Lab Manual Tables
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Overview

Overview

In this document, you'll learn:

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In this document, you'll learn:

- what the different lab manual tables are for

The tables in the lab manual template sections are mostly the same, because the *kind* of information collected in any experiment is the same.

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- Every *experimental factor* which potentially introduces uncertainty into the experiment needs to be identified.

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The lab manual has several tables to include all of this information.

Type of Quantities

Every *quantity* in an experiment is either:

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There are two tables for this information.

List of (non-calculated) quantities

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quantity	symbol	given/ mine	single/ repeated/ constant
Not in equations			

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quantity	symbol	given/ mine	single/ repeated/ constant
Not in equations			

In addition to what has already mentioned, this table keeps track of whether the symbol is "mine" (i.e. not from the manual), and whether it is measured once or multiple times.

List of (non-calculated) quantities

quantity	symbol	given/ mine	single/ repeated/ constant
height			
Not in equations			

In addition to what has already mentioned, this table keeps track of whether the symbol is "mine" (i.e. not from the manual), and whether it is measured once or multiple times.

List of (non-calculated) quantities

quantity	symbol	given/ mine	single/ repeated/ constant
height			
Not in equations			
	Fill in the symbol for height		

In addition to what has already mentioned, this table keeps track of whether the symbol is "mine" (i.e. not from the manual), and whether it is measured once or multiple times.

List of (non-calculated) quantities

quantity	symbol	given/ mine	single/ repeated/ constant
height			
Not in equations			

State whether this symbol was given, or my choice

In addition to what has already mentioned, this table keeps track of whether the symbol is "mine" (i.e. not from the manual), and whether it is measured once or multiple times.

List of (non-calculated) quantities

quantity	symbol	given/ mine	single/ repeated/ constant
height			
Not in equations			

State whether this is a constant, measured once, or many times

In addition to what has already mentioned, this table keeps track of whether the symbol is "mine" (i.e. not from the manual), and whether it is measured once or multiple times.

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- a *symbol* which is used for it in the manual or a report;

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- an *equation* to calculate it from measured quantities;

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- an *uncertainty equation* to calculate its uncertainty given the uncertainties in all of the measured quantities;

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It makes sense to have a table just for this information.

Calculated quantities

Calculated quantities

quantity	symbol	equation	uncertainty

Calculated quantities

quantity	symbol	equation	uncertainty
acceleration due to gravity	g		

First fill in the symbol.

Calculated quantities

quantity	symbol	equation	uncertainty
acceleration due to gravity	g	$g =$	

Put in the equation for the quantity to be calculated.

Calculated quantities

quantity	symbol	equation	uncertainty
acceleration due to gravity	g	$g = \ldots$	$\Delta g = \ldots$

Put in the equation for the *uncertainty* in the quantity.

Every *instrument* used for measurements needs to include

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- its *name*;

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- (If there is a *zero error* associated with it, that should be recorded as well.)

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- its *name*;
- the *units* in which it measures;
- the *precision measure* of measurements from it
- (If there is a *zero error* associated with it, that should be recorded as well.)

If the same instrument is used for many experiments, it makes sense to have a table just for this information so that it doesn't need to be recreated for every experiment.

Reference information for common instruments

Reference information for common instruments

ref. #	measuring instrument	precision measure	range	units
A1				
A2				
A3				
A4				
A5				
A6				

Reference information for common instruments

ref. #	measuring instrument	precision measure	range	units
A1	stopwatch			
A2				
A3				
A4				
A5				
A6				

Reference information for common instruments

ref. #	measuring instrument	precision measure	range	units
A1	stopwatch			
A2				
A3				
A4				
A5				
A6				

Fill in the precision measure

Reference information for common instruments

ref. #	measuring instrument	precision measure	range	units
A1	stopwatch			
A2				
A3				
A4				
A5				
A6				

Don't forget the units

Reference information for common instruments

ref. #	measuring instrument	precision measure	range	units
A1	stopwatch			
A2				
A3				
A4				
A5				
A6				

This is good for reference, but not essential.

Reference information for common instruments

ref. #	measuring instrument	precision measure	range	units
A1	stopwatch			
A2				
A3				
A4				
A5				
A6				

The *reference* allows a shorthand way of referring to this instrument in other tables without having to write out the whole name each time.

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- the *quantity* it affects;

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- the *quantity* it affects;
- its *description*;

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- the *quantity* it affects;
- its *description*;
- an estimated *bound* on the uncertainty introduced by it;

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- the *quantity* it affects;
- its *description*;
- an estimated *bound* on the uncertainty introduced by it;
- an indication of whether this uncertainty would be *random or systematic*;

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- the *quantity* it affects;
- its *description*;
- an estimated *bound* on the uncertainty introduced by it;
- an indication of whether this uncertainty would be *random or systematic*;
- (since this will indicate how the uncertainty can potentially be reduced.)

Every *experimental factor* which potentially introduces uncertainty into the experiment needs to include

- the *quantity* it affects;
- its *description*;
- an estimated *bound* on the uncertainty introduced by it;
- an indication of whether this uncertainty would be *random or systematic*;
- (since this will indicate how the uncertainty can potentially be reduced.)

It makes sense to have a table just for this information.

Experimental uncertainty factors and bounds

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
Sources of *random* error			

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h			
Sources of *random* error			

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h			
Sources of *random* error			

This is the quantity which is affected

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h	bend in tape measure		
Sources of *random* error			

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h	bend in tape measure		
Sources of *random* error			

This is the *description* of the cause

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h	bend in tape measure		
Sources of *random* error			

Experimental uncertainty factors and bounds

This is a *systematic* error

symbol	factor	bound	units
Sources of *systematic* error			
h	bend in tape measure		
Sources of *random* error			

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h	bend in tape measure	2	
Sources of *random* error			

Estimate a bound

Experimental uncertainty factors and bounds

symbol	factor	bound	units
Sources of *systematic* error			
h	bend in tape measure	2	cm
Sources of *random* error			

Don't forget units

Each quantity which is given or only measure once can be entered in this table with:

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- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;

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- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

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- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

In addition, if it's a *measured* quantity, then the table includes:

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- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

In addition, if it's a *measured* quantity, then the table includes:

- the *instrument* used to measure it;

Each quantity which is given or only measure once can be entered in this table with:

- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

In addition, if it's a *measured* quantity, then the table includes:

- the *instrument* used to measure it;
- the *precision measure* of the instrument (for convenience);

Each quantity which is given or only measure once can be entered in this table with:

- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

In addition, if it's a *measured* quantity, then the table includes:

- the *instrument* used to measure it;
- the *precision measure* of the instrument (for convenience);
- the *zero error* of the instrument (if applicable);

Each quantity which is given or only measure once can be entered in this table with:

- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

In addition, if it's a *measured* quantity, then the table includes:

- the *instrument* used to measure it;
- the *precision measure* of the instrument (for convenience);
- the *zero error* of the instrument (if applicable);
- the *effective uncertainty* if some experimental factor must be considered.

Each quantity which is given or only measure once can be entered in this table with:

- the *symbol* which is used for it in the manual or a report;
- the *value* of the quantity;
- the *units* of the quantity;

In addition, if it's a *measured* quantity, then the table includes:

- the *instrument* used to measure it;
- the *precision measure* of the instrument (for convenience);
- the *zero error* of the instrument (if applicable);
- the *effective uncertainty* if some experimental factor must be considered.

Quantities with a single value, given or measured

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
Not in equations						

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						

Fill in the instrument name
(or reference, if you filled the details
in the other table)

If you use a reference instead of a name, make sure it matches the other table. ▸ Go to table

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						

Fill in the value for height

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						

Don't forget the units

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						
	Fill in the precision measure					

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						

Fill in the zero error (if applicable)

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						
	If there's an effective uncertainy BIGGER than the precision measure					

Quantities with a single value, given or measured

symbol	value	units	instrument			effective uncertainty
			reference (e.g. A.1)	precision measure	zero error	
h						
Not in equations						

If there's an effective uncertainy BIGGER than the precision measure

If you fill in a value here, it must be explained in the *"Experimental uncertainty factors and bounds "* table. ▸ Go to table

Data for ball drops

Data for ball drops

Instrument					
reference (or name)					
units					
precision measure					
zero error					
	Times				
	Ball one ( )				Ball two ( )
	A dropping		B dropping		
i	gofer(B)	dropper(A)	dropper(B)	gofer(A)	
1					
2					
3					
4					
5					
average					
g					
σ					
α					
$\Delta(\bar{t})$					

Data for ball drops

	Instrument				
reference (or name)					
units	instrument used				
precision measure					
zero error					
	Times				
	Ball one ( )				Ball two ( )
	A dropping		B dropping		
i	gofer(B)	dropper(A)	dropper(B)	gofer(A)	
1					
2					
3					
4					
5					
average					
g					
σ					
α					
$\Delta(\bar{t})$					

Data for ball drops

Instrument					
reference (or name)					
units					
precision measure					
zero error					
	Times				
	Ball one ( )				Ball two ( )
	A dropping		B dropping		
i	gofer(B)	dropper(A)	dropper(B)	gofer(A)	
1					
2					
3	measurements				
4					
5					
average					
g					
σ					
α					
$\Delta(\bar{t})$					

Data for ball drops

Instrument					
reference (or name)					
units					
precision measure					
zero error					
	Times				
	Ball one ( )				Ball two ( )
	A dropping		B dropping		
i	gofer(B)	dropper(A)	dropper(B)	gofer(A)	
1					
2					
3					
4					
5					
average	calculated in lab				
g					
σ					
α					
$\Delta(\bar{t})$					

Data for ball drops

Instrument					
reference (or name)					
units					
precision measure					
zero error					
	Times				
	Ball one ( )				Ball two ( )
	A dropping		B dropping		
i	gofer(B)	dropper(A)	dropper(B)	gofer(A)	
1					
2					
3					
4					
5					
average					
g					
σ					
α					
$\Delta(\bar{t})$					

Don't miss this!

Data for ball drops

Instrument					
reference (or name)					
units					
precision measure					
zero error					
	Times				
	Ball one ( )				Ball two ( )
	A dropping		B dropping		
i	gofer(B)	dropper(A)	dropper(B)	gofer(A)	
1					
2					
3					
4					
5					
average					
g	fill in after lab				
σ					
α					
$\Delta(\bar{t})$					

Statistical quantities

Statistical quantities

Instrument			
reference (or name)			
units			
precision measure			
Trial #	time	time-average time $t - \bar{t}$	$(t - \bar{t})^2$
1 2 3 4 5	Measurements	Calculations	
average		$\bar{t}$	
sum		$\sum (time - \ average)^2$	
standard deviation		$\sigma = \sqrt{\frac{sum}{n-1}}$	
standard deviation of the mean		$\alpha = \frac{\sigma}{\sqrt{n}}$	

Recap

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1. For any experiment, many of the same types of things need to be recorded.
2. Many things need to be recorded in the lab, while some others can be determined later.