ACCURACY AND PRECISION OF MEASUREMENTS USING DIFFERENT MEASURING DEVICES

ACTIVITY NO. 1: UNCERTAINTY OF MEASUREMENT

OBJECTIVES :

1. **Identify the least count of common measuring devices.**
2. **Determine the uncertainty based on least count.**
3. **Write measurements with the correct notation and uncertainty.**

INTRODUCTION :

In any scientific measurement, no value is perfectly exact. Every measurement has a degree of uncertainty, which reflects the limitations of the measuring instrument and the person using it. This uncertainty is not a mistake-it's a normal and expected part of measuring.

The *least count* is the smallest division that a measuring device can reliably show.
The *uncertainty* is typically estimated as *± half the least count*, unless the instrument specifies otherwise.

EXAMPLE :

If a ruler's smallest division is 1 mm, the uncertainty is usually ± 0.5 mm.
So if the length measured is 12.0 cm, you should write:
12.0 cm ± 0.05 cm

Understanding and writing measurements with uncertainty is essential in physics to show the reliability and precision of your data.

MATERIALS :

- Ruler (cm and mm scale)
- Vernier caliper (if available)
- Triple beam balance or digital scale
- Measuring tape
- Stopwatch
- Objects to measure
  - -pen
  - -metal ball
  - -book
  - -your name
  - -coin
  - -cylinder

PROCEDURE:

- Use the smallest division you can reliably read to determine the least count.
- Uncertainty is usually *± half the least count* unless otherwise stated.
- Measure the following objects using appropriate devices. Write each result with the correct *measurement ± uncertainty* format.

PART 1 :IDENTIFY LEAST COUNT AND ESTIMATE UNCERTAINTY

Measuring Device	Least Count	Estimated Uncertainty (±)
Ruler (cm side)	0.5 mm	0.5mm ± 0.025mm
Ruler (mm side)	0.5mm	0.5mm ± 0.25mm
Measuring tape	0.5mm	0.5cm ± 0.25cm
Digital Scale (kg)	1g	1g ± 0.5g
Triple Beam Balance (g)	0.1mg	0.1mg ± 0.05g
Stopwatch (digital)	1ms	1ms ± 0.5ms

PART 2 : TAKE AND REPORT MEASUREMENTS

Object Measured	Device Used	Measured Value	Proper Notation (with ± uncertainty)
Length of a pen	Ruler (mm side)	140 mm	140mm ± 0.5m
Mass of a metal ball	Triple beam balance	61.1 g	61.1g ± 0.05g
Height of a book	Ruler (cm side)	32.6 cm	32.6cm ± 0.05cm
Time to say your name	Stopwatch	1.83 seconds	1.83 sec. ± 0.5ms
Width of a coin	Vernier caliper	2.9 cm	2.9cm ± 0.05cm
Mass of a cylinder	Tiple beam balance	153.5 g	153.5g ± 0.05g

QUESTIONS :

Why is it important to report uncertainty in measurement?

- It is important because no measurement is perfectly exact. Reporting uncertainty shows the possible range of error, increases reliability and helps others judge the quality and precision of the data.

QUESTIONS :

What is the difference between precision and accuracy?

- Accuracy is how close a measurement is to the true or accepted value. Precision is how consistent repeated measurement are, even if they are not close to the true value.

QUESTIONS :

If two students measured the same object but reported slightly different uncertainties, is one of them necessarily wrong? Explain

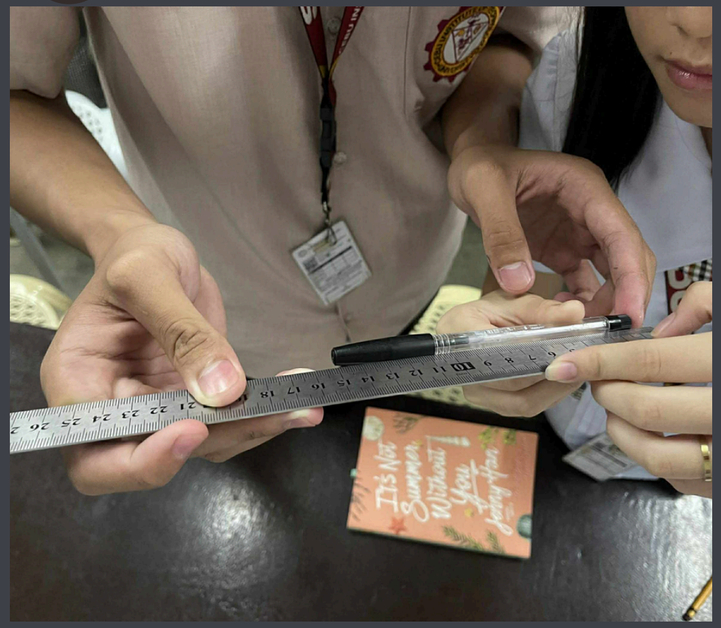
- Not necessarily, different instruments, measuring techniques or interpretasions of the smallest division can lead to sligthly different uncertaintie. Both results can still be valid within experimental limits.

QUESTIONS :

How can using better instruments reduce uncertainty?

- Better instruments have finer scale divisions and improved sensitivity, which allows for more exact readings. This reduces the range of possible error and increases measurement reliability.

DOCUMENTATION :



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