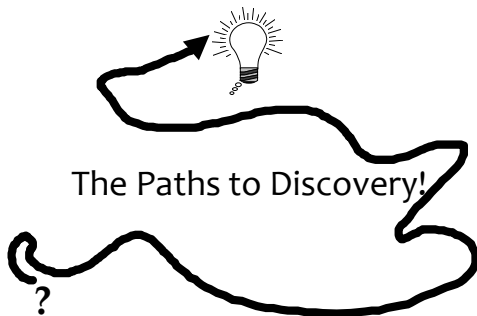


## Scientific Methods!



## Scientific Methods\*

\* adapted from Franklin Miller, Jr. 1977 College Physics. 4th ed. Harcourt Brace Jovanovich, Inc. NY.



- collect facts by observation
- construct a hypothesis
  - imaginative thinking
  - educated guess
  - carefully constructed hypothesis based on hundreds of controlled experiments
- test the hypothesis
  - previously known facts
    - a hypothesis is rejected if even a single previously known fact is at variance with it
  - new facts
    - analyze experiments performed by others
    - perform experiments suggested by the hypothesis

## Scientific Methods: the paths of discovery

- Attempt to optimize the path
  - investigate easily proven elements
  - incremental discovery
  - binary elimination
  - test extreme values
- Use available resources to solve a problem with the least effort
  - analysis of previous investigations
  - models
  - experimentation

## Take off the Blinders!

- Be aware of prejudices that can be created by:
  - funding
  - expertise
  - time investment
  - equipment
  - personal goals

## Observation/Evaluation!

- Your ability to learn is controlled by your ability to make observations and evaluate your hypothesis using those observations
- Focus on the task at hand
- Use all your senses
  - (no tasting in the lab!)

## Evaluate the Information Be Active, not Passive

- Does it make sense?
- Create new hypotheses as you go
- Aim to understand the unexpected (trouble shooting)
- Ask “why?”, and then answer based on what you know
- Verify that your answer is consistent with previous knowledge

## Capture the Magic of Exploration!

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- Learn from the “dead ends” as well as from the “successes”
- Keep the big picture in view when boredom begins to creep in
- Routinely reassess your strategy for finding the answer