Error in the Laboratory

Learning Objectives:

- Classify errors as random and systematic and differentiate between the two
- Distinguish between the three types of systematic error and suggest reasonable physical explanations for each
- Describe methods of quantifying random error and detecting systematic error.
- Define precision and accuracy and distinguish between them
- Perform propagation of error calculations

1. Define and describe the characteristics of systematic error

2. Define and provide a unique example (not from the video or readings) of each of the systematic errors listed below.

Instrumental systematic error

Method systematic error

Personal systematic errors

3. List at least 4 ways of detecting systematic errors

4. Define and state the characteristics of random error

5. Describe how random errors can be detected and quantified

7. Define and state an example of gross error.

8. Draw a Family Tree for the types of error you have learned about, including: random, systematic, gross, instrumental, method, personal errors.

Test yourself:

9. A 10 mL pipet consistently delivers 10.05 $\pm$ 0.08 mL. Identify the magnitude of the random and systematic errors.

10. A 10-ml buret consistently delivers 1.98$\pm$ 0.01 mL when drained from exactly 0 to 2mL and consistently delivers 2.03 $\pm$ 0.02 mL when drained from 2 to 4 mL. Identify the magnitude of the random and systematic errors.

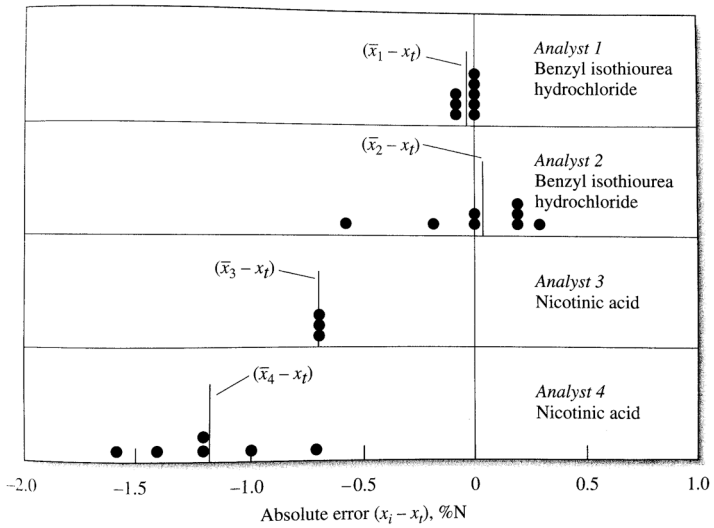
11. Calibration checks of your 750 uS cm-1 standard for a field electrical conductivity meter yields consecutive readings, taken at 2 hr intervals during the day, of: 753, 749, 735, 727, 711 uS cm-1. Classify the types of error you observe with this measurement and ascribe a cause if possible.

11. Define accuracy and precision and state the relationship between them.
Accuracy-

Precision-

Relationship?

12. Describe the systematic and random error you observe in the figure below.



Propagation of error

Learning Objectives:

- Be able to propagate errors associated with a series of measurements, given the appropriate equations.
- Apply the "common sense rule" to significant figures.

1. Do Problem 3-7.

2. State the "common sense rule" of significant figures.

3. Write the following measurements with the appropriate numebr of significant figures for the following:

10.25347 ± 0.00234853

238473.034 ± 230.53482

$0.000023293 \pm 0.0000032384$

4. What is the equation needed to calculate the relative undertainty?

5. What is the relative uncertainty of 10.05 ± 0.08 mL?

6. Fill in the table below for the most common equations needed for propagaing error.

Addition/ subtraction	
Multiplication/ division	

7. Practice by doing textbook question 3-16, parts a-c. BE SURE TO USE THE METHOD OUTLINED IN THE VIDEO AND EXAMPLE PROBLEMS!!!