-5}$	0.18	19.1	$(1.344\pm0.075)\times10^{-5}$	0.18	18.1	$(1.419\pm0.079)\times10^{-5}$
0.17	18.9	$(1.281\pm0.075)\times10^{-5}$	0.16	17.1	$(1.335\pm0.084)\times10^{-5}$	0.16	16.1	$(1.418\pm0.089)\times10^{-5}$
0.15	16.9	$(1.264\pm0.084)\times10^{-5}$	0.14	15.1	$(1.323\pm0.095)\times10^{-5}$	0.14	14.1	$(1.416\pm0.101)\times10^{-5}$
0.12	15.1	$(1.132\pm0.094)\times10^{-5}$	0.12	13.1	$(1.307\pm0.109)\times10^{-5}$	0.12	12.1	$(1.415\pm0.118)\times10^{-5}$
0.11	12.9	$(1.215\pm0.111)\times10^{-5}$	0.10	11.1	$(1.285\pm0.129)\times10^{-5}$	0.10	10.1	$(1.412\pm0.141)\times10^{-5}$
0.09	10.8	$(1.187\pm0.132)\times10^{-5}$	0.08	9.0	$(1.268\pm0.159)\times10^{-5}$	0.08	8.1	$(1.409\pm0.176)\times10^{-5}$
0.07	8.9	$(1.120\pm0.160)\times10^{-5}$	0.06	7.0	$(1.223\pm0.204)\times10^{-5}$	0.06	6.0	$(1.427\pm0.238)\times10^{-5}$
0.05	6.8	$(1.047\pm0.210)\times10^{-5}$	0.04	5.0	$(1.141\pm0.286)\times10^{-5}$	0.04	4.0	$(1.427\pm0.357)\times10^{-5}$
0.03	4.9	$(8.721\pm2.909)\times10^{-6}$	0.03	3.0	$(1.427\pm0.476)\times10^{-5}$	0.02	2.0	$(1.427\pm0.714)\times10^{-5}$
0.02	2.9	$(9.824\pm4.915)\times10^{-6}$	0.02	2.0	$(1.427\pm0.714)\times10^{-5}$			
0.01	1.9	$(7.497\pm7.500)\times10^{-6}$	0.01	1.0	$(1.427\pm1.428)\times10^{-5}$			
Average		**$(1.386\pm0.041)\times10^{-5}$**	**Average**		**$1.474\pm0.069)\times10^{-5}$**	**Average**		**$(1.520\pm0.039)\times10^{-5}$**

```
import numpy as np
from uncertainties import ufloat
from uncertainties import unumpy as unp

# Road File
filename = "Brass 2"
f = np.loadtxt(f"{filename}.csv", delimiter = ",", skiprows = 1)

# Set Up Data Arrays
T = f[:,0]
R = f[:,1]

R0 = R[-1]
T0 = T[-1]

L0_Aluminium = ufloat(702, 1)  # mm
L0_Brass = ufloat(701, 1)    # mm

Delta_L = unp.uarray([R[i] - R0 for i in range(len(R)-1)], 0.01)
Delta_T = unp.uarray([T[i] - T0 for i in range(len(T)-1)], 0.05)


if(filename == "Aluminium"):
    L0 = L0_Aluminium
else:
    L0 = L0_Brass

# Calculate Alpha
alpha = [Delta_L[i] / (L0 * Delta_T[i]) for i in range(len(Delta_L))]
```