

WHAT IS CHEMISTRY?

- Chemistry is the science that deals with the materials of the universe, and the changes they undergo.
- *Materials* of the universe can be of several forms:

Gas: air, oxygen

Liquid: water, gasoline, vinegar, orange juice,

Solid: rocks, charcoal, table salt, sugar, wood, baking soda

- Some examples of **changes**:

Burning of charcoal

charcoal + oxygen \longrightarrow carbon dioxide

Burning of gasoline

gasoline + oxygen \longrightarrow carbon dioxide + water vapor

Fermentation of grape juice

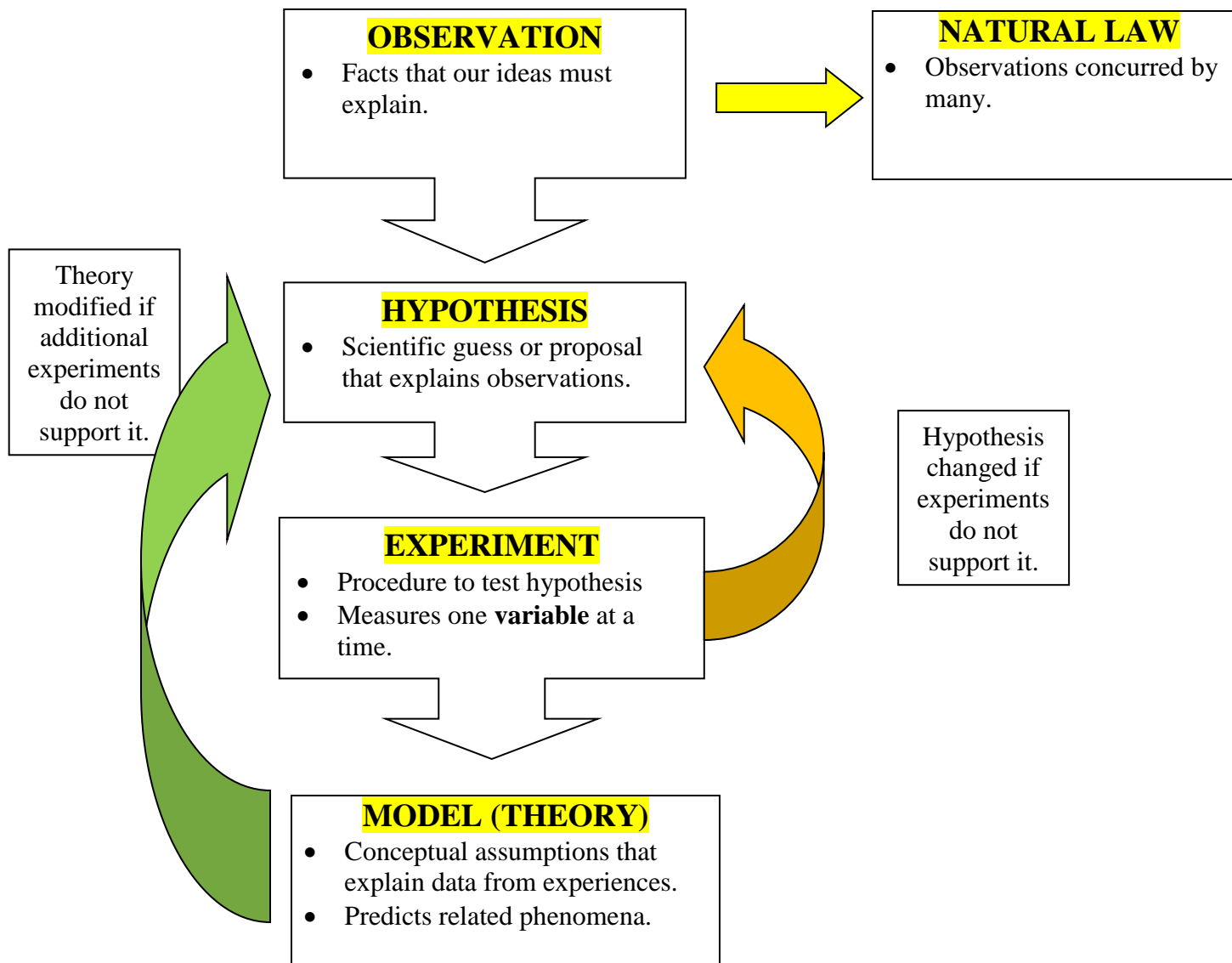
glucose \longrightarrow ethyl alcohol + carbon dioxide
(in water) (in water)

Souring of wine

ethyl alcohol + oxygen \longrightarrow acetic acid
(in water) (from air) (in water)

THE SCIENTIFIC METHOD

- The scientific method is a **process** of creative thinking and testing aimed at **objective** and **verifiable** discoveries. It is generally composed of the following steps:



SCIENTIFIC NOTATION

- Scientific Notation is a convenient way to express **very large** or **very small** quantities.

General form:

$$\mathbf{A \times 10^n} \quad \mathbf{1 \leq A < 10} \quad \mathbf{n = \text{integer}}$$

- Converting between decimal and scientific notation:
 1. Move the decimal point in the original number so that it is located after the first nonzero digit.
 2. Follow the new number by a multiplication sign and 10 with an exponent (**power**).
 3. The exponent is equal to the number of places that the decimal point was shifted.
 4. For numbers smaller than 1, the decimal moves to the right and the power becomes negative.

$$75,000,000 \text{ changes to } 7.5 \times 10^7 \quad (7 \text{ to the left})$$

$$0.00642 \text{ changes to } 6.42 \times 10^{-3} \quad (3 \text{ to the right})$$

Examples:

1. Write 6419 in scientific notation:
2. Write 0.000654 in scientific notation:

- Addition and subtraction (NOT COVERED)
- Multiplication and division :
 1. Change numbers to exponential form.
 2. Multiply or divide coefficients.
 3. **Add** exponents if **multiplying**, or **subtract** exponents if **dividing**.
 4. If needed, reconstruct answer in **standard** exponential notation.

Examples:

1. Multiply 30,000 x 600,000

$$(3 \times 10^4) (6 \times 10^5) = 18 \times 10^{(4+5)} = 18 \times 10^9 = 1.8 \times 10^{10}$$

2. Divide 30,000 by 0.006

$$\frac{3 \times 10^4}{6 \times 10^{-3}} = \frac{3}{6} \times 10^{[4-(-3)]} = 0.5 \times 10^7 = 5 \times 10^6$$

Follow-up Problems:

1. $(5.5 \times 10^3)(3.1 \times 10^5) =$

2. $(9.7 \times 10^{14})(4.3 \times 10^{-20}) =$

3. $\frac{2.6 \times 10^6}{5.8 \times 10^2} =$

4. $\frac{1.7 \times 10^{-5}}{8.2 \times 10^{-8}} =$

5. $(3.7 \times 10^{-6}) \times (4.0 \times 10^8) =$

6. $(8.75 \times 10^{14})(3.6 \times 10^8) =$

7. $\frac{1.48 \times 10^{-28}}{7.25 \times 10^{13}} =$