

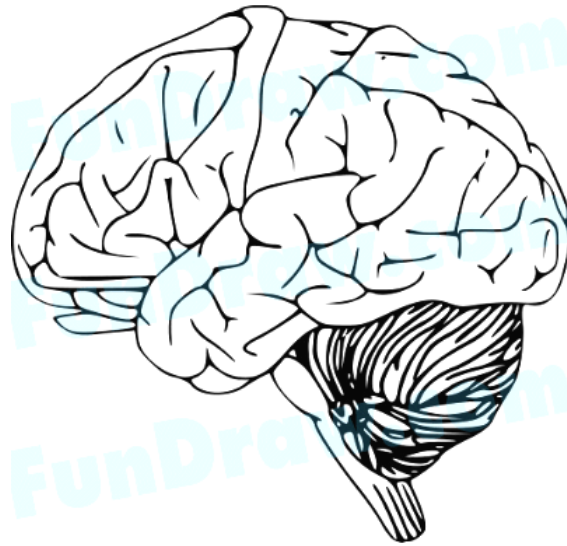
Physics 20 Labs

Fluffy, the "Galileo of the Lemmings,"
with his stopwatch.



Welcome to Physics 20 Labs

Warning! I



Physics

Labs

- Most lab reports you do in this course will require to collect & organize data and then analyze it
- Analysis of the data will be the most important part

Labs

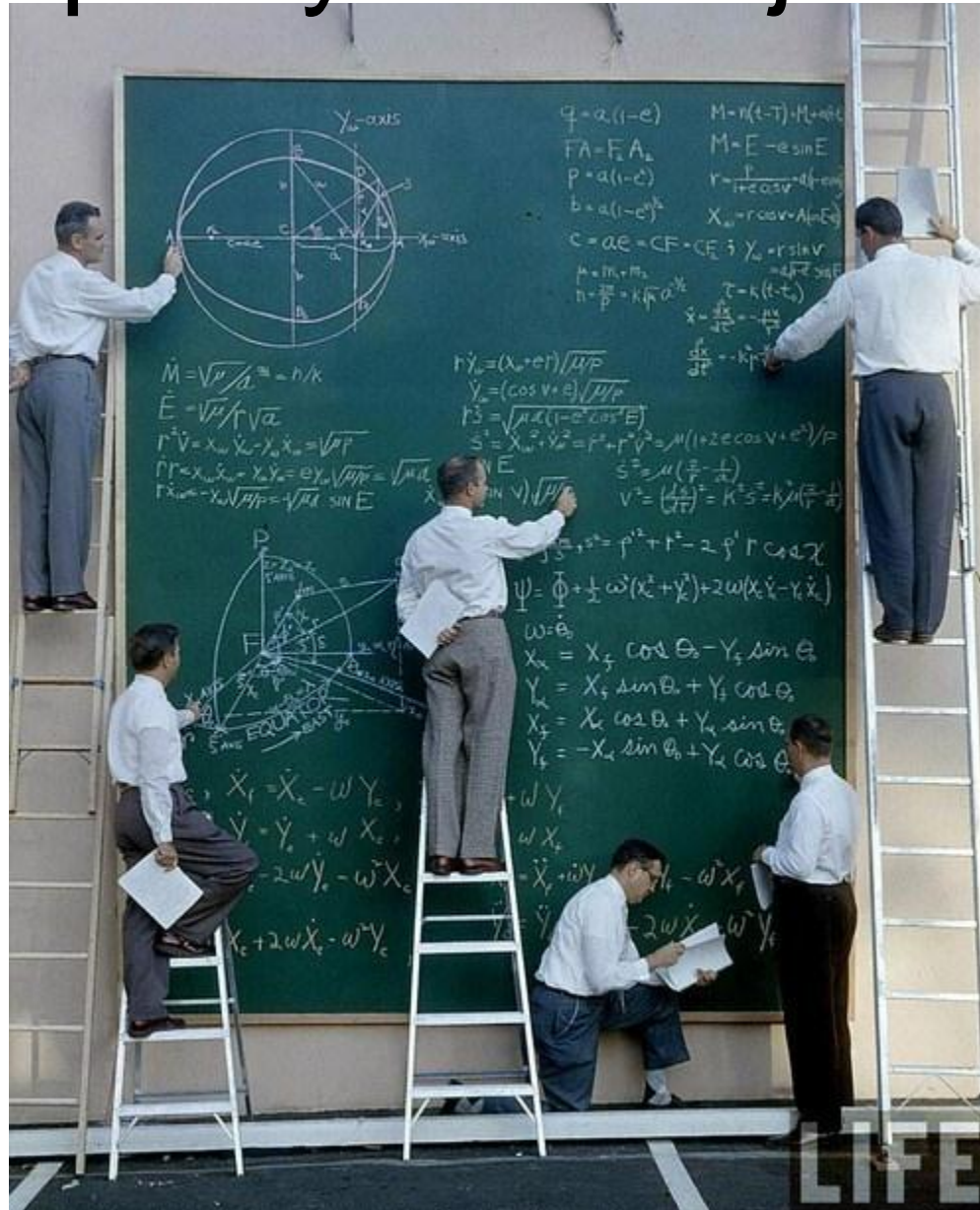
- Most labs will require a written assignment
- Some assignments will be a group effort, some must be 1 per person
- All members of the group must contribute to the activity

- Individual written assignments must not be just copied from other members of the group.

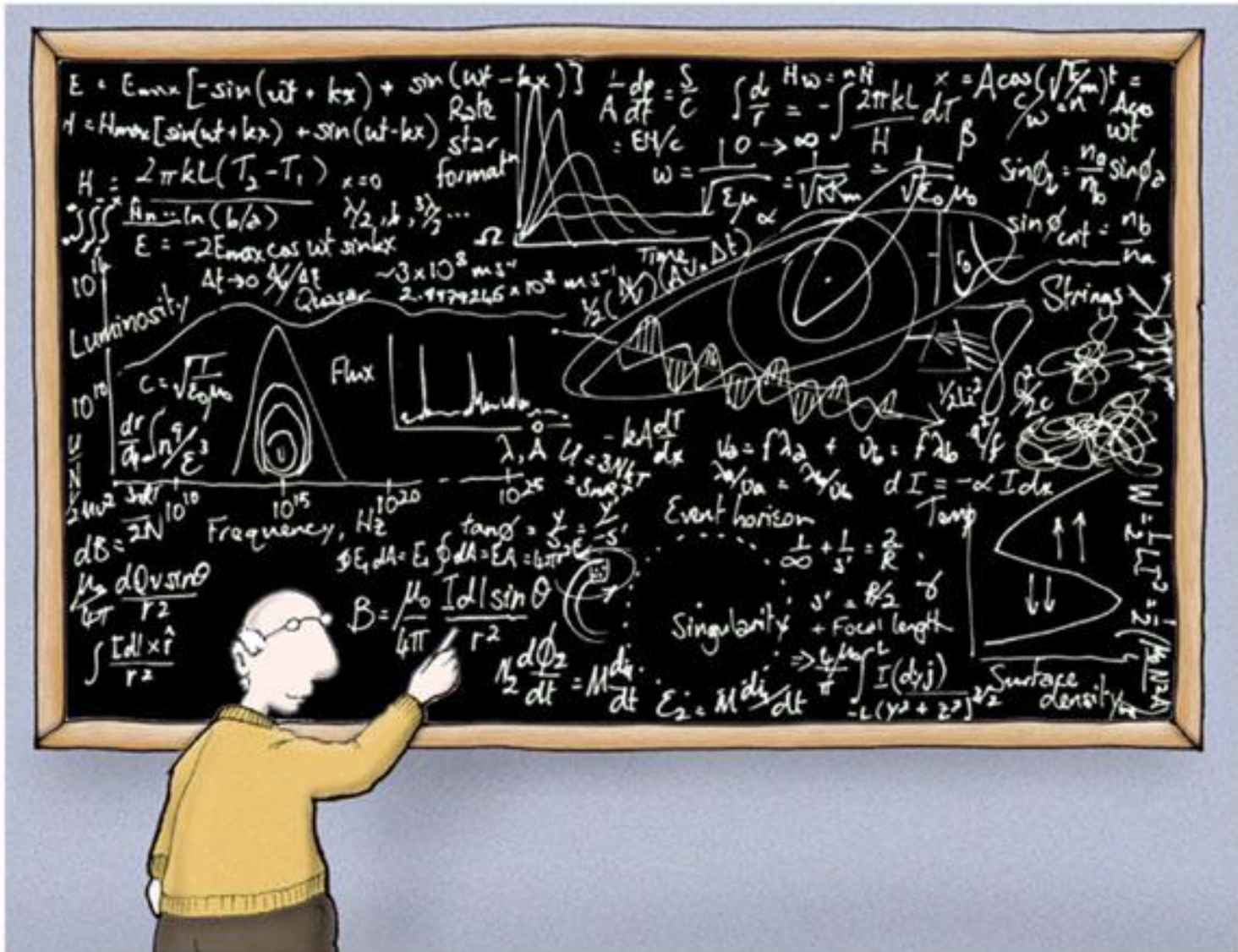
Labs

- It is a requirement of the Program of Studies that students demonstrate their ability to collect, organize, analyse and then interpret data and **clearly communicate** their results.

A Group Physics Project (Ideal)



An Individual Lab Report (Poor)



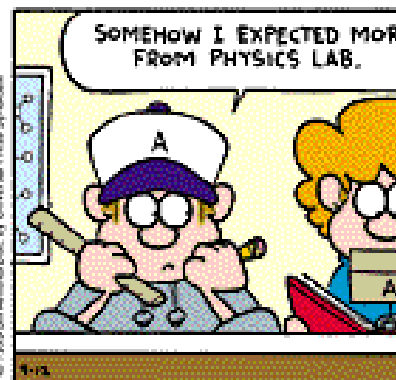
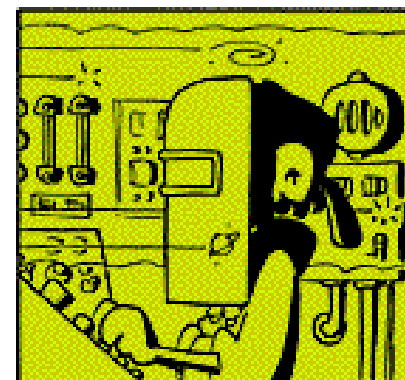
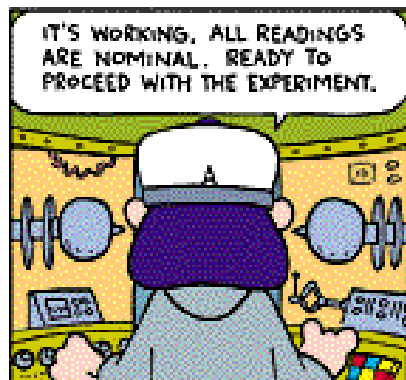
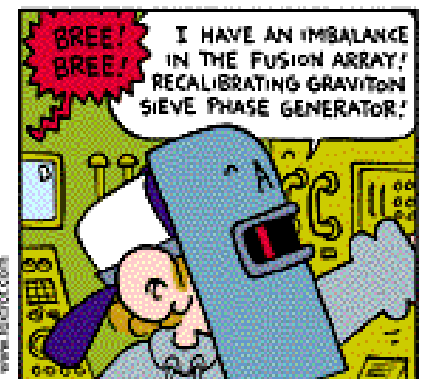
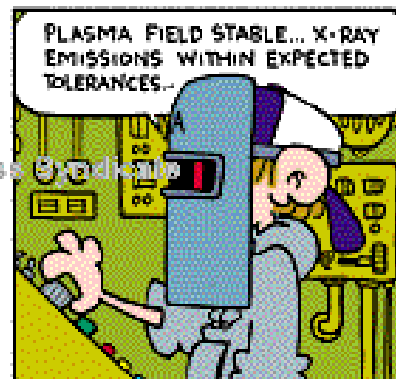
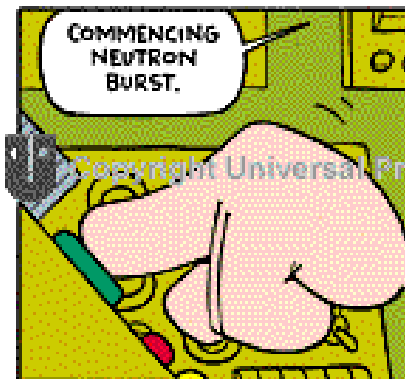
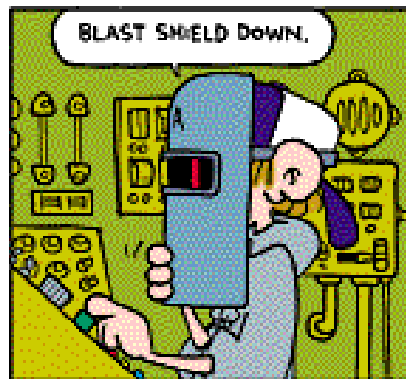
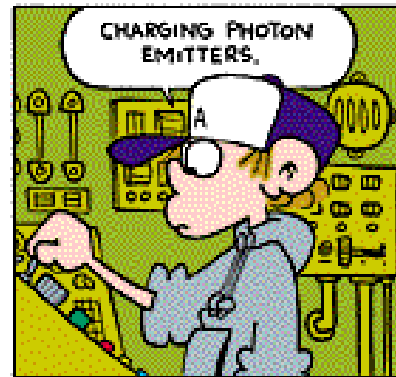
- These skills can not be learned or demonstrated by doing homework problems.
- Students examine the way in which "physics works" by taking into account the idealized assumptions of the theory and the practical limitations of the experiment.

Experimental error – a fact of scientific life.

- Experimental error is always with us; it is in the nature of scientific measurement that *uncertainty* is associated with every quantitative result.
- This may be due to built-in limitations in the measuring equipment, or of the measuring techniques, or perhaps the experience and skill of the person. However, mistakes do not count as part of the analysis.

FoxTrot

by Bill Amend



Human Error

- Human errors (mistakes, blunders, screw-ups) are NOT a source of experimental error; they are “experimenter's” error.
- **Do not mention** human error as a source of experimental error in any lab report!

- **Human error** occurs when you, or the lab partner you copied from, make a mistake.

- Examples include:

- Not setting up equipment correctly
- Misreading an instrument
- **Not following directions**
- **general sloppiness**
- Bad calculations, doing math incorrectly, using the wrong formula

Systematic Errors

- Systematic errors are characterized by the following properties:
- they are repeatable from experiment to experiment, with respect to both the sign of the error and also its approximate size
- they cannot be reduced or detected by repeating a trial

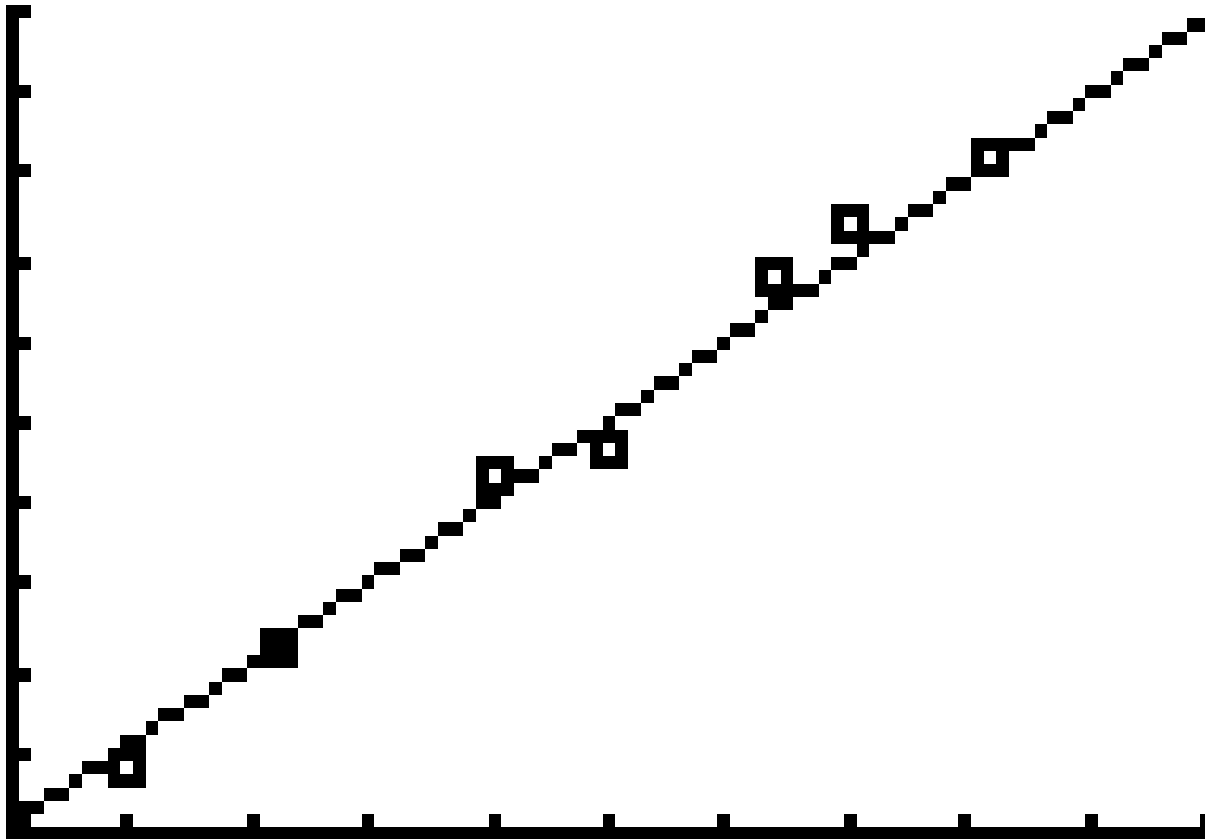
Examples:

- Defective meter zero in reading an instrument
- Incorrect positioning of the mark in the manufacture of a pipet
- Using oversize tires on a car which creates a constant error in the speedometer reading
- Using an out-of-date value for a physical constant such as the gas constant R or the gravitational constant (“ g ”) which varies with location
- Use of an uncalibrated balance

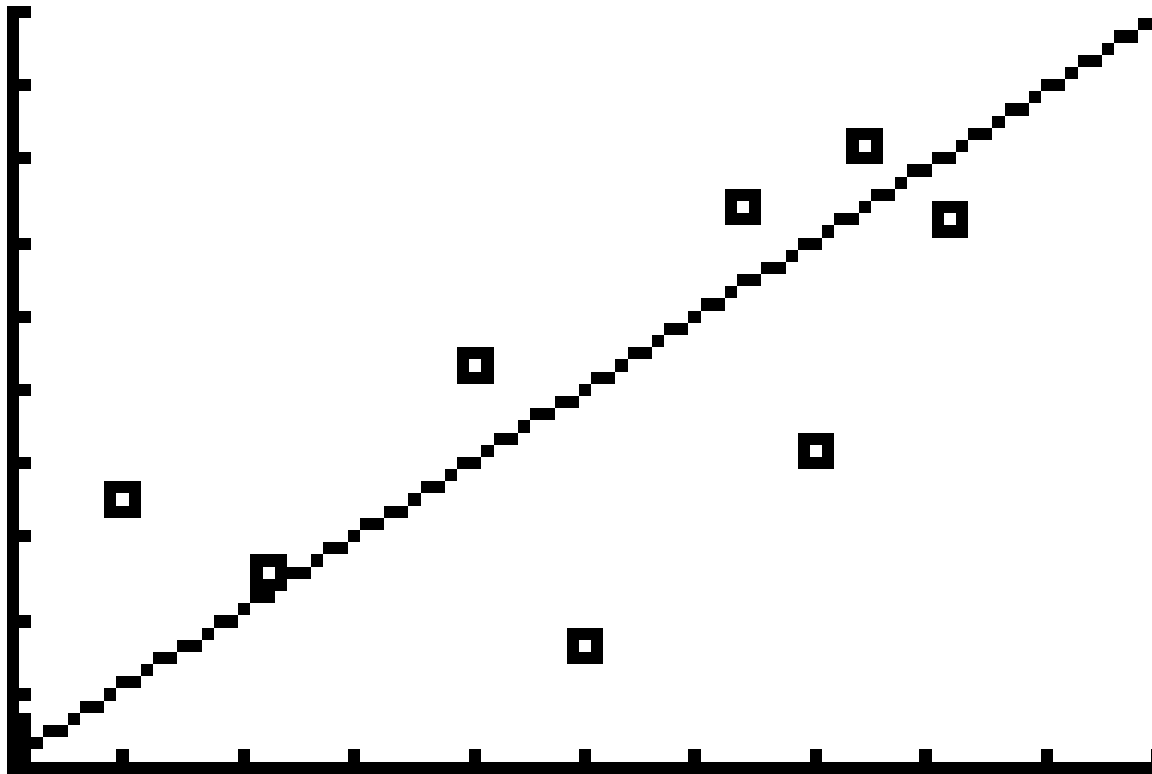
Random error

- All experiments have **random error**, which occurs because no measurement can be made with exact precision.
- Since random errors are equally likely to be high as low, performing several trials (and averaging the results) will also reduce their effect considerably.

Graph with little experimental error



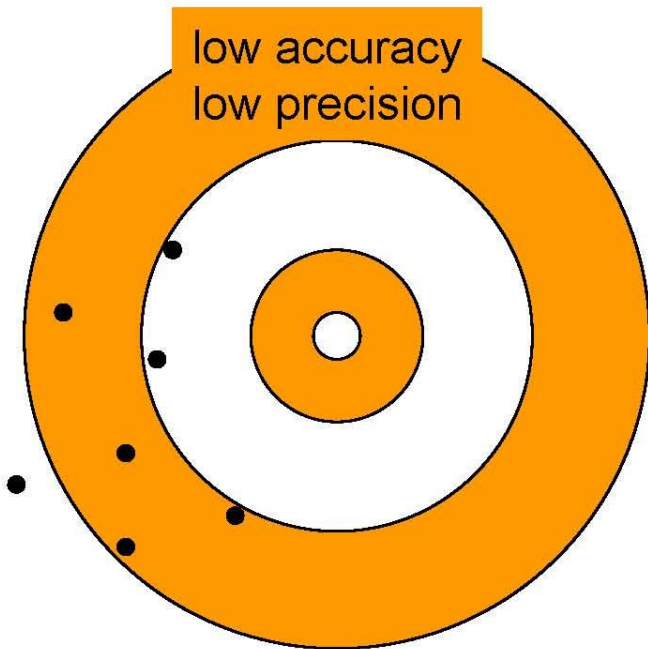
Graph with lots of experimental error



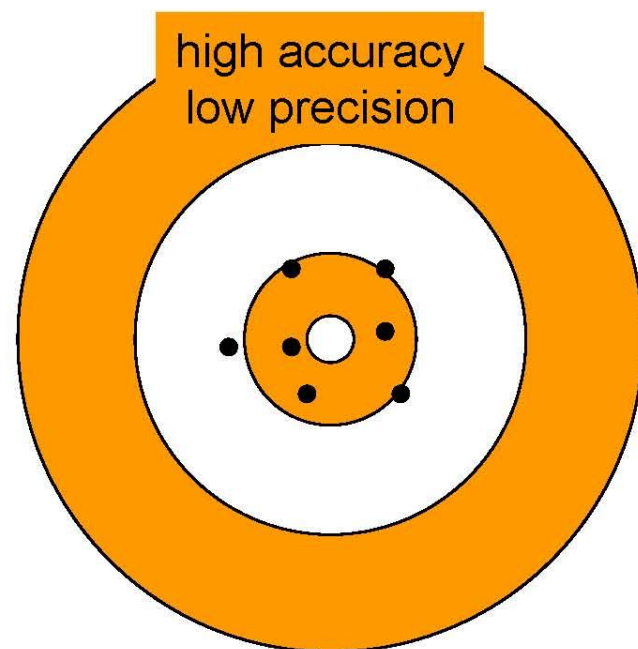
Precision and Accuracy

- Precision describes the reproducibility of a result. If you measure a quantity several times and the values agree closely with one another, your measurement is precise.
- If the values vary widely, your measurement is not very precise.
- Accuracy describes how close a measured value is to the “true” value.

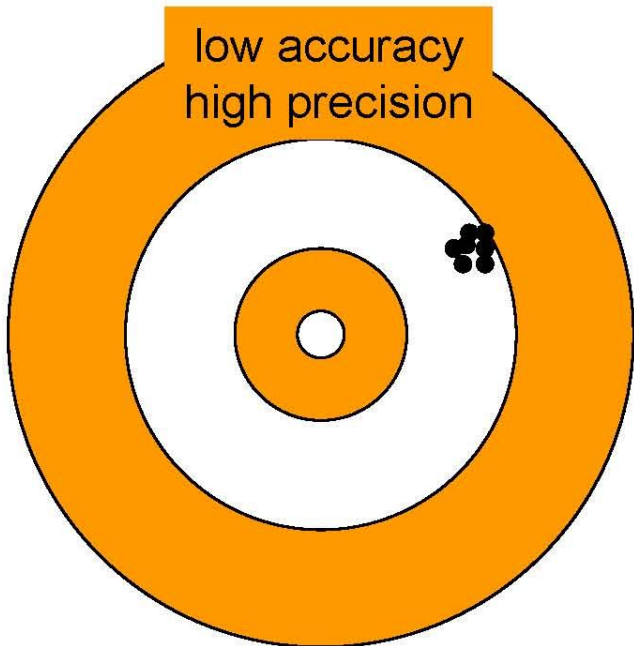
low accuracy
low precision



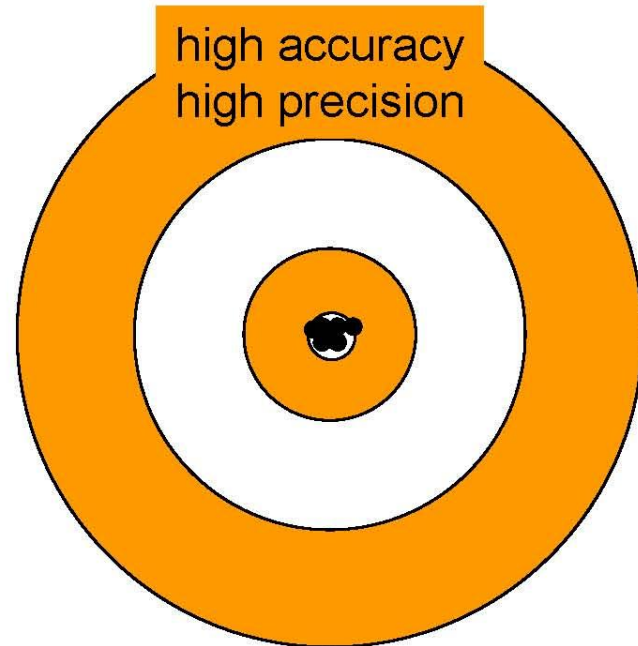
high accuracy
low precision



low accuracy
high precision



high accuracy
high precision



Lab reports

- In certain lab activities you will be expected to **think** and comment about where experimental errors may come from and their effect on your results.
- You will lose marks if your conclusions do not follow logically from your results. Do not say something just because that is what the textbook says.

- You will lose marks if you do not remark about remarkable results, and attempt to analyze their cause.
- For instance, if your lab record says "We measured the free-fall acceleration, g , in the classroom to be 468 m/s^2 " without any further comment, you are "toast."

You will lose marks

- if you only comment about sources of experimental error. Statements like "Friction may have caused an error in the results" must be supported with data, or at least **some likely source**.
- if you use the words "human error."

You will lose marks because

- Your teacher will assume this means "I don't care enough about this assignment to actually think about what is going on in it, so **please** lower my lab mark."

You will lose many marks

- if you say something like "I may have made a graphing or calculation error."
- Your teacher will read this phrase as "I really don't care enough about this assignment to go back and check my work, so please nuke my lab mark."

Need a written copy?

- Check the website soon!
- www.linville.ca