ERRORS AND SIGNIFICANT FIGURES

ERRORS

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

ERRORS

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

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

• 1. All nonzero numbers are significant figures.

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

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

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

 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.

Percentage difference = <u>difference</u> x 100% average



 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.

Percentage error = <u>error</u> x 100% accepted value



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