

“Precision & Accuracy” Answers

QUESTIONS:

- 1) Reaction Time: Reading the ruler with fingers in the way
Anticipation may have altered results
- Candle & Flame: Flame was moving
Reading the ruler with distance between the candle and ruler
- Watch: Time between reading your watch and the clock
Watch or clock set wrong
- 2) Usually, the candle experiment gives the most precise measurements with all measurements very close to each other, very close to the same number.
- 3) A systematic error definitely affects accuracy because the measurements are always off by the same amount. However, measurements can still be very precise (grouped well) with a systematic error. Thus, a systematic error affects accuracy but not precision.

4) **a. Precision of every measurement made with the new scale**

Measuring to the sixteenth of an inch gets the numbers closer to each other than when measuring to the eighth of an inch, so precision is increased. The measuring tool could be used incorrectly yielding very precise measurements that are wrong, so this does not necessarily increase accuracy.

5)

Teresa	Alexes	Krystina	Bacall
2.0	7.3	7.0	7.3
2.1	9.4	7.3	
1.9	4.2	7.2	
2.0	7.0	7.1	

Averages: Teresa 2.0
Alexes 6.98
Krystina 7.15

Calculating an average is necessary when determining the accuracy of the measurements.

- a) **Krystina** is accurate and precise
- b) **Teresa** is precise but not accurate
- c) **Alexes** is accurate but not precise (the average is relatively close to 7.3)
- d) **Bacall** is accurate only (there is only one measurement)
- e) **Teresa**'s measurements are a result of a systematic error (she is always off by about the same amount)

6) Teresa: $\frac{7.3 - 2.0}{7.3} \times 100 = \mathbf{72.6\% \text{ error}}$

Alexes: $\frac{7.3 - 6.98}{7.3} \times 100 = \mathbf{4.38\% \text{ error}}$

Krystina: $\frac{7.3 - 7.15}{7.3} \times 100 = \mathbf{2.05\% \text{ error}}$

Summary: Sets of numbers that are all approximately the same value are precise, but may not be correct. Calculating an average can remove random error and the average may be close to the correct number even if many of the measurements were not.