

# Science Research (developing new ideas)

1. Observing / Experimenting
2. Reflecting on observations / data / results, looking for trends / patterns
3. Developing models, laws (rules, facts), or theories (explanations)
4. Testing models, laws, or theories – apply to new situations
5. Predicting previously unobserved phenomena based on models, theories, or laws

## Some research is mathematically very difficult or tedious

- Past
  - limited how far could take some research.
  - some research just couldn't be done.
  
- Present ⇒ Computers
  - completely changed how we do science
  - allowed us to do previously undoable science
  - created new fields of science
  - simulate phenomena not directly observable

## We will use the computer to:

- Collect data
- Organize data
- Analyze data
- Graph data
- Model data
- Solve equations
- Do theoretical calculations
- Write reports

We need to develop good data collecting, analyzing and presenting skills in order to make valid conclusions and develop valid theories

### For Unit 1

Collect data  
Organize data (table)  
Analyze data  
Graph data  
Model data

- 1) By hand
- 2) Using computer  
(Develop spreadsheet skills)

## Unit 1.2

Prediction – must give a reason for your prediction.

Guess / Hypothesis       $\Rightarrow$

- Past experience
- Previous observation
- Logical reasoning

Ex) I predict that I can throw the tennis ball \_\_\_\_\_.

A Major League pitcher would throw  $\sim 90$  mph (40 m/s)

(55 mph  $\sim 25$  m/s)

Since I'm not a ML pitcher, haven't done any practice, and I'm an old man, I can throw  $\sim \frac{1}{2}$  of this speed  $\rightarrow 45$  mph. Also, since it is a tennis ball and not a baseball, I'm not going to throw as hard so that I don't hurt my arm.

## Unit 1.3

Since we have made our statement **testable**, and we are now taking data (observations) to test it.

⇒ prediction is a hypothesis

→ we are testing our prediction

- Be sure to warm up your arm (if you are going to throw hard).
- Purpose is to practice collecting **good** data, not to set speed records.
- Everyone does 3 timed pitches.
- Pick 10 m or 15 m (longer distance reduces uncertainty).

**Note:** We are not measuring speed.

We are measuring:

- positions
- time interval

We are calculating:

- distance
- speed

## Unit 1.3 (continued)

How good was your prediction?

- Include
- your initial prediction
  - your actual observation / result (speed)
  - a comparison of the two
    - how are they different
    - why do you think they are different

## Unit 1.4

Redo calculations from Unit 1.3 using a spreadsheet.

Appendix A walks you through how to:

- Enter the data
- Enter the formulas
- Change the number of sig. figs. (formatting)

## Unit 1.5

Be sure to put your results into the computer at the front of the room.  
Be sure to get everyone's results into your Activity Guide.

Can now do some of Homework 1.