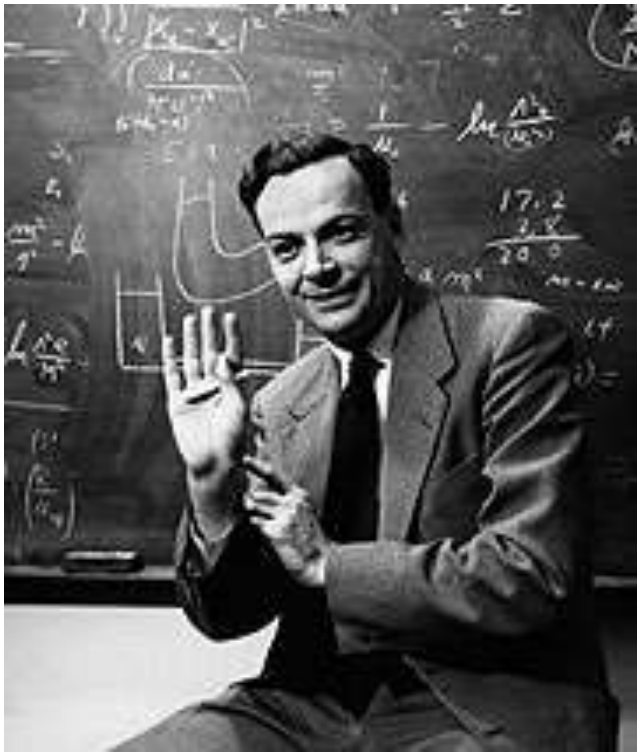
Pre-AP Chemistry

September 3, 2011

3. Scientific Method and Lab Safety



Sig Figs and Scientific Notation

Population of China: 1,344,060,000 people

Area of China: 9,640,821 km^2

- Calculate population density of China
- Express in 4 significant figures
- Express in scientific notation

Outline

- Scientific Method
- Lab Safety

- Scientific Method
  - Observation, Experimentation, Explanation
  - Accuracy and Precision
  - Error
- Lab Safety
  - General Rules
  - Dress Code

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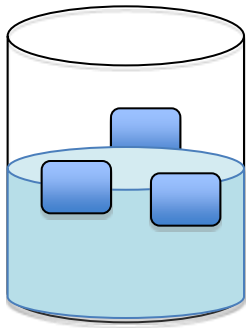
Scientific Method

- Observation
- Hypothesis
- Experiment
- Theory
- Prediction
- Experiment
- Law

- Observation: witnessing and becoming curious about a natural phenomenon



1. Ice floats on water

Scientific Method

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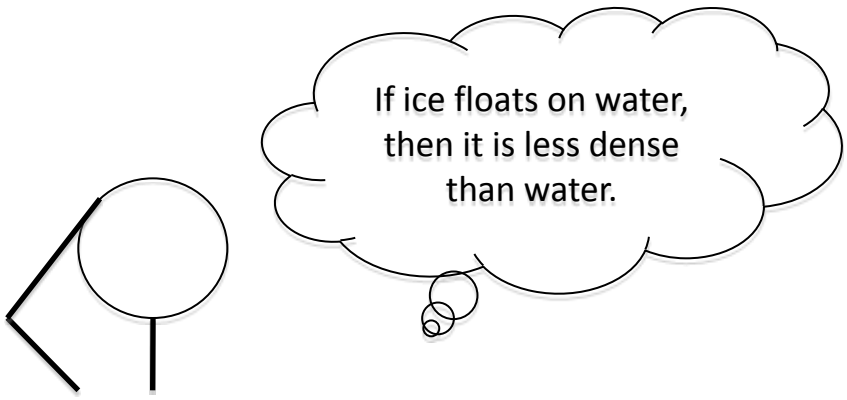
- Hypothesis: an if-then statement suggesting an explanation for an observation



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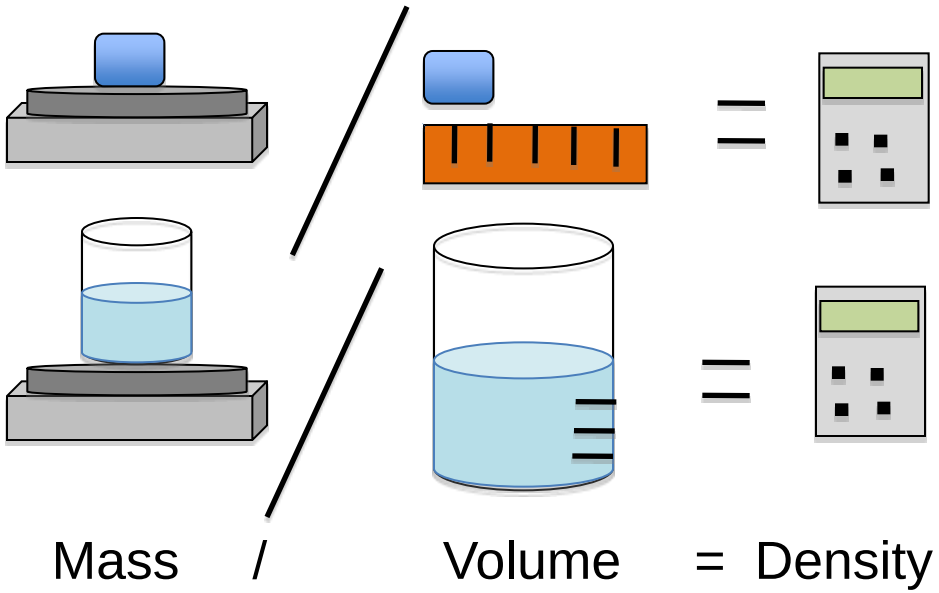
- Experiment: monitoring the change in one variable (dependent), while changing another (independent)



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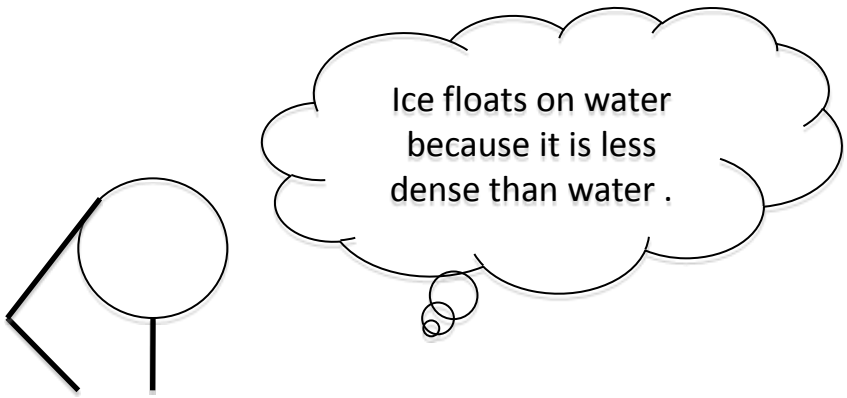
- Theory: experimentally supported explanation



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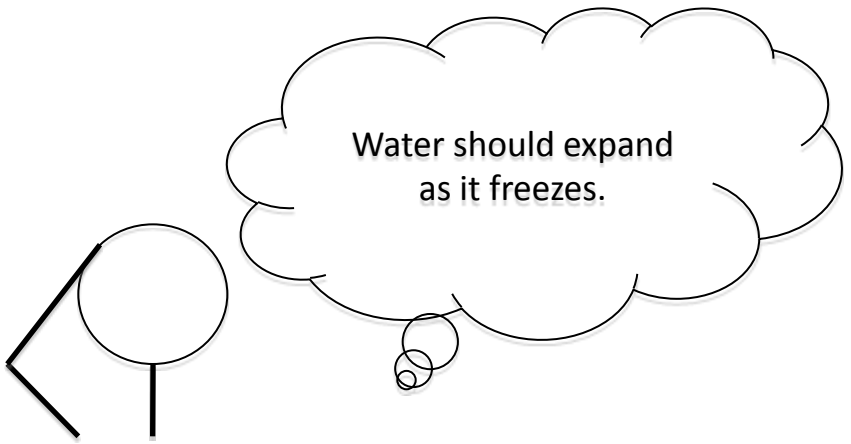
- Prediction: expected but untested theoretical result



Scientific Method

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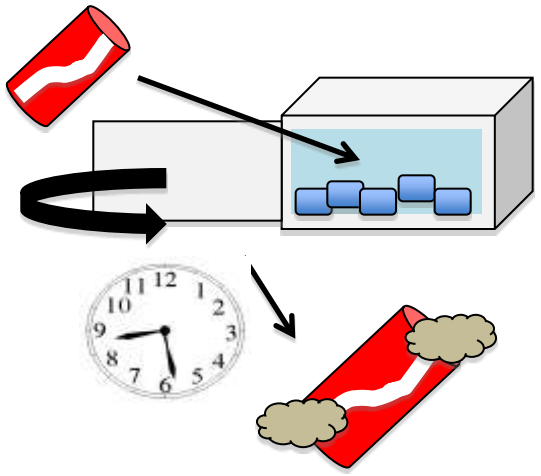
- Experiment: test predictions of theory and re-evaluate model



Frozen soda cans explode

Scientific Method

- Observation
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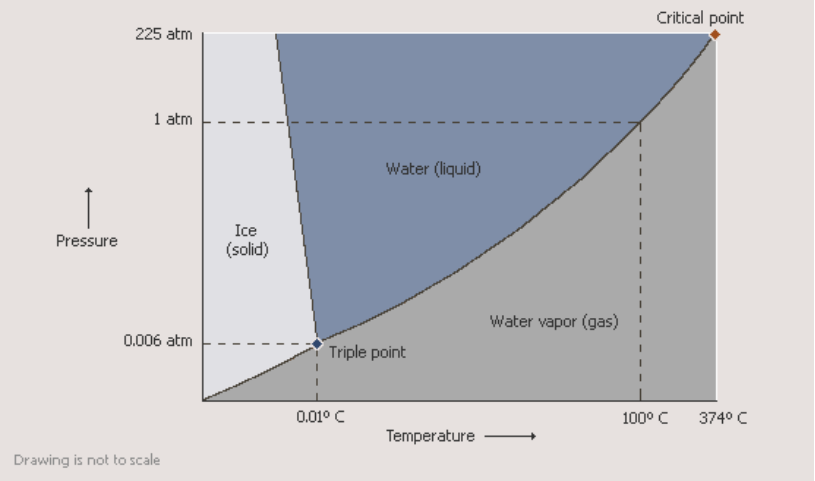
- Law: general description of nature supported by large body of evidence



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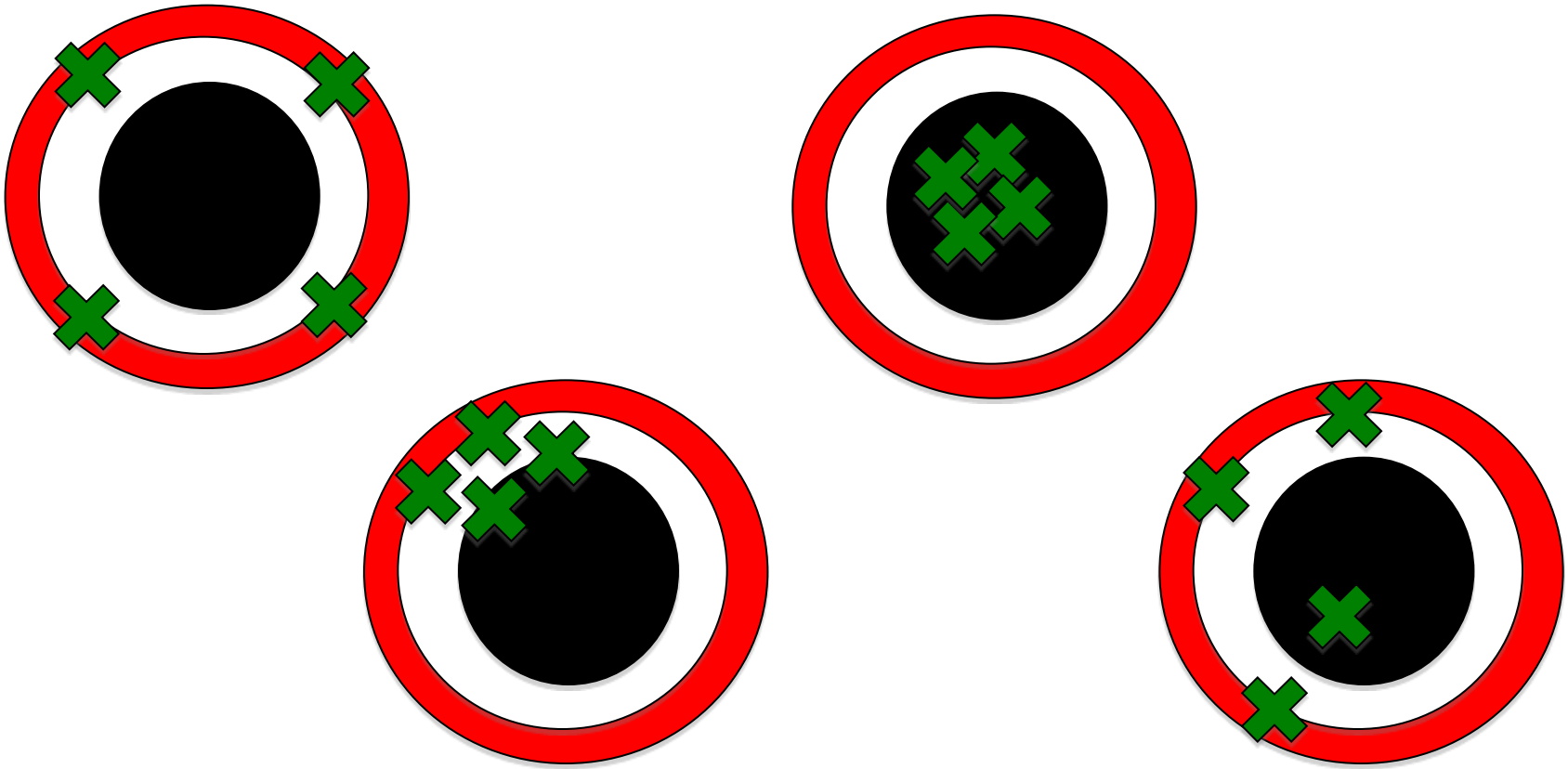
Accuracy and Precision

- Accuracy: How close is the measured value to the true value?

- Precision: How close are the measured values to each other?

Accuracy and Precision

- Which dart throwers have high accuracy? Which have high precision?



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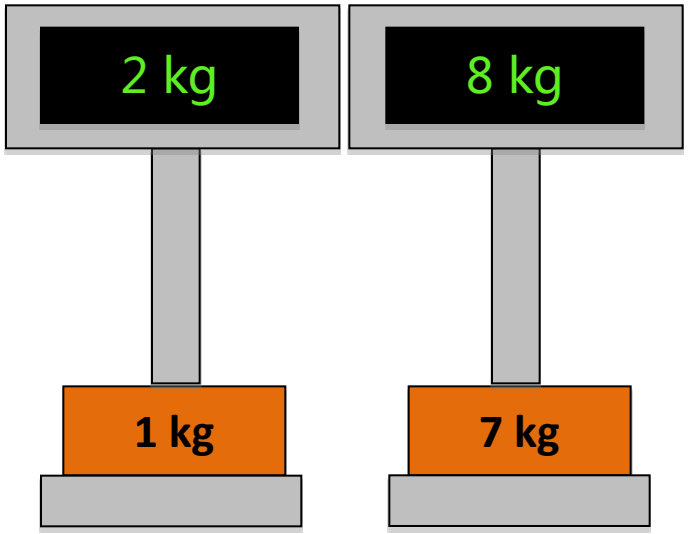
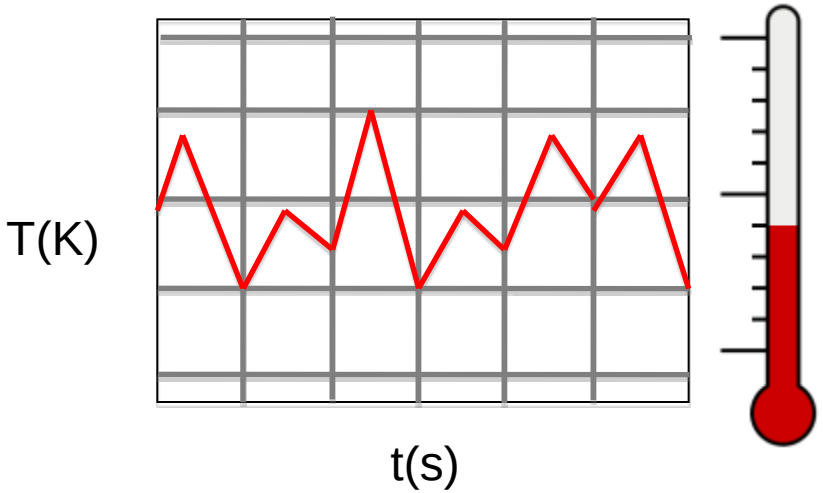
Error

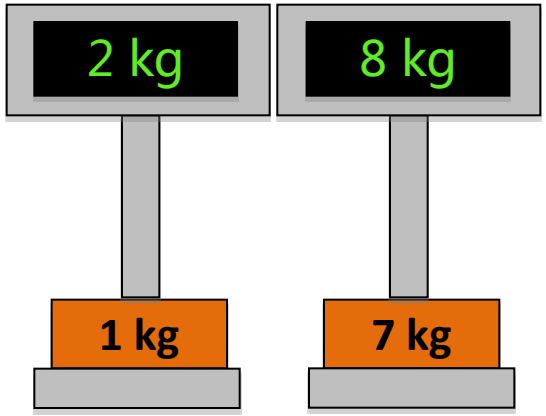




- Systematic Error: a correctable, built-in instrumental error

- Random Error: uncorrectable, inherent fluctuations in measured values for any instrument and any user

Error



- Absolute Error: the difference between the measured and true value

AE = measured – true

1 kg = 2kg – 1kg

1 kg = 8 kg – 7kg

- Relative Error: the percent difference between the measured and true value

$$RE = \frac{|measured - true|}{true} \times 100$$

$$100\% = \frac{|2kg - 1kg|}{1kg} \times 100$$

$$14.3\% = \frac{|8kg - 7kg|}{7kg} \times 100$$

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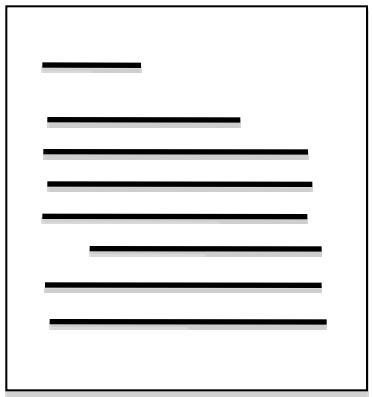
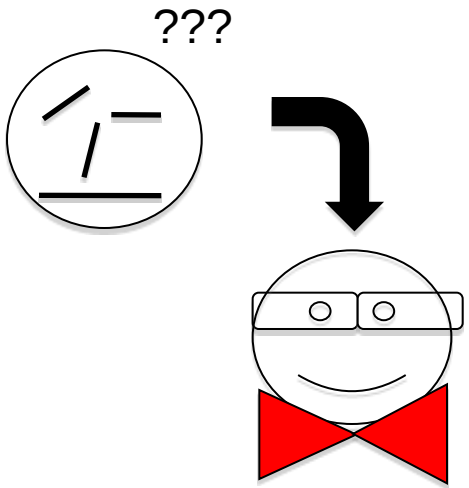
General Rules

- Experiments are fun! …
- … but they can be dangerous!





Read all directions before starting lab.	When in doubt, ask Mr. Shank!	Do nothing in lab without specific permission.	Wash hands before and after every lab.

General Rules

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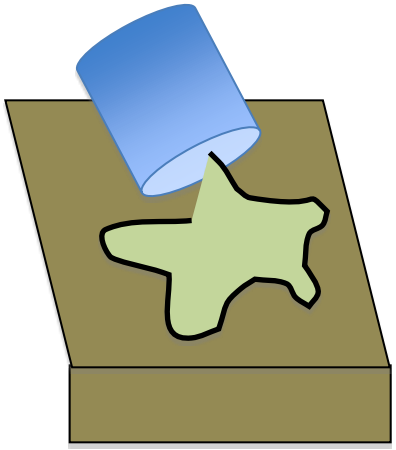

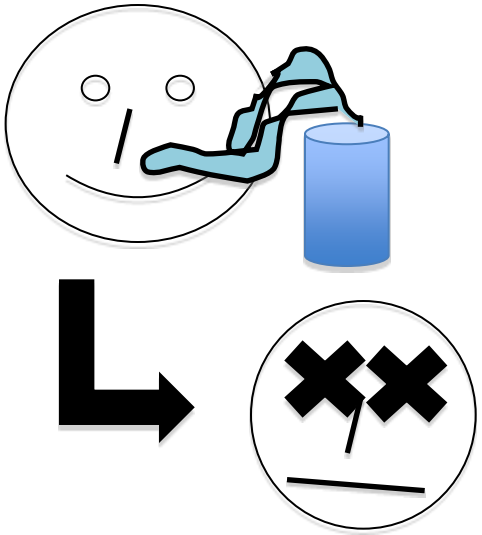

No food, drink, bookbags, purses, or books in lab!	Ask Mr. Shank about proper waste disposal.	Let me know about accidents or spills.	Don't touch, taste, or smell unknown chemicals.

Hazard Symbols

- Chemicals are fun! …
- … but they can be dangerous!

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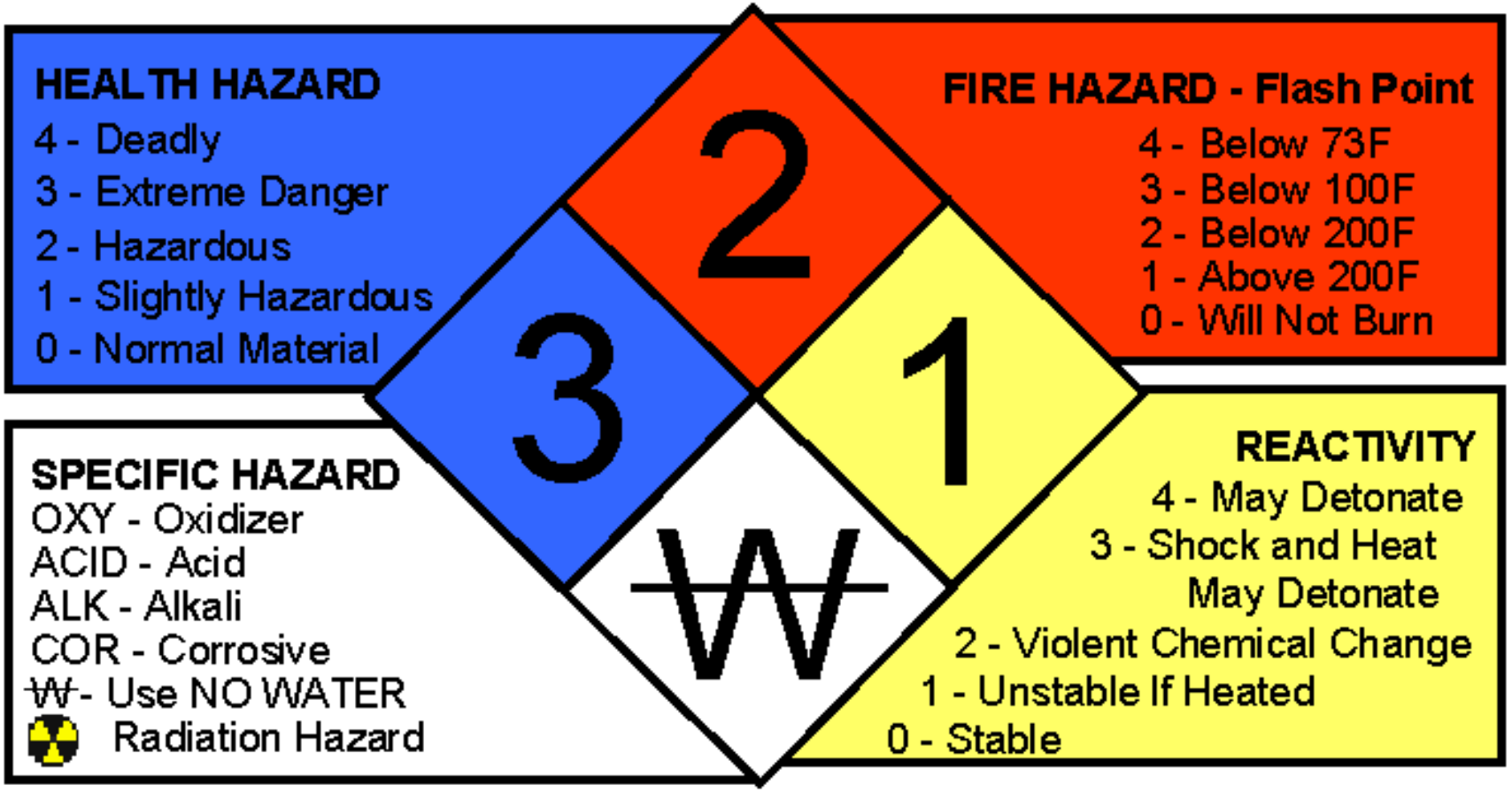

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Dress Code

Safety Goggles

Hair Tied Back

Sleeves Rolled Up or Buttoned

No Hairspray or Gel

No Nail Polish

Lab Coat

Jewelry and Watches Removed

Close-toed Shoes – No Sandals

Summary

- The scientific method is a way to study and verify natural laws
- Scientific notation and significant figures give chemists a way to quantify measurements and errors

Homework

- Read and sign safety contract.
- Read ‘Measurement Lab’ handout and complete pre-lab questions
- Problems …