SCIENCE 1206 **UNIT 3: MOTION**

WORKSHEET #7: ERROR AND PERCENT DISCREPANCY

No matter how careful we are and no matter how expensive our equipment is, no measurement made is ever exact. The **accuracy (correctness)** and **precision (number of significant figures)** of any measurement is always limited by a variety of factors:

- the skill of the observer (that is you or your lab partner)
- the calibration the measuring equipment is capable of
- the environment in which the experiment is performed.

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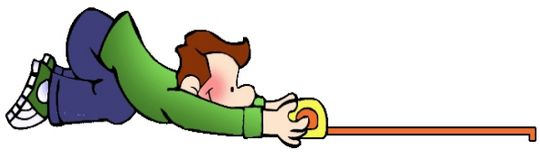
10

Two types of errors are possible:



1. SYSTEMATIC ERROR (YOU CAN FIX)

They are often due to a problem that persists throughout the entire experiment and is usually the result of a mis-calibrated device, or a measuring technique that always makes the measured value larger (or smaller) than the "true" value. You can usually fix these errors by inspecting and recalibrating equipment regularly

Examples:

- Parallax : The change in relative position of an object with a change in the viewing angle

-a clock that runs slow or a ruler with a rounded end

- The balance arm on a triple beam balance is not exactly on the zero mark.

$$\% \text{ Discrepancy} = \left| \frac{\text{Experimental value} - \text{accepted value}}{\text{accepted value}} \right| \times 100$$

2. RANDOM ERROR (UNPREDICTABLE)

These errors usually result from the experimenter's inability to take the same measurement in exactly the same way to get exact the same value. They can be reduced by taking many measurements and then averaging them (and having the same person take the measurement each time)

Example:

-a person measuring the length of an object using a ruler must estimate the last digit; another person may not estimate to the same digit

- You measure the mass of a wooden block four times using the same balance and get slightly different values: 57.46 g, 57.48 g, 57.45g, and 57.47g

PERCENT DISCREPANCY

The simplest way to express accuracy mathematically is percent discrepancy.

The difference between the value determined by your experimental procedure and the generally accepted value

$$\% \text{ Discrepancy} = \left| \frac{\text{Experimental value} - \text{accepted value}}{\text{accepted value}} \right| \times 100$$

Calculating Percent Discrepancy

For each of the following questions, calculate the percent discrepancy using the formula learned in class. Remember to use correct significant figures!! [10]

a. Mr. Fifield's Science 1206 class was doing an experiment to determine the value of the speed of light. Their experimental value was 1.9×10^8 m/s. If the accepted value for the speed of light is 3.00×10^8 m/s, what is their percent discrepancy?

b. A group of students were testing a nylon rope to determine what force could be exerted on the rope before the rope would break. The students found the maximum force to be 75 N, however, the manufacturer of the rope stated the maximum force to be 81 N. What is the percent discrepancy between the two values?

c. A radio controlled car is said to be able to attain a maximum velocity of 4.2 m/s, however upon testing this theory, Nick found the maximum velocity of the car to be 2.0 m/s. What percent discrepancy exists between the two values?

d. A motorcycle is said to weigh 406 kg upon arrival at the dealership. However, when the owner weighs the motorcycle to verify the statement, he finds that it weighs 4.1×10^5 g. What is the percent discrepancy between the value determined by the owner, and that given above?

e. An electrician estimates the current through an electric baseboard heater to be 6.32 A. The expected value however is 6. 60 A.