PHYS 100 EXPERIMENT 1 (week 2) Intro to Uncertainty

Name:	Student #:	Section:	Date:	
Outline:				

- 1. Introduction (10 min)
- 2. Diagnostic (20 min)
- 3. Clicker (5 min)
- 4. Planning (5 min)
- 5. Execution (20 min)
- 6. Group discussion (10 min)
- 7. Clickers and going over HW (10 min)

Intro (10 min)

1. Lab goals

The broad goals of the lab are:

- To gain experience with conducting scientific investigations
- To realize the relevance of science to everyday life.
- To appreciate the challenges and opportunities of applying scientific methods to answering questions about nature.

Components:

- Lab
 - In the lab you will be doing simple scientific experiments that address everyday questions.
 - Emphasis is on the scientific process and not on numeric outcomes.
- Homework
 - o Every week you will be given a homework task.
 - o The homework should take you less than 1 hour
 - The homework will prepare you for the subsequent lab and give you an opportunity to practice what was learned in the previous lab.
 - Always collect data. Do not use simulations authenticity has unique features.
- Final project
 - In the final project you will design, execute, and report an experiment of your choice.
 - An opportunity to apply what was previously learned.

2. Expectations

- You are expected to work and stay on task during the lab.
- Most tasks do not have one "correct" answer. Every answer is welcomed, as long as you can explain it.
- We expect you to think.
- Be active. Participate. Discuss with peers and TAs. Ask and answer questions. Learning in the lab takes place through interactions.

1. Marking

- Clickers, attendance, and homework: 7 points
- Final project: 8 points

Diagnostic (20 min)

The following diagnostic will help us identify what you already know and do not know, and will be used to tailor the labs to your needs.

It is graded for effort, not for correctness. Students who do their best will receive full marks; students who do not finish it or give random answers will receive less.

Topic: Intro to Uncertainties (5 min)

Understanding nature requires us to measure and compare different processes and quantities. For example, in this lab we will measure the average speed – either of a falling ball, or of a paper plane.

This lab focuses on:

- •Determining the average speed experimentally
- •Reducing uncertainty in the measurement
- •Estimating the uncertainty in your data.

Clicker 1.1: What is measurement uncertainty?

- A. A dispersion in the measured values due to faulty design, broken equipment, or something that went wrong during the experiment.
- B. The result of a human error in the measurement process.
- C. The capability of the measurement method and the equipment.
- D. A range of the experimental results.

Tasks

1. Today you will measure the average speed of either a falling ball or a paper plane, and estimate the uncertainty in your measurement. Remember that speed equals distance travelled over time. a. In pairs, choose whether you will use a ball or a paper plane, and answer the following questions: How will you measure the average speed? How many times should you measure it and why? (5 min) b. Execute your measurement plan and write the values below. Have you updated your initial plan? How and why? (20 min) c. What is the average? What is your estimated uncertainty? Report as average \pm uncertainty.

2.	Discussion: (10 min)				
	Join another group who measured a similar object (ball / plane) and answer the following questions:				
a.	Compare your method. What are the major differences between the ways you measured the average speed? What are the advantages and disadvantages of each method?				
b.	Why did you get different values for different trials and measurements of the same object?				
c.	What are the sources of variability? How can you minimize the uncertainty they introduce?				

3. Clickers (10 min)

☞ Clicker 1.2:

Which of the following sources, in your opinion, contributed the most to your uncertainty?

- a. Limitations of equipment
- b. Limitation of the measurement process (reaction time, etc).
- c. Uncertainty in measuring distance.

☐ Clicker 1.3:

Estimate the uncertainty that is introduced due to equipment:

- a. Less than 0.1 milliseconds.
- b. 0.1-1 milliseconds.
- c. 1-100 milliseconds.
- d. 0.1-1 seconds.
- e. 1 10 seconds.

☐ Clicker 1.4:

Estimate the uncertainty that is introduced due to the measurement process:

- a. Less than 0.1 milliseconds.
- b. 0.1-1 milliseconds.
- c. 1-100 milliseconds.
- d. 0.1-1 seconds.
- e. 1 10 seconds.

4. Go over homework for next week (5 min)

PHYS 100 Homework 1 (for week 3)

Name:	Student #:	Section:	Date:
Design and execute a plan for measurestep length, count steps, and measuresthould you repeat your measurement. Make sure to write neatly and clearly here.	e time; however, other method t? Report your walking speed	ds are possible in m/s.	e too. How many times
Submit the following using this page do not attach additional pages.	e. If you need more room, plea	ase use the oth	er side of this page, but
1. Description of your experiment:			
2. Raw data:			
3. Average walking speed and estimate	ated uncertainty:		

How long did it take you to complete the homework?

0 15 mm		0-15 min	15-30min	30-45min	45-60min	Over 60min
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Rubric

	Sufficient (✓)	Lacking (≠)	Insufficient (x)
Sufficient description of experiment			
Sufficient data was collected			
Calculation of average is sensible			
Estimation of uncertainty is sensible			

Clicker 1.1:

What is measurement uncertainty?

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- b. B. The result of a human error in the measurement process.
- c. C. The capability of the measurement method and the equipment.
- d. D. A range of the experimental results.

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