

PowerPoint Notes on Science, Measurement, Uncertainty, and Error

Slide 1: The introductory cartoon, humorous, details the fact that almost every time you take a measurement in science you have its two buddies, uncertainty and error. The humor is that everyone including scientists makes errors.

Slide 2: Correlates the link among measurement, uncertainty, and error.

Slide 3: There are two sources of error, random and systematic. Systematic errors occur when the error is always present in the same direction by the same amount, for example, a balance that is uncalibrated. You can do something to remove systematic error but not random error. Random errors are there because, well, that's life. Our measurement tools are never exact.

Slide 4: Outlines random errors, always present, and their sources. The only way to minimize them is to take repeated measurements which will eventually lead to statistics. By doing statistics, you hope the random errors cancel each other out.

Slide 5: Outlines systematic errors, how to recognize them and minimize them with better experimental design, better calibration

Slide 6: Shows what is meant by accuracy and precision.

Slide 7: Uses the dartboard analogy to demonstrate accuracy and precision.

Slide 8: Precision is limited by the measuring tool and that the last number in a scientific measurement is an estimate. A number to a scientist is different than a number to the rest of the world. For example, 7.0 is different from 7.00.

Slide 9: Shows how scientific data and accuracy and precision are linked.

Slide 10: Tells us how to identify and then limit the errors when we are making measurements.

Slide 11: In spite of all we can try and do, there will always be errors whenever we take measurements. In order to deal with them and get valid interpretations, we need statistics. Question: Is it better to take one big measurement or many small ones? Statistics says the latter.

