ERRORS AND SIGNIFICANT FIGURES

ERRORS

- Mistakes - result of carelessness, easily detected
- Errors - fall into two types, systematic or random

ERRORS

- Systematic errors - due to imperfections in instruments and/or way experimenter does things
- Random errors - due to limitations of the scale divisions of an instrument

SIGNIFICANT FIGURES

- Retain as many figures as actually represent a measurement but no more.
- Uncertain figure - last figure of a measurement estimated when using rulers and glassware

SIGNIFICANT FIGURES

- 1. All nonzero numbers are significant figures.

SIGNIFICANT FIGURES

- 2. Zeros that do not appear after some other digit are called leading zeros and are never significant.

SIGNIFICANT FIGURES

- 3. Zeros surrounded by nonzeros are called captive zeros and are significant.

SIGNIFICANT FIGURES

- 4. Zeros following a nonzero in a number with a decimal point are called trailing zeros and are significant.

SIGNIFICANT FIGURES

- 5. In numbers larger than ten, use a decimal point to indicate if the trailing zeros are significant.

RULES FOR MATHEMATICAL OPERATIONS

- When adding or subtracting, the smallest number of digits to the right of the decimal point determines the number of significant figures.

RULES FOR MATHEMATICAL OPERATIONS

- When multiplying or dividing, the smaller number of significant figures of the two numbers is the number of significant figures the answer is expressed in.

ROUNDING RULES

- Rule 1. If the first digit to the right of the last significant figure is less than five, the preceding digit is left unchanged.

ROUNDING RULES

- Rule 2. If the digit to the right of the last uncertain digit is greater than five, the preceding digit is increased by one.

ROUNDING RULES

- Rule 3. If the digit to the right of the last significant digit is five, the preceding digit is not changed if it is an even number and changed if it is an odd number.

ACCURACY

- The accuracy of measurements is often expressed in terms of the percentage difference or percentage error.

ACCURACY

- The percentage difference is often calculated in the absence of an accepted value.

$$\text{Percentage difference} = \frac{\text{difference}}{\text{average}} \times 100\%$$

ACCURACY

- For example, two measurements of a hallway were 14.2 m and 15.1 m.

ACCURACY

- Often, the accuracy obtained through laboratory measurements is determined by comparing the experimental values with standard values.

$$\text{Percentage error} = \frac{\text{error}}{\text{accepted value}} \times 100\%$$

ACCURACY

For example, a meter stick is measured to be 1.009 m long.