

PHYS101 EXPERIMENT 1. MEASUREMENT AND ERRORS

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Data & Results Part A: [25]

Length (mm)		Breadth (mm)		Thickness (mm)	
L	ΔL	B	ΔB	T	ΔT
100.5	± 0.025	58.65	± 0.025	0.95	± 0.005

Table a1: Dimensional measurements

$\Delta L/L$	$\Delta B/B$	$\Delta T/T$
0.025%	0.043%	0.5%

Table a2: Percentage errors

Percentage error for Length: $\frac{\Delta L}{L} \cdot 100 = \frac{0.025}{100.5} \cdot 100 = 0.02497562$

Percentage error for Breadth: $\frac{\Delta B}{B} \cdot 100 = \frac{0.025}{58.65} \cdot 100 = 0.04262575$

Percentage error for Thickness: $\frac{\Delta T}{T} \cdot 100 = \frac{0.005}{0.95} \cdot 100 = 0.52631579$

V (mm ³)	ΔV (mm ³)	$\Delta V/V$
$56 \cdot 10^2$	$\pm 3 \cdot 10$	0.5%

Table a3: Volume with errors

V (Volume) = L (Length) * B (Breadth) * T (Thickness)

$V = 100.5 * 58.65 * 0.95 = 5,599.60875 \text{ mm}^3$
 $= 56 \cdot 10^2$ (rounding to two significant numbers)

$\Delta V = \sqrt{\left(\frac{\Delta L}{L}\right)^2 + \left(\frac{\Delta B}{B}\right)^2 + \left(\frac{\Delta T}{T}\right)^2} \cdot V = \sqrt{\left(\frac{0.025}{100.5}\right)^2 + \left(\frac{0.025}{58.65}\right)^2 + \left(\frac{0.005}{0.95}\right)^2} \cdot (56 \cdot 10^2) = 29.602 \dots$
 $\Delta V/V = \frac{29.100}{5600} = 0.5178 \dots$
 0.00528624688

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W (g)	ΔW (g)	$\Delta W/W$
7.71	± 0.005	0.06 %

Table a4: Weight with errors

Percentage error for weight = $\frac{\Delta W}{W} \cdot 100 = \frac{0.005}{7.71} \cdot 100 = 0.06485084$
 \Rightarrow rounded to 0.06

$\frac{7.71}{56.10^2} \Rightarrow$

ρ g/mm ³	$\Delta \rho$ g/mm ³	$\Delta \rho/\rho$
$1.4 \cdot 10^{-3}$	$7 \cdot 10^{-6}$	0.5 %

Table a5: Density with errors

$$\frac{\Delta \rho}{\rho} = \sqrt{\left(\frac{\Delta W}{W}\right)^2 + \left(\frac{\Delta V}{V}\right)^2} = \sqrt{\left(\frac{0.005}{7.71}\right)^2 + \left(\frac{0.029}{5.6}\right)^2}$$

Data & Results Part B: [15]

$0.00521901957 \cdot 100 \approx 0.5$

Number of Papers N	5	10	15	20	25
Thickness of Stack $T \pm \Delta T$ (mm)	0.05 ± 0.025	0.105 ± 0.025	0.155 ± 0.025	0.205 ± 0.025	0.255 ± 0.025

Thickness of 1 paper $\Rightarrow 0.01$ mm

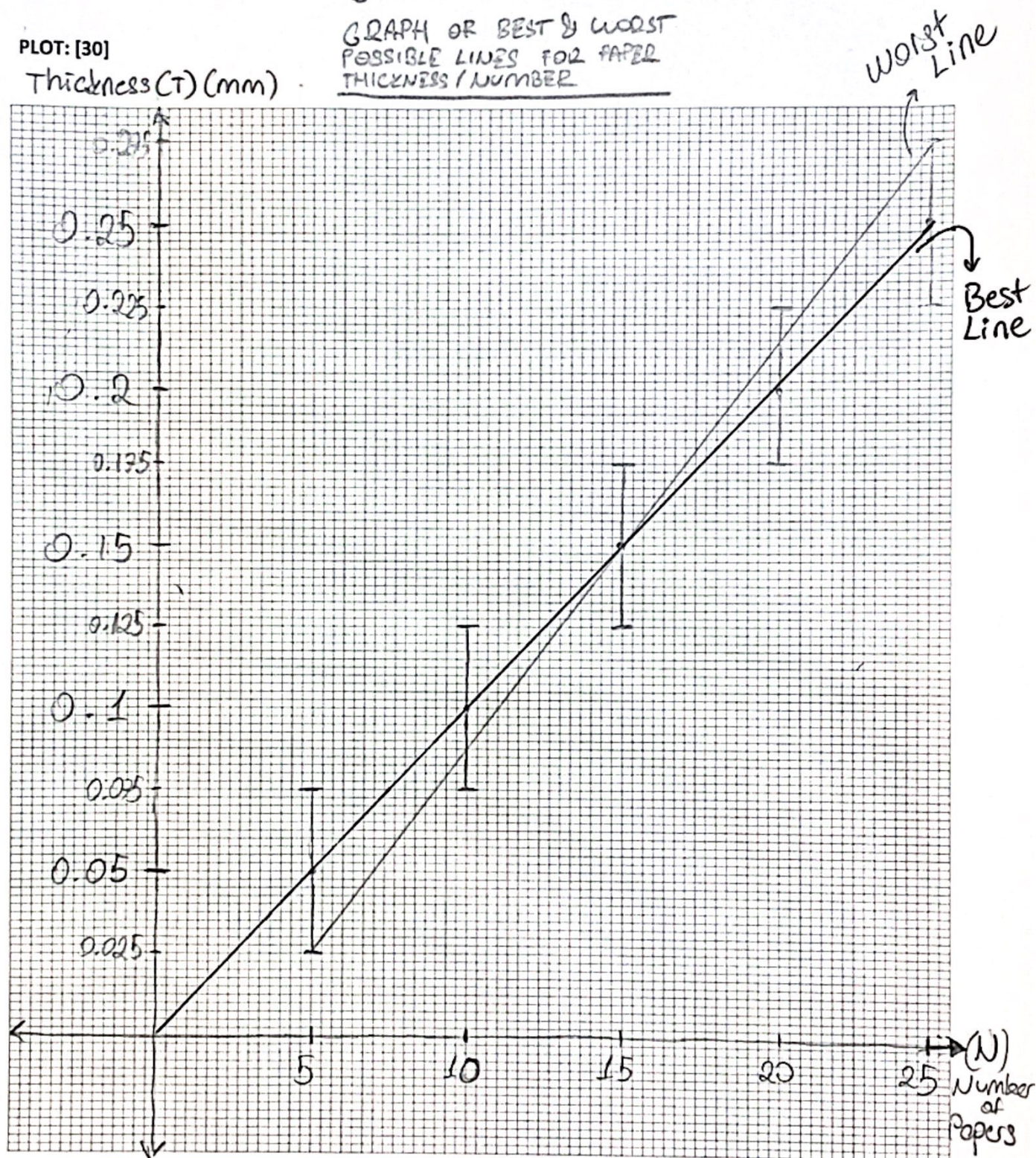
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PLOT: [30]

Thickness (T) (mm)

GRAPH OF BEST & WORST
POSSIBLE LINES FOR PAPER
THICKNESS / NUMBER



Slope: 0.01mm for best line $x=0, y=0$ for best line
Slope: 0.0125mm for worst line $x=0, y=-0.0375$ for worst line

Thickness of a single paper: $0.01\text{mm} \pm 0.025\text{mm}$

slope of the best line: $0.05/5 = 0.01\text{mm}$
slope of the worst line: $\frac{0.15 - 0.025}{15 - 5} = 0.0125\text{mm}$

$\Delta m = |m - \hat{m}| = |0.01 - 0.0125| = 0.0025\text{mm}$