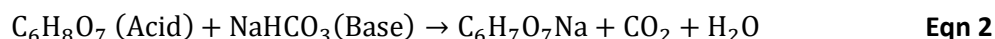


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Lab #1: Acid/Base Rocket

Background: The year was 1232. The Chinese and Mongols were at war. During the battle Kai-Feng, the Chinese repelled the Mongol invaders by “arrows of flying fire.” The simple arrows were solid-propellant rockets. Later, during the latter part of the 17th century, Sir Isaac Newton devised the laws of motion, ultimately trajectory, and Dutch professor Willem Gravenhage the steam car. Today, the United States and Russia share experimental programs with astronauts in space. Why? Acid and base reactions.



Null Hypothesis: Reaction ratios cannot theoretically approximate the maximal height of launch.

Alternative Hypothesis: Reaction ratios theoretically approximate the maximal height of launch.

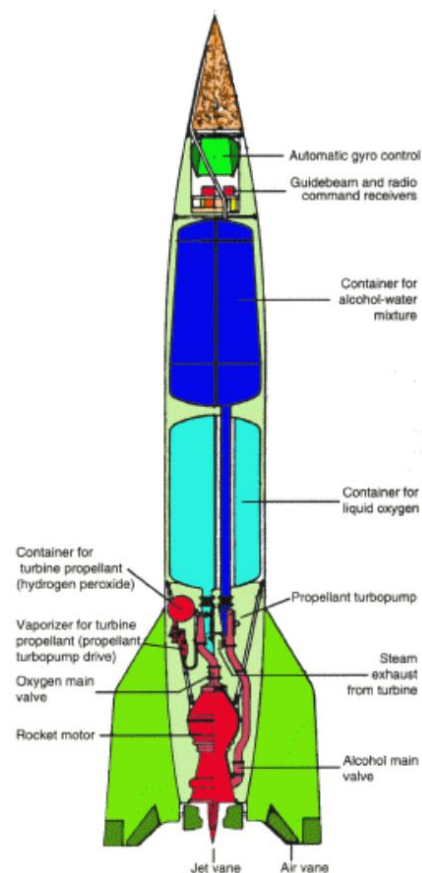
Goal: An experiment with estimated reaction masses prior to the initial launch.

Learning Outcomes:

1. A material list accurately prepared for an experimental launch.
2. Precise chemical reaction ratios calculated before experiment.
3. Masses of vinegar (CH_3COOH), sodium bicarbonate (NaHCO_3), and citric acid ($\text{C}_6\text{H}_8\text{O}_7$) recorded.
4. A rocket volume from measured dimensions.
5. Final evidence results about mass ratios.

Experimental:

1. In a lab notebook, experimentally record the mass of the solid rocket propellants.
2. With a scale or graduated cylinder, quantitatively record the liquid rocket propellant's volume.
3. A rocket launch.
4. The rocket design, reactants, and model for increased height
5. Steps two through five repeated, three times.



Data:



Evaluation:

Note: Please practice on paper before submission.

1. What were the materials?
2. What was the initial chemical mass: sodium bicarbonate?
3. How much mass (or volume) of acid was in the initial launch?
4. The rocket weighed how much?
5. What height was the initial test?
6. What were the trial numbers?
7. What changed after the first test?
8. Final launch changed how? Masses changed in sodium bicarbonate?
9. How much acid (g or mL) measured in the final launch?
10. What was the final mass in the rocket?
11. What height was the final launch?
12. What confirms the alternative hypothesis?

Lab #2: Gibbs Free Energy, Enthalpy, and Entropy

Background: Surroundings are everything around a system. We define systems with different parameters, such as temperature, pressure, and volume. With parameters, scientists model simple ideas. Macroscopic criteria are rate; time-duration from reactants to products; work; the differences between volume or pressure; and heat; the energy transfer. Chemist characterize a reaction by enthalpy (ΔH), entropy (ΔS), and Gibbs free energy (ΔG). Enthalpy is the heat absorbed or emitted from a reaction under constant pressure. Entropy is the number of microscopic arrangements in the system. While, Gibbs free energy is the relationship between enthalpy (ΔH) and entropy (ΔS) at a specific temperature. Negative Gibbs free energy indicates a spontaneous reaction. Else, a positive Gibbs, and the reaction is non-spontaneous.



Compound	ΔH = Enthalpy (kJ)	ΔS = Entropy (J/K)
Acetic Acid [CH ₃ COOH]	-874.5	86.6
Ammonium Chloride [NH ₄ Cl]	-314.4	94.6
Ammonium Ion [NH ₄ ⁺]	-132.5	113.4
Carbon Dioxide [CO ₂]	-167.2	213.6
Chlorine Ion [Cl ⁻]	0.0	56.5
Copper [Cu ²⁺]	-142.6	33.2
Copper (I) Nitrate [CuNO ₃]	-277.7	46.8
Ethanol [CH ₃ CH ₂ OH]	-174.1	160.7
Nitric Acid [HNO ₃]	33.2	155.6
Nitrogen Dioxide [NO ₂]	0.0	240.0
Oxygen [O ₂]	0.0	205.0
Sodium Bicarbonate [NaHCO ₃]	-947.7	102.1
Water (l) [H ₂ O]	-285.8	69.9
Water (g) [H ₂ O]	-242.0	188.7
Hydrochloric Acid (g) [HCl]	-167.1	-131.2
Sulfuric Acid (g) [H ₂ SO ₄]	-909.3	20.1
Sodium carbonate [Na ₂ CO ₃]	-1130.7	135.0

Equation #1: Gibbs Free Energy

$$\Delta G = \Delta H - T\Delta S$$

Null Hypothesis: The thermodynamic table never predicts the spontaneity of a reaction.

Alternative Hypothesis: The thermodynamic table predicts the spontaneity of a reaction.

Goal: From experimental measurements, student devise experimental proof and evidence by a thermodynamic table.

Learning Outcomes:

1. Identify exothermic and endothermic processes
2. Predict spontaneity using a thermodynamic data
3. Understand the difference between enthalpy (ΔH), entropy (ΔS), and Gibbs free energy (ΔG).
4. Demonstrate relationships between enthalpy (ΔH), entropy (ΔS), and Gibbs free energy (ΔG).

Experimental:

1. Prepare [1 M] NaOH and dissolve in 100 mL of H_2O
2. Add 25 mL of 1M M NaOH into four test tubes
3. Measure the room's temperature within each vial
4. Add 25 mL of [1 M] HCl to a test tube
5. Measure the maximum reaction temperature
6. Repeat steps #1-6 for HNO_3 , H_2SO_4 , and Na_2CO_3



Data:

	HCl	HNO ₃	H ₂ SO ₄	Na ₂ CO ₃
Initial Temperature	24.0 °C	24.0 °C	24.0 °C	24.0 °C
Final Temperature	28.5 °C	29.0 °C	27.0 °C	24.0 °C

Evaluation:

Note: Please practice on paper before submission.

1. What is positive or negative heat?
2. The HCl reaction was exothermic or endothermic?
3. An HNO₃ reaction was exothermic or endothermic?
4. The H₂SO₄ reaction was exothermic or endothermic?
5. An Na₂CO₃ reaction was exothermic or endothermic?
6. What is (ΔG) for all compounds in the table at a temperature, 298 K?
7. Spontaneity and definitions.
8. What was Gibbs Free Energy (ΔG) for HCl, HNO₃, H₂SO₄, and Na₂CO₃?
9. The hypothesis or null hypothesis was correct?

Lab #3: Physical Quantities, Units, and Measurements

Background: Physical quantities, units, and measurements are essential to chemistry. Physical quantities describe a fundamental expression. The base description is a unit, such as mass, length, and time. While, tools or instruments measure the unit for scientists. Terminology from scientist is both intensive and extensive units. Today three pieces of glassware demonstrate error in a unit measurement by density.

Null Hypothesis: Analytical glassware has no quantifiable unit and error from a measurement.

Alternative Hypothesis: Analytical glassware has a quantifiable unit and error from a measurement.

Goal: Chemical glassware experiences through liquid water. Also, experimentally review lab glassware by average and standard deviation.

Learning Outcomes:

1. Exposure using a thermometer, digital scale, beaker, Erlenmeyer flask, and volumetric flask.
2. A correlation between density and temperature inside glassware.
3. An average, percent error, and standard deviation from the equations below.
4. A lab summary about scientific laboratory data.

Equation #1: Density:

$$\text{Density} = \frac{\text{mass (g)}}{\text{volume (mL)}}$$

Equation #2: Temperature:

$$^{\circ}\text{C} = \frac{9}{5}^{\circ}\text{F} + 32$$

Equation #3: Average:

$$\bar{x} = \frac{\sum_{i=1}^N x_i}{N}$$

Equation #4: Standard Deviation:

$$\sigma = \sqrt{\frac{\sum_{i=1}^N |x_i - \bar{x}|^2}{N}}$$

Equation #5: Percent Error:

$$\text{Percent Error (\%)} = \frac{|\text{Measured value} - \text{Actual value}|}{|\text{Actual value}|} * 100\%$$



Experimental Steps:

1. The experiment began with a beaker, Erlenmeyer flask, and volumetric flask on a top loading scale. What were the masses on the scale?
2. Incrementally, 20mL of water poured into each glassware.
3. A thermometer recorded temperature in liquid water.
4. Soon after, glassware mass from the scale.
5. Steps #1-3 for five measurements and fill in the table below.

Tabular Data: Atmospheric Pressure (atm): _____ Water Temperature (°): _____

Beaker (100 mL)	
Measurement	Mass (g)
1	
2	
3	
4	
5	
Erlenmeyer Flask (100 mL)	
Measurement	Mass (g)
1	
2	
3	
4	
5	
Volumetric Flask (100 mL)	
Measurement	Mass (g)
1	
2	
3	
4	
5	

Evaluation:

Note: Please practice answers on paper before submission.

1. What were the average masses?
2. What glassware was most near actual volume?
3. What is density?
4. Why is temperature important to the experiment?
5. Why is pressure important to today's experiment?
6. What is percentage error?
7. Why care about standard deviation?
8. What photographs or drawings describe accuracy and precision?

Lab #4: Soaps and Detergents

Background: Soap has history before the 16th century. Figurative information dates to salve, resin, tallow, suet, and grease. Romans referenced soap to Romance, Germans to 'flattery' of loan, while today's vocabulary of Saponification to the jocular Latin root of sapon. Saponification converts oils, fats, and glycerides into glycerin with "salt." For proof, students process raw material in a strong base to produce household soap.

Hypothesis: A strong base reacts with fats or oils into glycerin.

Null Hypothesis: A strong base never reacts with fats or oils into glycerin.

Goal: Trial chemical reactants for practice and the production of soap via saponification.

Learning Outcomes:

1. Understand soap production includes raw ingredients, oils, fats, and glycerides
2. Assess the chemical safety about sodium hydroxide in laboratory setting
3. Create good soaps from crude chemical instruction and procedure

Chemical Safety:

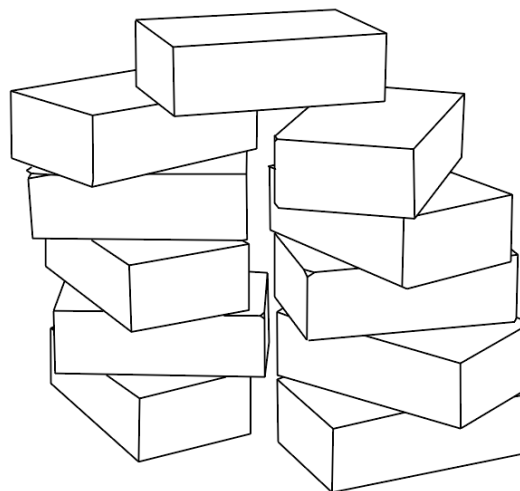
Sodium Hydroxide (Safety Data Sheet):

Health: _____

Fire: _____

Reactivity: _____

Personal Protection: _____



Experimental:

1. A graduated cylinder measures 50 mL of deionized water.
2. A scale weighs 10 grams of **NaOH** flakes.
3. Mixtures begin with **NaOH** into deionized water.
4. A hot plate raises the temperature of **NaOH + H₂O** solution to boiling
5. Thermometers record temperature of hot **NaOH + H₂O** solution (solution A)
6. Separately, a scale weighs 100 grams of solid fats or oil.
7. A solid fat melts above room temperature.
8. Thermometers record temperature of boiling liquid and fat solutions (solution B)
9. Solution A mixes with solution B.
10. The mold is for the liquid mixture. The soap hardens within 24 hours.

Data:

Record Temperatures:

Solution A (K): _____

Solution B (K): _____

Evaluation:

Note: Please practice answers on paper before submission.

1. What fat or oil was a reactant in the experiment?
2. The null or alternative hypothesis was correct? Why?
3. The chemical sodium hydroxide (**NaOH**) was innocuous?
4. What temperature melted the fat and/or oil?

Lab #5: Mineral Decomposition Rate

Background: Decay order describes rate in liquid or gas phase. Mineral decomposition occurs from a reaction, additional pressure, radioactive decay, and friction. In the environment, calcium carbonate decomposes by acidic rains. Decay order follows acidic aliquots onto calcium carbonate for masses loss.

Null Hypothesis: Acidic solutions onto a mineral never quantify decay order in aqueous medium.

Alternative Hypothesis: Acidic solutions onto a mineral quantify decay order in aqueous medium.

Goal: Reaction order of a controlled experiment between calcium carbonate and sulfuric acid.

Learning Outcomes:

1. The rate of decomposition from, a substitute, calcite mineral known as chalk
2. Arithmetically average aliquots of H_2SO_4 for standard drop-mass
3. Mass vs. time data as incremental amounts of acidic solutions add to chalk

Chemical Safety: Sulfuric Acid (Safety Data Sheet)

Health: _____

Fire: _____

Reactivity: _____

Personal Protection: _____

Reaction: $H_2SO_4(aq) + CaCO_3(s) \rightarrow H_2O(l) + Ca^{2+}(aq) + SO_4^{2-}(aq) + CO_2(g)$

Experimental:

1. A watch glass needs a mass before the drop averages.
2. Drop-by-drop aliquot sulfuric acid onto a watch glass on top a scale with record.
3. Chalk mass on a scale needs an initial mass
4. Repeatedly, drops react with the chalk into aqueous components into product, carbon dioxide (CO_2).

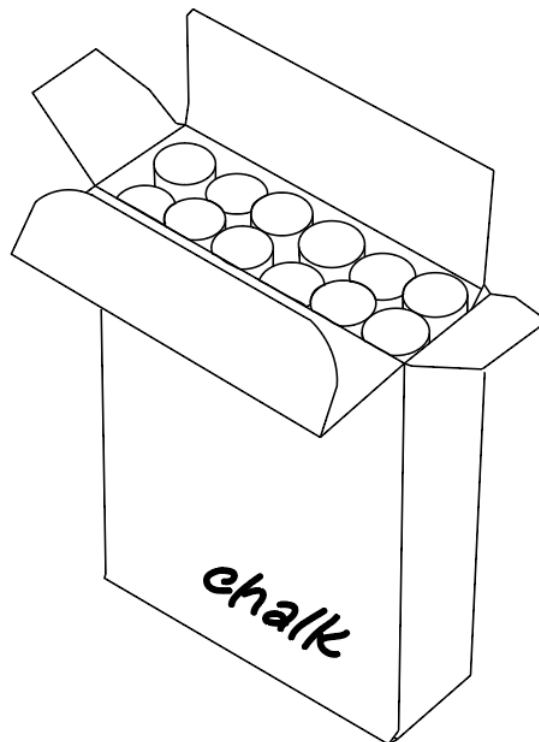
Tabular Data:

Watch glass (g): _____

Drop	Total Mass (g)
1	
2	
3	
4	
5	
6	
7	

Average (g): _____

Standard Error (g): _____



Mass of Chalk (g): _____

Drop	Remaining Chalk Mass (g)	Time (s)
1		
2		
3		
4		
5		
6		
7		

Reaction Kinetics: Rate = $k [Ca^{2+}]^m [CO_3^{2-}]^n$

Order of Reaction: m = _____ n = _____

Evaluation:

Note: Please practice answers on paper before submission.

1. Why was chalk a substitute to calcium carbonate ($CaCO_3$)?
2. Why an average drop mass?
3. What units describe rate?
4. What were rate constants, m and n?
5. What was the experimental rate?

Lab #6: Biological Catalysis

Background: Danish chemist, Christian Hansen's rennet specimens started a revolution in biochemistry. Enzymes digested lactose inside saline solutions, eventually a foundational concept for researchers and industry. Although, historically practitioners fermented foods centuries before the comprehensive material. Today, biochemists in industry ferment food, digest textiles, bate leather, and wash detergents with enzymes. Enzymatic digestion is the topic today with solid enzymes tablets.

Null Hypothesis: Enzymes decompose cabbage into a dissimilar textures, colors, and smells.

Alternative Hypothesis: Enzymes decompose cabbage into a similar textures, colors, and smells.

Goal: Experiment in enzymatic digestion with an enzyme discovered in 1874 called β -amylase enzyme.

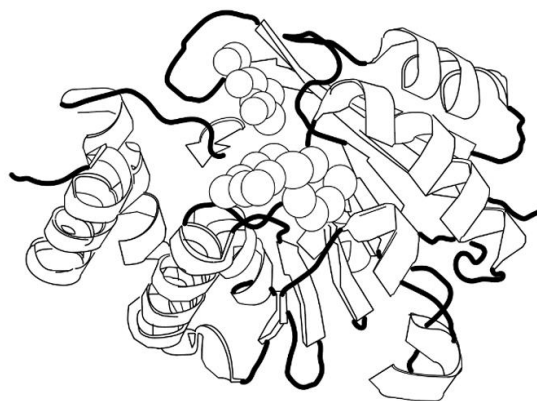
Learning Outcomes:

1. A laboratory procedure containing biological components from a blank sheet.
2. Cabbage fermentation with an enzyme catalyst, such as general β -amylase tablet
3. Qualitative, along with quantitative information for experimental fermenting

Reaction: $\text{Cabbage} + \text{Enzyme} \xrightarrow{\text{Fermentation}} \text{Decomposition}$

Materials:

1. A glass jar [Two holes]
2. Painter's tape [A cover for holes]
3. Black marker [Date]
4. Cabbage [Digestant]
5. Enzyme tablet [Enzyme]
6. Scale [Cabbage mass]
7. Water [As appropriate]



Laboratory Procedure:

Note: A personally prepared fermentation lab

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

Evaluation:

Note: Please practice answers on paper before submission.

1. What is an enzyme?
2. Enzymes derive from what in the environment?
3. How was the personal procedure?
4. Tape had what purpose?
5. Any necessary changes in personal procedure?
6. After two weeks, what was the outcome for the null hypothesis?

Lab #7: Lewis Acid Concentration

Background: The American physicist Gilbert Newton Lewis won a Nobel Prize by a new model for chemical acids and bases. The Lewis acid accepts pairs of electrons. While a Lewis base donates electrons in the acid-base conjugate pair. After electronic bond produces an adduct, the product after the reaction. For metal chemistry examination, student interaction entails colorimetric analysis toward a Lewis acid concentration.

Null Hypothesis: Copper ions (Cu^{2+}) never react with sodium hydroxide (NaOH) as a Lewis acid.

Alternative Hypothesis: Copper ions (Cu^{2+}) never cause a reaction with sodium hydroxide (NaOH) as a Lewis acid.

Goal: The intense blue color indicates copper ion concentration, especially through measurement.

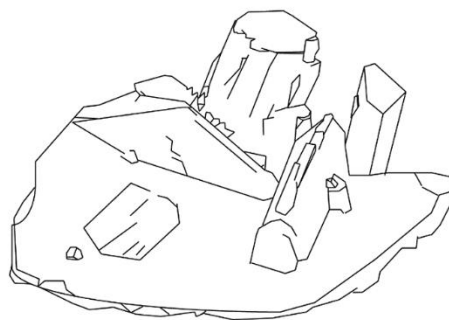
Learning Outcomes:

1. Information about standard solution concentration.
2. A serial dilution with sets of test tubes, graduated cylinders, and mathematical ratios.
3. Aliquots of base in order to decrease the Lewis acid concentration.
4. With colorimetric analysis, an equation describing concentration.

Reaction: $\text{CuSO}_4 + 2\text{NaOH} \rightarrow \text{Cu}(\text{OH})_2 + \text{Na}_2\text{SO}_4$

Experimental:

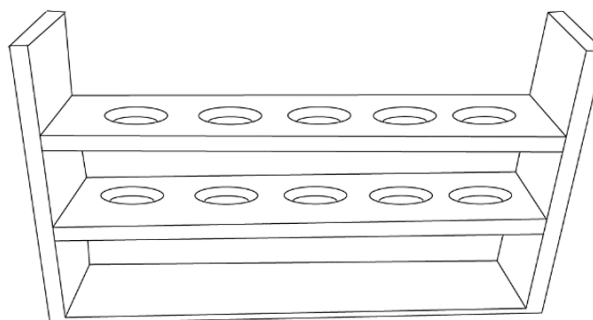
1. Five test tubes each with a label "10 M", "5 M", "1 M", "0.5 M" and "0.1 M" CuSO_4 for experimental analysis of linear series
2. NaOH drops decrease the concentration of CuSO_4
3. A linear model for the instruction of colorimetric testing conclusions and results
4. Linear Equation:



Evaluation:

Note: Please practice answers on paper before submission.

1. What color is copper sulfate (CuSO_4)?
2. What are the independent variables in the linear equation?
3. What are the dependent variables in the linear equation?
4. What is the purpose for a linear equation?
5. What was a necessary alteration in the steps?
6. Concentration is both qualitative and quantitative. A qualitative analysis involves inspection of color. A paragraph length of 4-5 sentences about quantitative concentration analysis.



Lab #8: Molarity measuring

Background: Concentration is ubiquitous. In a tea leaf mixture or simple Sweet Black Tea, concentration is visible by both color and taste. In other words, chemists comprehend concentration (molarity). Specifically, how substance mass relates to volume. The Periodic Table of Elements aids with the determination by elemental mass. This day, students embark on a definition about concentration, molarity.

Null Hypothesis: Additional mass never increases molarity and not possibly visible by eye.

Alternative Hypothesis: Additional mass never increases molarity and not possibly visible by eye.

Goal: The Periodic Table of Elements applied to chemical calculations in molarity.

Learning Outcomes:

1. With an analytical scale, concentration from a Erlenmeyer flask with blue solution.
2. Molarity calculating in a solution at a constant volume in a volumetric flask.
3. The percent error of original molarity measurements by a top loading scale.

Equation #1: Molar Mass:

$$\text{Molar Mass} = \frac{\text{Mass (g)}}{\text{Amount (mol)}}$$

Equation #2: Molarity:

$$\text{Molarity} = \frac{\text{Amount (mol)}}{\text{Volume (L)}}$$

Equation #3: Percent Error:

$$\text{Percent Error} = \frac{|\text{Measured} - \text{Actual}|}{\text{Actual}} * 100\%$$



Tabular Data: Temperature (°F): _____ Density of H₂O (g/cm³): _____

Compound	Chemical Formula	Molarity Label [M]	Substance Mass (g)	Volume (mL)	Solution Mass (g)	Liquid Mass (g)	Actual Molarity [M]
Sodium Iodide	NaI						
Sodium Iodide	NaI						
Sodium Iodide	NaI						
Iron (II) Chloride	FeCl ₂						
Iron (II) Chloride	FeCl ₂						
Iron (II) Chloride	FeCl ₂						
Copper (II) Carbonate	CuCO ₃						
Copper (II) Carbonate	CuCO ₃						
Copper (II) Carbonate	CuCO ₃						

Evaluation:

Note: Please practice answers on paper before submission.

1. Why is concentration apparent from additional mass?
2. What color was sodium iodide (NaI)?
3. What color was iron (III) chloride (FeCl_3)?
4. What was copper (II) carbonate color (CuCO_3) in solution?
5. Temperature and water density were critical?

Lab #9: Molar Mass: Carbon Dioxide

Background: The Periodic Table of Elements contains elemental masses for scientific aid. Across majors, scientists depend on accurate atomic masses for references in experiment. Molar mass, the typical mass unit derives a ratio between compounds, such as water or carbon dioxide. The lab determines masses in a gas, carbon dioxide at room temperature.

Goal: Density using a scale and container about a gaseous phase substance, carbon dioxide.

Null Hypothesis: Carbon dioxide density at 1 mole quantity is not the molecular molar mass.

Alternative Hypothesis: Carbon dioxide density at 1 mole quantity is the molecular molar mass.

Learning Outcomes:

1. Conservation of mass from dry ice [carbon dioxide (g)] subliming on a scale.
2. Substance density involves measurements about mass and volume.
3. A relationship between density and molar mass by mole units.

Equation #1: Density:

$$\text{Density} = \frac{\text{Mass (g)}}{\text{Volume (cm}^3\text{)}}$$

Equation #2: Avogadro's value:

$$\text{Avogadro's Value} = \frac{6.022 \times 10^{23}}{1 \text{ mol}}$$

Equation #3: Percent Error:

$$\text{Percent Error} = \frac{|\text{Measured} - \text{Actual}|}{\text{Actual}} * 100\%$$



Tabular Data: Temperature (°F): _____ Container mass (g): _____

Trial	Mass (g)	Volume (cm ³)	Density (g/cm ³)	Moles (n)	Molar Mass (g/mol)	Percent Error (%)
1				1		
2				1		
3				1		
4				1		
5				1		

Evaluation:

Note: Please practice answers on paper before submission.

1. Temperature was helpful in references to density. Why?
2. Dry ice is solid carbon dioxide (CO₂). Solid and gaseous carbon dioxide had equal mass?
3. What is the mole unit?
4. Percent error helps a scientist. Why?
5. A paragraph about John Dalton (5-7 sentences).

Lab #10: Molar Mass: Water

Background: ‘Atomism’ was a perspective from John Dalton, and a natural philosophy about fundamental particles. The developments about molecular gases led to the law of multiple proportions, then eventually molar mass. An explanation about elemental ratios; electrolysis examples John Dalton’s ‘atomism’ with hydrogen and oxygen. This lab separates water into components for determination of molar mass.

Goal: Pure water’s molar mass from molecular ratios and differences inside a volumetric container.

Null Hypothesis: An electrolysis device never separates water into molecular ratios.

Alternative Hypothesis: An electrolysis device separates water into molecular ratios.

Learning Outcomes:

1. Conservation of mass using an electrolysis apparatus with water inside the vessel.
2. Substance density through discernable molecular ratios.
3. A substance's molar mass at standard temperature and pressure, 1 mole equals 22.4 liters.

Equation #1: Density:

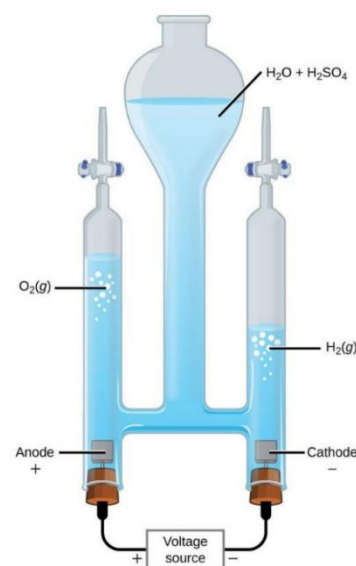
$$\text{Density} = \frac{\text{Mass (g)}}{\text{Volume (cm}^3\text{)}}$$

Equation #2: Molar Mass:

$$\text{Molar Mass} = \frac{\text{Mass (grams)}}{\text{Amount (mol)}}$$

Equation #3: Percent Error:

$$\text{Percent Error} = \frac{|\text{Measured} - \text{Actual}|}{\text{Actual}} * 100\%$$



Tabular Data:

Temperature (°F): _____

Trial	Ratio of Oxygen	Ratio of Hydrogen	Volume Oxygen (mL)	Volume Hydrogen (mL)	Moles Oxygen (mols)	Moles Hydrogen (mols)	Molar Mass (g/mol)	Molar Mass Error
1								
2								
3								
4								
5								

Evaluation:

Note: Please practice answers on paper before submission.

1. What were hydrogen and oxygen ratios?
2. What dangerous activity proves different gases in the left and right columns?
3. The true water (H_2O) molar mass is 18 g/mol. How accurate an answer in the experiment?
4. The electrolysis apparatus separated water into molecular gases. What about other liquids? What is the outcome with juice, tea, or coffee?
5. Why was Dalton's conjecture correct?
6. The 1 mole equals 22.4 L was in the experiment. Why?

Lab #11: Temperatures effect on Equilibria

Background: Le Châtelier's principle models chemical shift in reactants and products from current environmental parameters. Ambient temperature shifts an equilibrium away or toward heat production. Pressure and volume also shift an equilibrium. Other conditions change's reaction potential, parameters, and reaction outcomes. For classes' lab, students examine thermodynamic effects of equilibria through temperature.

Goal: An observable equilibrium by a simple pressure and temperature vessel.

Hypothesis: Temperature never perturbs an equilibrium throughout repeatable experiments.

Null Hypothesis: Temperature perturbs an equilibrium throughout repeatable experiments.

Learning Outcomes:

1. A table about Le Châtelier's principles before laboratory testing
2. The temperature inside a water bath before fluid displacement
3. Temperature's effect on equilibria by evaluating a model system

Le Chatlie'rs Principle:

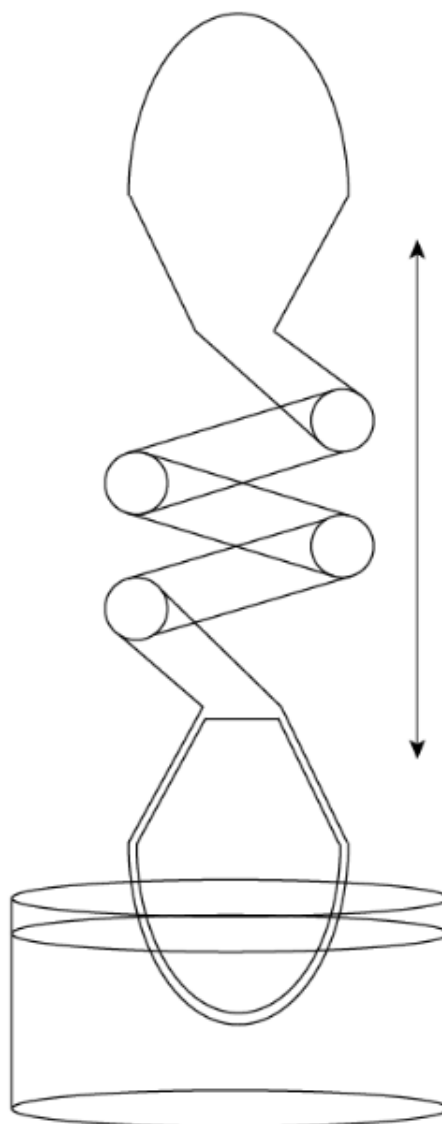
Equilibrium Reaction: $N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g)$

	Parameter Increase	Parameter Decrease
Temperature		
Pressure		
Volume		
Concentration		

Procedure:

1. A beaker with 50 mL water for demonstration of Le Châtelier's principles.
2. A thermometer measures the temperature of a lukewarm water bath.
3. The final temperature records below.
4. An equilibrium apparatus goes into a water bath for conditional equilibrium change.
5. Steps #2-#3 repeat for apparatus demonstration.

Temperature (°C): _____



Evaluation:

Note: Please practice answers on paper before submission.

1. What are Le Châtelier's principles?
2. What happened in the equilibrium device?
3. What average temperature shifted the apparatus' liquid?
4. Why was the above table important?
5. How many predictions in the table were correct?

Lab #12: Emission Spectra

Background: A flame test is a mechanism to element type. Color in the fire is unique to a large set of elements. The light derives from two processes; one, the metal solid vaporizing into a gaseous elemental state; while the second, the metal solid reacting with oxygen into a gaseous oxide fume. The simple description about a flame test being a phase transition and final light emission. For our experiment vaporization of a salt solid generates emission upon transition.

Goal: An elemental type via the emission spectra of a gaseous salt.

Hypothesis: The element has assignable colors when a phase transition occurs from heat.

Null Hypothesis: The element has no assignable colors when a phase transition occurs from heat.

Learning Outcomes:

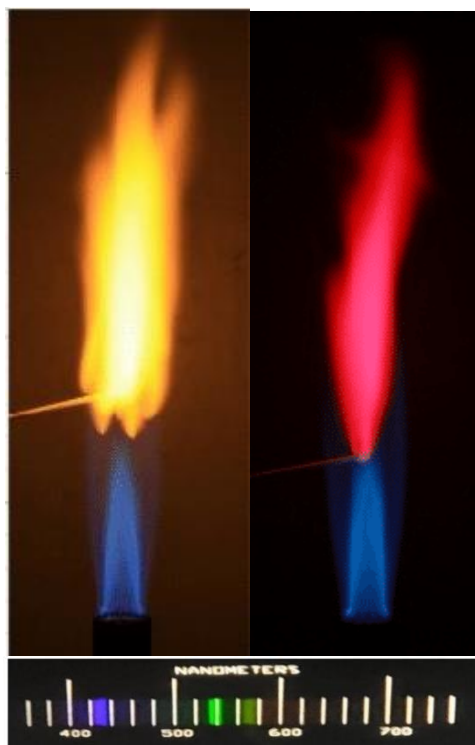
1. An unknown salt vaporizing from solid to gaseous phase with a Bunsen burner, wand, and flame.
2. A spectrometer to quantitatively measure emission spectra of gaseous salts in darkness.
3. A data table of atomic spectra for determining an unknown metal.
4. Accuracy and precision measuring.

Equation #1: Accuracy (Average):

$$Average = \frac{\sum_{i=1}^n x_i}{n}$$

Equation #2: Precision (Standard Deviation):

$$Precision = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$



Chemical Process:



Data table:

Instrument Model (No): _____

Gas	Trial #1:	Trial #2:	Trial #3:	Average (nm)	Salt	Standard Deviation (nm)
Unknown A						
Unknown B						
Unknown C						
Unknown D						

Evaluation:

Note: Please practice answers on paper before submission.

1. Why was the flame test helpful?
2. What was the standard deviation from flame experiments?
3. What was dangerous about the experiment?
4. The elements each had unique colors. Why did each element produce different colors?
5. A sketch exemplifying the experimental setup.

Lab #13: Second Law of Thermodynamics

Background: Law is congressional agreement. A committee (or chamber of representatives) enact a formal resolution of theory through experimental legislation. If their experiment fails, then newfound resolution is assented (or ordained). The second law of thermodynamics classifies natural law and order. Heat's relationship to temperature, or division, thereof, jointly, typifies measurable outcomes of local motion. By creating a boat from convection, students account for gaseous molecules and temperature . With a majority resolution, members for both in-house, and constitutional signature.

Goal: A steam-powered boat certifying natural laws of entropy and thermodynamics.

Learning Outcomes:

1. A convection vessel, ship, or barque validating entropic quantities of nature.
2. Motion of gas molecules by the heating of a glass test tube via candle stick
3. Entropy through recording temperature and heat change of an open system

Equation #1: Second Law of Thermodynamics

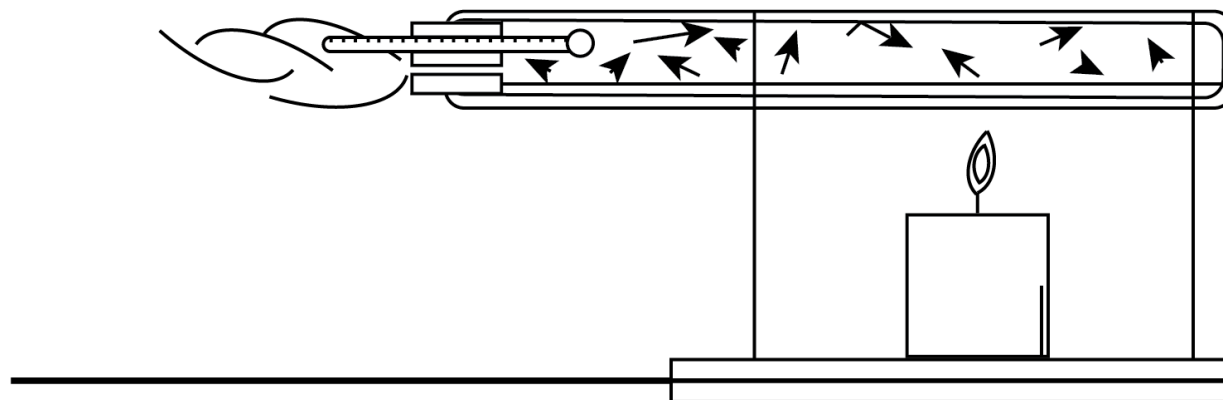
$$Entropy = \frac{\Delta q}{T} = \frac{q_{Final} - q_{Initial}}{T} = \frac{mC\Delta T}{T}$$

Equation #2: Celsius to Kelvin:

$$K = ^\circ C + 273$$

Tabular Data:

Determination of Second Law of Thermodynamics - Entropy					
Air Volume (cm ³)	Air Density (g/cm ³)	Specific Heat of Air (J/g °C)	Initial Temperature (°C)	Final Temperature (°C)	Entropy (J/K)



Evaluation:

Note: Please practice answers on paper before submission.

1. What are laws of thermodynamics?
2. What is a photo about the barque or vessel?
3. What is entropy??
4. The second law of thermodynamics was specific to the experiment. Why?
5. A sketch exemplifying the experimental setup.

Lab #14: Freezing-point Depression

Background: Colligative properties are physical changes in solution from the addition of a solute to solvent, also an industrial mechanism. From purifying seawater to separating enzymes, colligative properties are proportional to linear concentrations of solutes. The physical properties chemists speak, ‘freezing temperature, boiling temperature, vapor pressure, and osmotic pressure.’ Our solvent, water’s freezing point depresses with the addition of sodium salt.

Goal: The freezing point depression of solution while determining the freezing constant (K).

Null Hypothesis: Water’s freezing point never changes from additional solutes.

Alternative Hypothesis: Water’s freezing point changes from additional solutes.

Learning Outcomes:

1. An accurate temperature change of a frozen solution, such as water vs saltwater.
2. A freezing point constant (K) from sodium chloride (NaCl) adding to water.
3. The experimental error from standard deviating.
4. A freezing point constant compared to literature values.

Equation #1: Accuracy (Average):

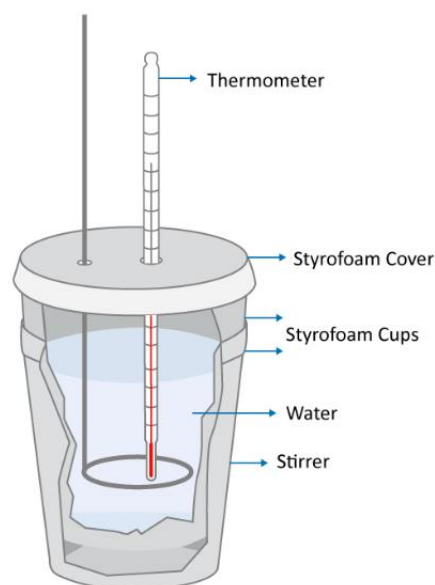
$$Average = \frac{\sum_{i=1}^n x_i}{n}$$

Equation #2: Precision (Standard Deviation):

$$Precision = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$

Equation #3: Freezing Point Depression

$$\Delta T = imK_f$$



Tabular Data: NaCl Molar Mass (g/mol): _____ Mass of Water (g): _____

	Initial Solution Temperature (°F):	Mass of Salt (g)	Final Solution Temperature (°F):	Mols of Salt (mol)	Solution Molality (mol/kg)	Van't Hoff Factor (i)	Molal Freezing Point Constant (°F/m)
Trial #1							
Trial #2							
Trial #3							
Trial #4							

Evaluation:

Note: Please practice answers on paper before submission.

1. How much difference was water's freezing point?
2. What was the standard deviation in water's freezing point?
3. The amount of salt is relevant to freezing point. What was the experimental amount of salt?
4. What happens with a different salt type?
5. Why is Styrofoam helpful to the experiment? Even though, styrofoam is not necessary.

Lab #15: Battery Voltage

Background: Electricity developed as both a technological and social process. The United States of America statutes electricity as broad resource with policy throughout energy standards, sequestration technologies, and renewable source developments. Initially in the 1870's, electricity was in popular entertainment, playscripts, playbills, and motion pictures. While Early Motion Pictures promoted inventors, such as the Thomas Alva Edison - "Wizard of Menlo Park." In the lab, student's measure voltage.

Goal: With a voltmeter, quantitatively and accurately measure battery voltage across samples.

Null Hypothesis: The standard on a battery label never states appropriate voltage.

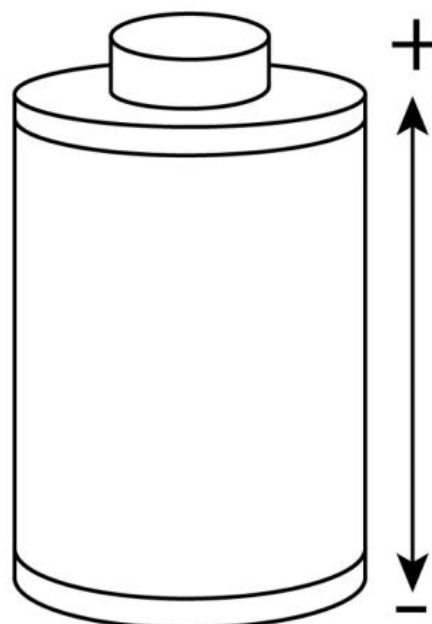
Alternative Hypothesis: The engineer's standard on the battery label correctly states appropriate voltage.

Learning Outcomes:

1. A theory for potential energy within different batteries
2. Voltage measurements of battery cells.
3. The standard error from engineers by applying a voltmeter

Equation #1: Voltage:

$$\text{Voltage} = \frac{\text{Joules}}{\text{Coulombs}}$$



Data Table:

Battery Voltage	Experiment				
	Trial #1	Trial #2	Trial #3	Average	Standard Error
1.5 V					
6.0 V					
9.0 V					
12.0 V					

Evaluation:

Note: Please practice answers on paper before submission.

1. What batteries had the most error?
2. Why is an average voltage important?
3. What is the relationship between battery voltage and error? What relationship exist at all between voltage and error?
4. For energy storage, batteries transfer energy. What other objects store energy?
5. Why was a voltmeter useful?

Lab #16: Filtering and Osmosis

Background: A filter separates fluids from solids. Equipment filters by mechanical, gravity, and osmosis methods. A mechanical filter uses a pump (or vacuum). While the gravity filter contains a semipermeable membrane for fluid separation. Osmosis, also, diffusive filtration translates low concentration water to high concentration solutes. This lab provides three filter apparatus as observation and expository examples.

Goal: A deep examination about three types of filtration equipment categorized by mechanism.

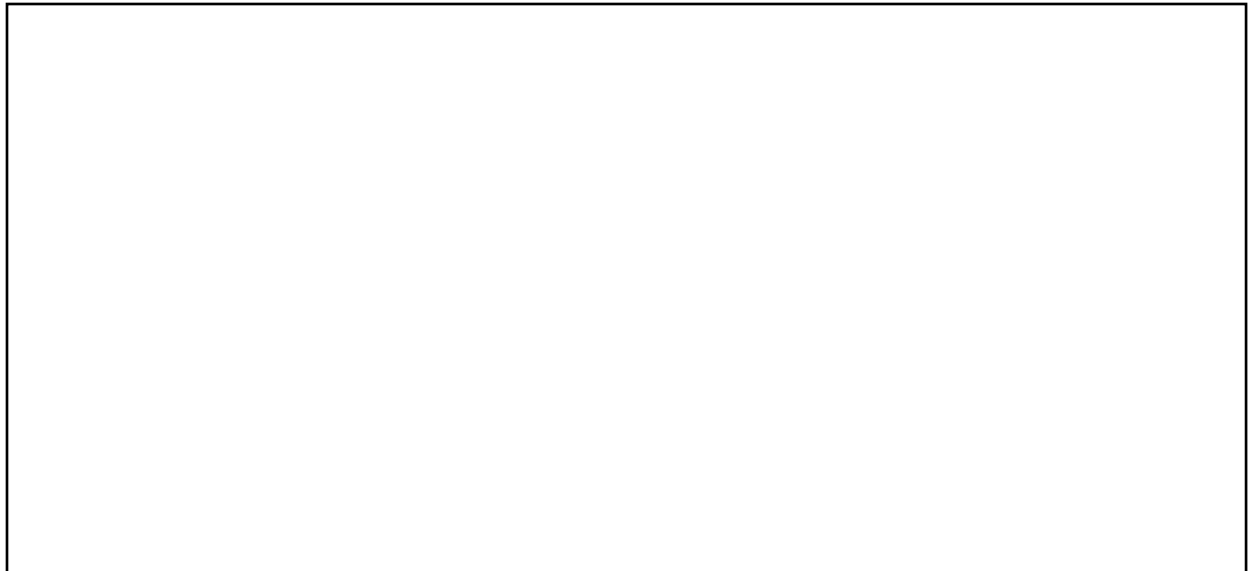
Null Hypothesis: A filter cannot separate liquids from solids by mechanical, gravitational, and osmosis.

Alternative Hypothesis: A filter separates liquids from solids by mechanical, gravitational, and osmosis.

Learning Outcomes:

1. Two expository paragraphs about previously displayed filtration apparatus
2. An expository paragraph explaining a mechanically driven filter
3. A gravity-fed filtration systems for analyzing.
4. A compare or contrast about an osmosis separating technique

A Mechanical Filter sketch:



Notes about a Mechanical Filter:

- 1.
- 2.
- 3.
- 4.
- 5.

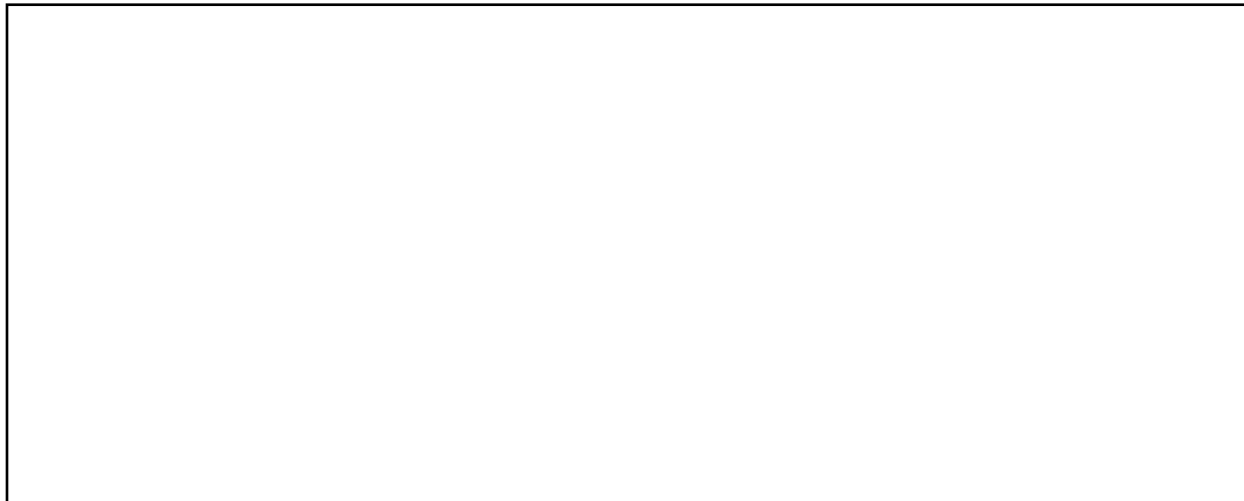
A Gravity-Fed Filter sketch:



Notes about a Gravity-Fed Filter:

- 1.
- 2.
- 3.
- 4.
- 5.

An Osmosis Filter sketch:



Notes about an Osmosis Filter:

- 1.
- 2.
- 3.
- 4.
- 5.

Evaluation:

Note: Please practice answers on paper before submission.

1. What is filtering?
2. What is osmosis?
3. What is a mechanical filter?
4. What is a gravity-fed filter?
5. What is an osmosis filter?

Lab #17: Ideal Gases

Background: The ideal gas constant derived from experiments by Boyle, Avogadro, Charles, and Gay-Lussac. In reversible systems, the ideal gas constant (R) approximates a relationship between Standard Temperature and Pressure (STP). An ideal gas constant formulates from carbon dioxide reactions. Students weigh carbon dioxide solid, then quantify a reaction by a balloon's volume at room temperature and pressure.

Goal: A gaseous apparatus measuring ideal gas constant.

Null Hypothesis: A gas constant is not possible from an experimental setup about volume.

Alternative Hypothesis: A gas constant is possible from an experimental setup about volume.

Learning Outcomes:

1. The volume using geometry.
2. With stoichiometry, total moles of carbon dioxide produced from a reaction.
3. Room temperature and pressure by a thermometer, along with barometer.
4. An internal pressure calculation from previously recorded results during the experiment.

Equation #1: Gas Constant:

$$R = 8.135 \text{ J}/(\text{mol}\cdot\text{K})$$

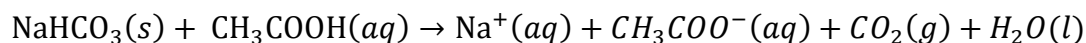
$$= 0.08206 \text{ L}\cdot\text{atm}/(\text{mol}\cdot\text{K})$$

Equation #2: Ideal Gas Law:

$$P \propto m (\text{slope}) * \frac{nT}{V}$$



Equation #3: Reaction of sodium bicarbonate (NaHCO₃) and acetic acid (CH₃COOH):



Tabular Data:

Temperature (°C): _____

Pressure (atm): _____

Experiment	Balloon Mass (g)	NaHCO ₃ Mass (g)	NaHCO ₃ Mass (g)	Radius (cm)	Volume (L)	NaHCO ₃ (mols)	CH ₃ COOH (mols)	CO ₂ (mols)	Internal Pressure (atm)	Gas Constant (L·atm/mol·K)
Trial #1										
Trial #2										
Trial #3										

Evaluation:

Note: Please practice answers on paper before submission.

1. What is the math toward an average gas constant (R)?
2. What happened in the reaction between sodium bicarbonate (NaHCO_3) and acetic acid (CH_3COOH)?
3. How accurate was Equation #1 to results from the experiment?
4. How precise was Equation #1 to results from the experiment?
5. Volume required math. What is the volume in a sphere?

Lab #18: Methane and Hydrogen production

Background: Industry generates vast gas. Research continues in coal gasification, hydrocarbons, steam reform, distillation, pyrolysis, and other alternatives. In 1899, Mathews et. al prepared pure methane from sodium hydroxide and acetate. His methodology heated homes by the 20th century. Also gases, such as, hydrogen propelled rockets into the atmosphere, and beyond. In lab, we prepare both gaseous methane and hydrogen by classical methods.

Goal: The percent uncertainty of reaction when producing methane and hydrogen gas.

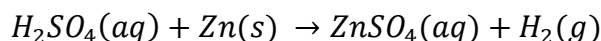
Null Hypothesis: Hydrogen and methane are not flammable gases.

Alternative Hypothesis: Hydrogen and methane are flammable gases.

Learning Outcomes:

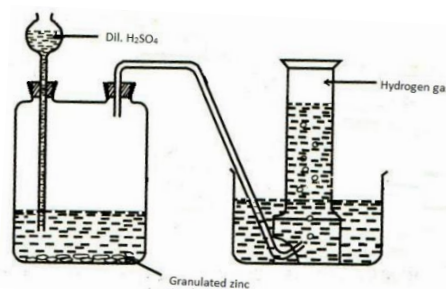
1. An inorganic experiment with special glassware for measuring the yield from a reaction.
2. Aqueous sulfuric acid with solid zinc rendering molecular hydrogen gas.
3. Inside of a chemical hood, Mathews et. al 1899 production of methane.
4. The percent uncertainty from a reaction through measuring both input and output.

Reaction #1 – Sulfuric Acid and Zinc:

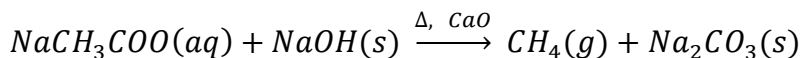


Laboratory Data:

Test Tube Mass (g): _____
 Sulfuric Acid (H₂SO₄) Molarity [M]: _____
 Sulfuric Acid (H₂SO₄) Volume [mL]: _____
 Zinc (Zn) Mass [g]: _____
 Final Test Tube Mass [g]: _____
 Predicted Hydrogen (H₂) Mass [g]: _____
 Actual Hydrogen (H₂) Mass [g]: _____
 Percent Uncertainty (%): _____

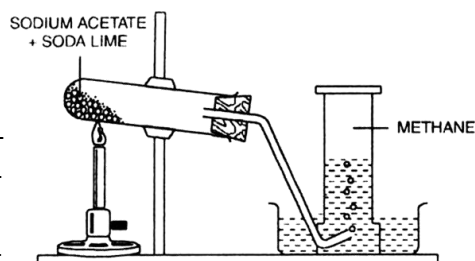


Reaction #2 – Sodium Acetate and Soda Lime:



Laboratory Data:

Test Tube Mass (g): _____
 Sodium Acetate (NaCH₃COO) Molarity [M]: _____
 Sodium Acetate (NaCH₃COO) Volume [mL]: _____
 Soda Lime Mass [g]: _____
 Final Test Tube Mass [g]: _____
 Predicted Hydrogen (CH₄) Mass [g]: _____
 Actual Hydrogen (CH₄) Mass [g]: _____
 Percent Uncertainty (%): _____



Evaluation:

Note: Please practice answers on paper before submission.

1. What is methane gas?
2. What is gaseous hydrogen?
3. The gases were or were not flammable? How many trials certify the hypothesis?
4. What reaction was more dangerous?
5. Which reaction generated more gas? Why?

Lab #19: Distillation of Mint

Background: Essential oils are volatile compounds. The oils embody plants and soaps, flavors, perfumes, incenses, and cosmetics. Popular oils are eucalyptus, peppermint, tea tree oil, citrus, and lavender. A simple separation for oil is vaporization and consecutive condensation. Individual groups boil mint leaves near a temperature toward the spearmint, and peppermint constituents. Analytical analysis confirms yield and purity, thereof.

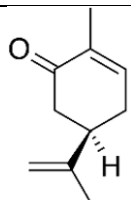
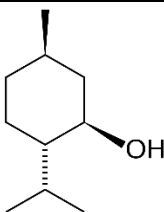
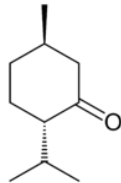
Goal: A mixture of high-purity essential oils distilled from native mint leaves.

Null Hypothesis: Oils never resided inside mint leaves with specific properties and smell.

Alternative Hypothesis: Oils reside inside mint leaves with specific properties and smell.

Learning Outcomes:

1. An exposure to liquid and gas phase separation techniques; process chemistry.
2. A simple organic glassware preparation for vaporization and condensation.
3. The percent yield of plant through measuring experimental input and output.
4. Purity of an essential oil mixture extracted from mint leaf (genus: mentha).

Chemical	Molecular Structure	Boiling Temperature
Carvone (Spearmint)		231 °C / 448 °F
Menthol (Peppermint)		214.6 °C / 418.3 °F
Menthone (Peppermint)		207 °C / 405 °F

Tabular Setup:

Mint [g]: _____

Essential Oil [g]: _____

Evaluation:

Note: Please practice answers on paper before submission.

1. What is mint?
2. What is vaporization?
3. Why was condensation a necessary step in essential oil extraction?
4. What other plants possibly have essential oils?
5. What is a reasonable percent yield of extraction? The percent yield has a standard threshold or not?

Lab #20: Copper (I) Oxide Melting

Background: From Greeks to Romans, astringents, or mordant dyes; copper is foundational to history. From metallurgy, copper was a feasible product before many civilizations. The primary role was mirrors, blades, coins, and statues. During the Industrial Revolution, copper became a major industry in Great Britain. Later, conductive properties in metals led locals toward silver, gold, and copper. As a pure red or brown metal, and malleable, Copper (²⁹Al) remains an important element. For experimental analysis, contiguous metal melting into a singular piece.

Goal: A solid or liquid copper metal from a reaction with Copper (II) oxide and carbon.

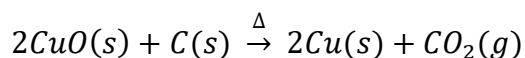
Null Hypothesis: The reaction between Copper (II) oxide and carbon never produces copper.

Alternative Hypothesis: The reaction between Copper (II) oxide and carbon produces copper.

Learning Outcomes:

1. A crucible containing metals and carbon above a flame from a Bunsen burner.
2. Copper (II) oxide reaction with carbon as a second reactant.
3. A description of the active developments toward copper metal.
4. Reactant calculations from measuring the mass of solid.

Reaction #1 – Copper (II) Oxide:



Stoichiometry:

Have:

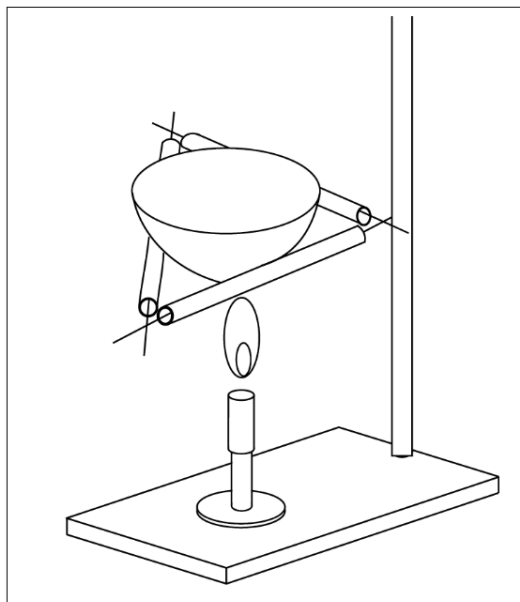
Want:

Mass of Copper (I) Oxide [g]: _____

Mass of Pure Carbon [g]: _____

Process Description:

Mass of Copper Metal [g]: _____



Evaluation:

Note: Please practice answers on paper before submission.

1. What was the color of copper metal?
2. A sketch with labels about tools characterizes the reaction for another scientist.
3. Why is mass important to percent yield?
4. Carbon was necessary? Why?
5. What was the percent yield?

Lab #21: Plastics and Polymers

Background: Polymers are both synthetic and nonsynthetic. Originally a disposable product, plastics are viable and available for sale. Alone, plastics account for a large dollar industry in packages, automotive, and electronics. Plastics, e.g. polymers derive from hydrocarbons. The polymer describes multiple materials; wool, silk, proteins, deoxyribose nucleic acid (DNA), cellulose, and chitin. Modern techniques produce nylon, acrylic, neoprene, polyethene, polyvinyl chloride, and “Teflon.” With purpose, material properties are a requirement before commercial production. For laboratory practice, students prepare nylon and measure wet vs. dry tensile strength.

Goal: The tensile strength of wet and dry nylon threads having a diameter of one millimeter.

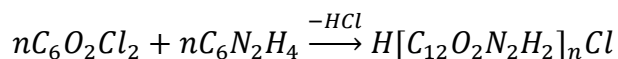
Null Hypothesis: Tensile strength is never larger in dry nylon than wet nylon averages.

Alternative Hypothesis: Tensile strength is larger in dry nylon than wet nylon averages.

Learning Outcomes:

1. A polymer of nylon from adipoyl chloride in cyclohexane solution.
2. A mixture of 1,6-hexanediamine into an organic solution of reactants.
3. Dry portions of nylon of given diameters for tensile strength.

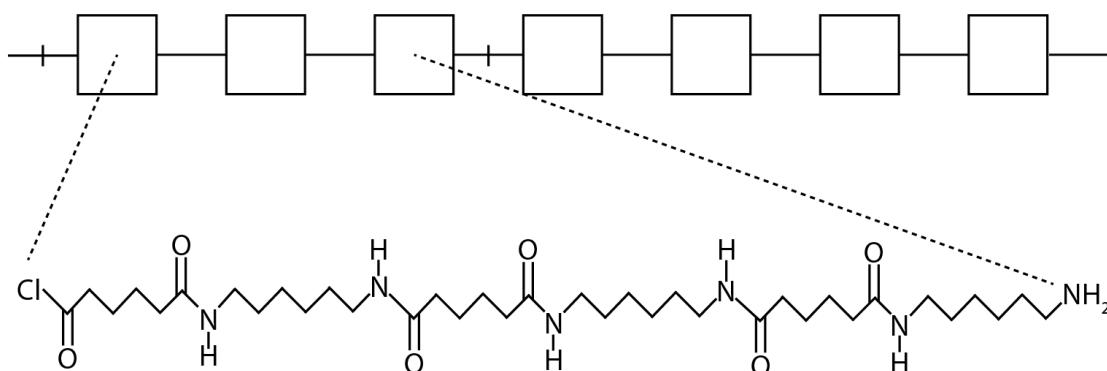
Equation #1 – Nylon Reaction:



Data Collection:

Dry Trial	Trial #1	Trial #2	Trial #3	Average	Standard Deviation
Nylon Diameter (mm)					
Tensile Strength (mN)					

Wet Trial	Trial #1	Trial #2	Trial #3	Average	Standard Deviation
Nylon Diameter (mm)					
Tensile Strength (mN)					



Evaluation:

Note: Please practice answers on paper before submission.

1. What was the color of wet and dry nylon?
2. Dry nylon had a larger or smaller strength average than wet?
3. The hypothesis was correct or incorrect?
4. What are example polymers?
5. What is the purpose of the photograph on the laboratory page?

Lab #22: Cloud Chamber

Background: Particle physicists' study atomic structure evolution. Primary methodology derives from nuclear phenomena, including, fission, fusion, ionization, and decay. In 1903, Marie Curie received a Nobel prize for radioactivity. Then, a 20th-century physicist, Enrico Fermi discovered fermions, an entire class of subatomic particles. With a multitude of others, Wolfgang Pauli, Paul Dirac, and later, in 1935 Hideki Yukawa. The carrier particles from radiation were the soon the foundation in both strong and weak forces. The nuclear forces bound Murray Gell-Mann to hadron collider experiments, and the quark model. For this afternoon's lab, a classroom produces a cloud chamber, radiation, and microscopic photography thereof.

Goal: A cloud chamber for measurements of radioactive decay emission angles.

Null Hypothesis: Radioactive decay never scatters at specific angles from incident source.

Alternative Hypothesis: Radioactive decay scatters at specific angles from incident source.

Learning Outcomes:

1. From a microscopic camera, radioactive particle images in gaseous condensate.
2. A trigonometric function applied to high-resolution snapshots of particle decay.
3. Radiation values through the counting of particles during emissions.

Image Collection:



Tabular Data:

Particle Number	Emission Angle (°)
1	
2	
3	
4	
5	

Emission Flux:

Particle Count (n): _____

Duration of Count (s): _____

Emission Density (n/s): _____



Evaluation:

Note: Please practice answers on paper before submission.

1. What was fun about the experiment?
2. What angles appeared from the experiment?
3. What is a particle? Nuclear particle?
4. Why is angle important?
5. How often is radiation?

Glossary:

6-HEXANEDIAMINE (noun) – a chemical with two amines, six carbons, and another twelve hydrogens. An ingredient in producing nylon.

ABSORB (adjective, verb) – a process about an effect, specifically input.

ACCOUNT (noun, verb) – a financial receipt or notation. Also, an arrangement based in importance.

ACCURACY (noun) – a mathematical average or exactness

ACCURATE (adjective) – a correct value

ACETATE (noun) – a chemical in biological systems, then later a mass produced commercial solvent.

ACID (noun) – various liquid substances with pH < 7, corrosive and sour when safe. Commonly, not safe.

ACID-BASE (noun) – chemist linked acids and bases by a hyphen.

ACIDIC (adjective) – a description about a solution when pH < 7.

ACRYLIC (noun) – a chemical, readily a plastic purposes in emulsion, resin, and water-resistance.

ACTUAL (adjective) - fact

ADD (verb) – symbol (+), additional, together, and sum. 1+1=2

ADDITIONAL (adjective) - more

ADDUCT (verb) – encompass

ADIPOYL (verb) – a toxic chemical in the reaction to nylon, the molecule contains a radical.

AFTERNOON (noun) – military time beyond 12:00, twelve o'clock, but before 6:00, six o'clock.

AGREEMENT (noun) – similar opinion

ALiquot (noun) – a small amount, in chemistry, 'a little liquid'

ALTER (verb) – a change

ALTERNATIVE (adjective) – a second plan

AMBIENT (adjective) – surrounding environment

AMERICA (noun) – a northern, also a southern continent. United States of America is a smaller nation.

AMERICAN (adjective) – an informal term related to South and North America or United States of America.

AMMONIUM (noun) – an ion from ammonia.

AMOUNT (noun) – a quantity

ANALYSIS (noun) – a judgment about order, state, or timeline.

ANALYTICAL (noun, adjective) – in chemistry a technique, method, instrument, scale, or tool.

ANALYZE (verb) – a study

ANGLE (noun) – measurement in radians related to perpendicular, obtuse, and oblique, also a corner or vertex.

ANOTHER (determiner, pronoun) – a modifier to plural noun or in a group, a reference.

ANSWER (noun, verb) – a conclusion, action, or outcome

APPARATUS (noun) – a tool, method, or machine

APPARENT (adjective) – noticeable, clear, and understood

APPEAR (verb) – visible or becoming visible

APPLY (verb) – a request or statement

APPROXIMATE (adjective) – not accurate

AQUEOUS (adjective) – a mixture with ions in solution.

ARITHMETIC (adjective) – adding, subtracting, multiplying, or dividing numbers

AROUND (preposition, adverb) – a position, behind, or in direction

ARRANGEMENT (noun) – a location, plan, or opinion

ARROW (noun) – a long and sharp weapon requiring a bow

ASSENT (noun, verb) – a request, agreement, or approval

ASSESS (verb) – a judgement about a situation or importance

ASSIGN (verb) – a goal

ASTRINGENT (adjective) – a vague category in chemicals about drying tissue

ASTRONAUT (noun) – a role in space

ATMOSPHERE (noun) – the gaseous environment around a planet

ATOM (noun) – an undivisible component; simple unit

AUTOMOTIVE (adjective) – car, truck, or other

AVAILABLE (adjective) – open, accessible, an optional choice or purchase

AVERAGE (noun, verb) – a representation about a group

AVOGADRO (noun) – a number (6.022×10^{23} /mol) or person from the early 1800's

AWAY (adverb) – somewhere, not here

BACKGROUND (noun) – an ambient condition, behind

BALLOON (noun) – a gas container and toy

BAROMETER (noun) – an instrument, the measurement is pressure

BARQUE (noun) – a wide boat

BASE (noun) – various liquid substances with pH > 7, caustic and bitter when safe. Commonly, not safe.

BASIC (adjective) – description about a liquid

BATE (verb) – an action involving leather and enzymes, such as a protease

BATH (noun) – a vessel containing water

BATTERY (noun) – an electrical device

BATTLE (noun, verb) – conflict, argument, challenge

BEAKER (noun) – chemical glassware accurate to 10%

BECOME (verb) – grew, start, initial

BEGIN (verb) - start

BEYOND (preposition, adverb) – farther

BICARBONATE (noun) – a chemical, both an acid and base, so a buffer. An item cooked in small dosages.

BIOCHEMISTRY (noun) – a scientific field about chemicals in organisms

BIOCHEMIST (noun) – a role studying biochemistry

BIOLOGY (noun, adjective) – organism taxonomy, origin, region, growth

BLACK (adjective) – a colorful object like the night sky

BLADE (noun) – a tool or weapon

BLANK (adjective) – empty or clear

BLUE (adjective) – a colorful item looking as the ocean or sky

BOAT (noun, verb) -

BOIL (verb) – when a liquid raises temperature above a critical value

BOND (noun, verb) – a relationship between citizens, family, or society

BOUND (adjective) – a duty, obligation, or likely situation, also physically locked by rope

BRITAIN (noun) – a former great nation in Europe on a island chain northwest. Presently, the United Kingdoms; England, Scotland, and Wales.

BROAD (adjective) – varied, wide, separate

BROWN (noun, verb, adjective) – color; burn; cook; camels are brown

BUNSEN (noun) – a person and burner in scientific laboratories. The device requires gaseous methane up to 2700 Fahrenheit.

BURNER (noun) – equipment burns or sterilizes in biology, biochemistry, chemistry, geology, and other.

C₆H₈O₇ (noun) – citric acid, a metabolite in breathing organisms

CABBAGE (noun) – a plant; a vegetable; an ingredient in international fermentation

CaCO₃ (noun) – calcium carbonate is a mineral in seashells, chalk, and The White Cliffs of Dover

CALCITE (noun) – specific calcium carbonate formed in low pressure

CALCIUM (noun) – element no. 20, twenty protons and twenty neutrons, white or opaque

CALCULATE (verb) – judgement about an amount

CALL (verb) – an address in formal speech

CAMERA (noun) – a gadget to photographs

CANDLE (noun) – light by a wax cylinder with wick

CARBON (noun) – element no. 6, six protons and six neutrons, black or coal-like

CARBONATE (noun) – an anion in multiple materials

CARE (noun) – protection by a person

CARRIER (noun) – a vehicle

CARVONE (noun) – a volatile oil inside plants. Commerce distills the chemical from herbs, such as spearmint, caraway, and dill.

CATALYSIS (noun) – a chemical reaction sped by an intermediary

CATALYST (noun) – a substance, enzymes, metal, or molecule lowering time during a reaction

CATEGORY (noun) – a group

CAUSE (noun) – an implicature

CELL (noun) – a basic unit within biological kingdoms: plants, bacteria, fungus, protists, or animals

CELLULOSE (noun) – a carbohydrate; a wall in cells located in plants. Also, a chemical synthesized for food, plastics, cloth, thread, and paper.

CELSIUS (noun) – a temperature unit measured from frozen ice and vapor.

CENTURY (noun) – a timeline counted in a 100 years

CERTIFY (verb) – an official receipt about truth

CH₃CH₂OH (noun) – ethanol, the chemical sterilizes organisms.

CH₃COOH (noun) – an acid from fermented sugars. Acetic acid is the chemical name. Industry applies the chemical to plastics, rubbers, adhesives, pharmaceuticals, and vitamins.

CH₄ (noun) – a molecule known as methane. The gas heats homes in the United States of America.

CHALK (noun) – a soft white rock, limestone, or mineral used as a utensil on blackboards

CHARACTERIZE (verb) – a typical group or quality

CHATLIER (noun) – Le Chatelier's principle describes an equilibrium at specific conditions.

CHEMICAL (noun) – a basic substance like a medicine, in chemistry.

CHEMISTRY (noun) – a scientific study about reactions from two or more substances or qualities in a chemical

CHEMIST (noun) – a major working on chemicals

CHINA (noun) – a settlement in 221 BC united into a modern nation. His excellency's include Mao Zedong and Xi Jinping

CHITIN (noun) – a carbohydrate in animals, and fungi

CHLORIDE (noun) – an anion from chlorine charged by an electron

CHLORINE (noun) – element 17. A halogen with high electronegativity.

CITRIC (adjective) – a description about acid; sharp flavored fruit

CITRUS (noun) – trees with acidic fruit composed of citric acid

CIVILIZATION (noun) – a society, organization, culture, or heritage by people living on earth.

CLASS (noun) – a room full for learning

CLASSICAL (adjective) – traditional form with lasting value to history

CLASSIFY (verb) – a division into groups having similarities

CLASSROOM (noun) – a space taught by a teacher with students

CLOUD (noun) – gas condensing to liquid in the sky. Clouds stratify into cumulus, stratus, and cirrus by incliment conditions.

CO₂ (noun) – a chemical, other names include carbon dioxide when gaseous or dry ice in solid.

COAL (noun) – a sedimentary rock from a metamorphic stage starting with peat; lignite, bituminous, and anthracite.

COFFEE (noun) – the liquid soup from roasting a brown or black bean

COIN (noun) – metal in currency

COLLECTION (noun) – objects gathered into a pile, lot, cluster, heap, mass, or agglomeration

COLLIDER (noun) – the tool accelerates atomic particles

COLLIGATIVE (noun) – three (or four) properties in liquid and salt mixture, such as freezing point depression, boiling point elevation, osmosis, and vapor pressure.

COLOR (noun, verb) – the visible electromagnetic spectrum displaying red, orange, yellow, green, blue, indigo, and violet

COLORIMETRIC (noun) – the instrument measures colors

COLUMN (noun) – a vertical cylinder

COMMERCIAL (noun) – a sector divided goods and services for profit

COMMITTEE (noun) – a small group delegating larger organizations

COMPARE (verb) – the observation about differing properties

COMPONENT (noun) – a piece in the total operating device

COMPOUND (noun) – a chemical or molecule

COMPREHEND (verb) – completely understand

COMPREHENSIVE (adjective) – an idea detailed into a guide

CONCENTRATION (noun) – a solute measured inside a liquid by molar mass

CONCEPT (noun) – an idea incepted into a principle

CONCLUSION (noun) – the outcome

CONDENSATE (noun) – a liquid from gas near the boiling temperature

CONDENSATION (noun) – drops from gas becoming liquid

CONDITION (adjective, noun) – a dependent clause

CONDITION (noun, verb) – a state or arrangement

CONDUCTIVE (adjective) – a property in a material transferring energy, heat, or electricity

CONGRESSIONAL (adjective) – a relationship to bureaucracy, government, or committees.

CONJECTURE (noun) – a statement without visible fact, an assumption, approximation, or bet

CONJUGATE (verb, noun) – a different form or chemical pair

CONSECUTIVE (adjective) – sequential

CONSERVATION (noun) – protection, limiting, minimal

CONSTANT (noun) – stable

CONSTITUENT (noun) – components

CONSTITUTIONAL (noun) – an action allowed by a document from government, the constitution

CONTAINER (noun) – a hollow object holding objects

CONTAIN (noun) – within

CONTENT (noun) – an item or part

CONTIGUOUS (adjective) – beside, along, whole, or continuous

CONTINUE (verb) – further events, action, or direction

CONTRAST (noun) – a comparison between two or more things

CONTROL (verb, noun) – an action limited by a person or an individual imposing control

CONVECTION (noun) – hot phases displaced by density in a gradient

CONVERT (verb) – a change

COPPER (noun) – element 29, the substance is a colorful mineral and useful in electronics

CORRECT (verb) – a proper action, link; proper auxiliary state

CORRELATION (noun) – a relationship between two or more objects

COSMETIC (noun) – a product or process about appearance, usually on false hope

COULOMB (noun) – a unit about electric charge

COUNT (verb, noun) – an abstract action about numbers or a leader in Europe, countess

COVER (verb) – drape

CREATE (verb) – cause, manifest, guide

CRITERIA (noun) – a conditional arbitration, standard judgement, or decision

CRITICAL (adjective) – important, essential, or necessary at dangerous propensity

CRUCIBLE (noun) – a container durable in high temperatures for melting solid substances or chemical elements

CRUDE (adjective, noun) – rough, simple, raw

Cu (noun) – element 28, copper metal defined the copper age

CuCO₃ (noun) – copper (II) carbonate; a green mineral known as malachite inside pigments, glazes, and pottery

CuNO₃ (noun) – copper (II) nitrate; a blue mineral used in ceramics and pyrotechnics

CURIE (noun) – a unit about radioactivity, a Polish, then French physicist, Marie Curie won a Nobel Prize

CURRENT (noun, adjective) – common word for amperage or present time

CuSO₄ (noun) – copper (II) sulfate; a blue chemical used in agriculture for fungus, fertilizer or medicine as an antidote

CYCLOHEXANE (noun) – a chemical, a hydrocarbon with six carbons and twelve hydrogens in a ring.

CYLINDER (noun) – a shape with a circle as the cross section

DANGEROUS (adjective) – an activity with possible harm

DANISH (adjective) – a relationship to Denmark, a Nordic country with capital called Copenhagen and current King Frederic X.

DARK (adjective) – no light; absence; without knowledge

DATA (noun) – the numerical value from a measurement

DATE (noun) – a calendar day

DAY (noun) – a 24 hour period counted by hours in the military or by two 12 hours with label ante meridiem (AM) and post meridiem (PM).

DECAY (verb) – radioactivity by electrons, protons, neutrons, or particles.

DECOMPOSE (verb) – a degraded item usually organic

DEEP (adjective) – a large distance

DEFINE (verb) – a meaning, or collection

DEFINITION (noun) – a statement about a word; expression

DEIONIZED (noun) – water without ions, neutral liquid purified to pH=7.0

DEMONSTRATION (noun) – an act or presentation

DENSITY (noun) – the ratio between mass and volume, heavy at size

DEOXYRIBOSE (noun) – deoxyribose is a five-membered sugar, deoxyribose nucleic acid is a molecule in organisms.

DEPEND (verb) – rely, need, necessary

DEPRESS (verb) – press downward or lower

DERIVE (verb) – source

DESCRIBE (verb) – a statement about someone or something

DESIGN (verb) – prepare or draw plans about buildings, ships, planes, and clothes

DETERGENT (noun) – a surfactant or soluble chemical for removing soil from clothes

DETERMINE (verb) – a choice

DEVELOP (verb) – the cause progressing an item into existence; maturity

DEVIATE (verb) – a separate path or direction

DEVICE (noun) – gadget, gizmo, or widget

DEVISE (verb) – a solution from imagination

DIFFUSIVE (adjective) – particles moved by a gas without internal force; diffusion constant

DIGEST (verb) – biological processing into small chemicals; process from the stomach through intestines in humans

DILUTE (verb) – additional liquid mixed toward lower concentration

DIMENSION (noun) – an axis, direction, or measurement about height, length, or width

DIOXYGEN (noun) – molecule or atom oxidized with two oxygens

DISCERNABLE (adjective) – separable

DISCOVER (verb) – find, first time

DISPLACE (verb) – a movement from original position or place

DISPLAY (verb) – an arrangement to the public

DISPOSE (verb) – throw-away, trashed, material left away from the scene, influence, and feeling toward another

DISSIMILAR (adjective) – different and not relatable

DISSOLVE (verb) – a solid absorbed in a liquid; aqueous form.

DISTILL (verb) – a chemical technique separating liquid mixtures by temperature through condensation and vaporization

DIVISION (noun) – a mathematical operation separating into groups, numbers, or parts;

DNA (noun) – an acronym for deoxyribosenucleic acid; genetic coding for an organism

DOLLAR (noun) – a currency in The United States, Canada, Australia, New Zealand and other nations

DONATE (verb) – a gift

DRAW (verb) – a sketch

DRIVE (verb) – operate a motor vehicle

DROP (verb) – fallen from a fixed position

DRY (verb) – no liquid on an object or inside a substance

DURATION (noun) – time

DUTCH (adjective) – people's longing to the Netherlands

DYE (noun, verb) – color changed by a mordant; pigment; glaze

EARLY (adjective, adverb) – the beginning on a timeline

EFFECT (noun) – a particular cause

ELECTRICITY (noun) – electrons transported through medium; spark; power; voltage; current; energy; potential

ELECTROLYSIS (noun) – a chemical change by electricity; a chemical technique separating water into oxygen and hydrogen

ELECTRONIC (adjective) – a device controlled by voltage or current

ELECTRON (noun) – a negatively charged atomic particle

ELEMENT (noun) – a pure substance indivisible by properties; part of; periodic table of elements

ELSE (adverb) – other, next in a list, another

EMBARK (verb) – boarding a ship

EMBODY (verb) – a theme or idea

EMISSION (noun) – output energy via heat or light

EMIT (verb) – output sound, residue, or wave

ENACT (verb) – action in law till agreement between individuals, parties, and organizations

ENDOTHERMIC (adjective) – energy from heat absorbed into a system; thermodynamics

ENERGY (noun) – ability; potential from radiation, nuclei, locations, movements, or chemistry

ENGINEER (noun, verb) – a job designing infrastructure, machines, or plants; build

ENTERTAIN (verb) – a group producing agreeable thought; comedy; interest; joke; art, literature, and music.

ENTHALPY (noun) – heat at constant pressure; thermodynamics; chemical reactions generate heat and to a chemist, enthalpy .

ENTIRE (adjective) – not without a part or piece; complete

ENTROPY (noun) – arrangements involving order; microscopic arrangements measured by energy; thermodynamics; chemist .

ENVIRONMENT (noun) – natural state with humans, animals, plants, fungus, and bacteria

ENZYMATIC (adjective) – by an enzyme

ENZYMES (noun) – a large substance (chemical) in cells; protease; lipase; kinase; amylase

EQUAL (verb, adjective) – exact amount in units; the same; a symbol in mathematics expressed as (=).

EQUATION (noun) – an expression about amount

EQUILIBRIUM (noun) – a balance between chemicals in solid-, liquid-, or gas-phase; equilibria

EQUIPMENT (noun) – a tool important to a job or particular activity

ERLENMEYER (noun) – a flask named after Emil Erlenmeyer. Mr. Emil was a German chemist in pharmaceuticals.

ERROR (noun) – a margin from average; accident; systematic, experimental, or human mistake

ESPECIALLY (adverb) – much, a great deal, indeed, great, and considerably.

ESSENTIAL (adjective) – crucial, root, or basic

ESTIMATE (verb) – calculate, assess, guess, average

ETHANOL (noun) – a chemical used for sterilization, ethyl alcohol derives from fermentation by grain or sugar

EUCALYPTUS (noun) – a tree in Australia classified into Angiosperm: Eudicot: Rosid clades with Koalas in native habitat

EVALUATE (verb) – a judgement about importance or qualities; not superfluous decision; at greatest importance a rubric, but not necessary

EVEN (adverb) – comparison; unusual; a multiple of two

EVENTUAL (adjective) – will end; finally; after a long time

EVERYTHING (pronoun) – all; total; entire; whole

EVIDENCE (noun) – an exact piece to an argument by an object, fact, timeline, document, or truth

EVOLUTION (noun) – a biological change or development

EXAMINE (verb) – investigate, inspect, study, check a skill or subject

EXAMPLE (noun) – an obvious or particular item to another

EXIST (verb) – a present or living thing without extraneous circumstances

EXOTHERMIC (adjective) – heat released from the system-to-system, system-to-environment, or system-to-surroundings; thermodynamics

EXPERIENCE (noun, verb) – an activity or knowledge about an activity

EXPERIMENT (noun, verb) – a measurement or examination conducted for a discovery

EXPLAIN (verb) – an argument with clarity and composition

EXPOSITORY (adjective) – an explanation; in English courses a formal description by writing contrast, sequence, cause or effect, and classification

EXPRESS (verb) – a gesture about an emotion, thought, or opinion

EXTENSIVE (adjective) – large range, region, or area

EXTRACT (verb) – remove or take

EYE (noun, verb) – an organ for vision in animals; see

FACTOR (noun, verb) – a piece to a situation whether physical or abstract; a whole number from dividing a number

FAIL (verb) – not successful to expectations; no success

FAT (noun, adjective) – a lipid in biology; high-energy substance stored beneath skin, also for warmth during cold nights or entire winters.

FEASIBLE (adjective) – possible circumstances; achievable by safety constraints

FeCl₂ (noun) – a chemical, iron (II) chloride, an ionic substance used as a flocculant or coagulant

FeCl₃ (noun) – an inorganic chemical, iron (III) chloride is a Lewis Acid for treatments in water or sewage

FERMENT (verb) – chemical change by organisms in anaerobic or aerobic environments; kimchi, sauerkraut, soy sauce, mustard, ketchup, mayonnaise, yogurt, and cheese.

FERMION (noun) – a subatomic particle with half-integer spin ($m_s = \pm 1/2, \pm 3/2, \pm 5/2, \dots$)

FIGURATIVE (adjective) – an imaginative meaning by metaphor, simile, personification, hyperbole, idiom, onomatopoeia, alliteration; play

FILL (verb) – full and without empty space

FILTER (noun, verb) – an apparatus for removing matter; separate

FIRE (noun) – heat and light from combustion, flame

FIRST (determiner) – the initial amount, time, quality, or importance

FISSION (noun) – a nucleus from an atom dividing into particles

FLAKE (noun, verb) – a flat and brittle particle; knap; shatter, debitage

FLAME (noun) – the hottest part in a fire colored red, yellow, orange, green, blue, indigo, or violet and gaseous

FLAMMABLE (adjective) – capable to ignite by heat or work

FLASK (noun) – a container for liquids made from plastic, glass, ceramics, or metal

FLATTERY (noun) – insincere judgement toward personal interest

FLAVOR (noun, verb) – taste when consuming food; sense from tongue

FLUID (noun) – a liquid or gas shaped to container; viscous

FLUX (noun) – a stage changed by different energy

FLY (verb) – an action lifting an object above the ground up till etcetera

FOLLOW (verb) – movement next to a thing sustaining observation

FOOD (noun) – an edible item necessary for digestion and life

FORCE (noun, verb) – pressure; momentum; move;

FORMAL (adjective) – a proper formatting; acceptable in etiquette courses

FORMULA (noun) – a relationship between numbers, letters, standards, or physical quantities

FOUNDATION (noun) – infrastructure; organization; government; first

FREEZE (verb) – liquid changing phase into a solid; phase change

FREEZING-POINT (noun) – the temperature, which a phase changed

FRICTION (noun) – rubbing action between two objects;

FUME (verb) – angry; gases emitting from a chemical

FUN (noun, adjective) – pleasure; emotion; favorite but not serious

FUNCTION (noun) – an expression about natural evidence

FUNDAMENTAL (adjective) – basal; root; the beginning to else

FUSION (noun) – nucleus combining into larger particles; nuclear

GAS (noun, verb) – a chemical phase; no shape and infinite volume; particle transferring within similar phase

GENERAL (adjective) – a unit or common to most in group

GENUS (noun) – taxonomic rank by between family and species

GEOMETRY (noun) – principles between lines, curves, and surface

GERMAN (noun) – Hallo, Guten Morgen; a language in central Europe

GIVE (verb) – offering, produce or cause

GLASS (noun) – silicon dioxide; a transparent material in windows

GLASSWARE (noun) – a chemist uses glass and ware in science

GLOSSARY (noun) – a dictionary near last pages in a book

GLYCERIDE (noun) – a chemical, an ester derived from glycerol

GLYCERIN (noun) – chemical; viscous liquid; in foods and explosives

GO (verb) – travel; vacate a particular location or direction

GOAL (noun) – abstract thought about step or aim; objective

GOLD (noun) – element 79; inert; lustrous; 79 protons and 118 neutrons

GOOD (adjective) – philosophy among variety; opposite is bad

GRADUATED (adjective) – glassware measuring exact quantity

GRAM (noun) – a unit; mass; weight in pure water at a hundredth cubic part per meter near melting temperature in ice; pound; ounce; troy;

GRAVITY (noun) – a force around mass; between objects; falling

GREASE (noun, verb) – lubricant by fat or oil; animal fat; happen more

GREAT (adjective) – a majority amount, size, or degree

GREEK (noun) – language, nation, and mythology; special characters;

GROUP (noun) – a transient unit; a number of people, companies, etc.

H₂ (noun) – hydrogen; diatomic molecule; flammable; gas on earth

H₂O (noun) – water; solid, liquid, and gas phase are on earth at S.T.P.

H₂SO₄ (noun) – sulfuric acid; strong acid; diprotic molecule;

HADRON (noun) – location colliding particles;

HAPPEN (noun) – a situation or event; an effect in the future

HARD (adjective) – not easy; difficult; a challenging effort;

HCl (noun) – hydrochloric acid; a strong acid; gastric acids in gut

HEALTH (noun) – a state; physical and mental well-being

HEAT (noun, verb) – energy transfer; warmth; thermodynamics
HEIGHT (noun) – vertical length in
HELP (verb) – assistance during danger; cooperation
HIGH (adjective) – large distance from ground
HISTORY (noun) – a subject about past events
HNO₃ (noun) – nitric acid; strong acid; ingredient to aqua regia
HOLE (noun) – an empty space; absent by matter
HOME (noun) – residence; apartment; house; cabin; boat
HOOD (noun) – a container built for chemicals
HOT (adjective) – high temperature above ambient conditions
HOURLY (noun) – unit about time; 24 hours in a day; 60 minutes per hour
HOUSEHOLD (noun) – family; a group living at the same location
HYDROCARBON (noun) – a chemical with hydrogen and carbon atoms; alkane; alkene; alkyne; saturated and unsaturated; cyclic structure
HYDROCHLORIC (noun) – a chemical with hydrogen and chlorine
HYDROGEN (noun) – element no 1; diatomic molecule
HYDROXIDE (noun) – an anion with oxygen and hydrogen; hydroxyl
HYPOTHESIS (noun) – an idea or explanation about evidence and fact
ICE (noun) – solid water; snow; frost; frozen; glacier; iceberg; icecube
IDEAL (adjective) – perfect or best possible
IDEA (noun) – plan, thought, opinion, action, or situation
IDENTIFY (verb) – observe; recognize; characterize
IMAGE (noun, verb) – photograph; portrait; picture; illustrate
IMPORTANT (adjective) – essential; influence; great outcomes
INCENSE (noun) – smell by burning; a substance producing smell
INCIDENT (noun, adjective) – unusual event; next to a surface
INCLUDE (verb) – part; piece; component; ingredient; element
INCORRECT (adjective) – not true; wrong; false; against rules
INCREASE (verb) – more; further amount; additional quantity
INCREMENT (noun) – multiple increases; the minimal step
INDEPENDENT (adjective) – not dependent; alone; an adult
INDIVIDUAL (noun) – a single separate object and not in a group
INDUSTRY (noun) – companies or activities for business
INFORMATION (noun) – evidence, fact, detail, direction
INGREDIENT (noun) – a specific component in a meal or mixture
IN-HOUSE (adjective, adverb) – local organization, on-site
INITIAL (adjective) – the start, beginning, or first
INNOCUOUS (adjective) – not harmful to physical or mental health
INORGANIC (adjective) – chemical with little or no carbon
INPUT (noun, verb) – entry; amounts entering
INSPECT (verb) – observe, discover, investigate in detail
INSTRUCT (verb) – a formal explanation; discourse;
INSTRUMENT (noun) – a tool or device for a particular job
INTENSE (adjective) – powerful event or an extreme experience
INTERACT (verb) – communicate in-person or remotely
INTERNAL (adjective) – inside the body; within an organization
INVADE (verb) – attack by soldiers; an assault; a forceful entering
INVENT (verb) – a new idea from imagination by an individual or group
INVOLVE (verb) – an activity with a person, place, or thing
IODIDE (noun) – an anion from chemicals with iodine; I;
ION (noun) – atoms or molecules charged with more or less electrons
IONIZE (verb) – electrons removed from an atom or molecules
IRON (noun) – element no. 26. Commonly in red clays and soils.
JAR (noun) – a glass or container with a lid for storing food
JOCULAR (adjective) – funny; laughter about a joke; amusing
JOINT (adjective) – belonging or shared between individuals
JOULE (noun) – a unit about energy, heat, and work
JUICE (noun) – liquid squeezed or blended from fruit and/or vegetables
KELVIN (noun) – a unit; absolute temperature measured from the lowest temperature; thermodynamics; Lord Kelvin was a Brit
Kg (noun) – unit about mass; an abbreviation for kilogram

KINETIC (noun) – forces assigned to movement; scientific study in physics about objects in a dynamic state;
KJ (noun) – a unit; an acronym for kilojoule; one thousand joules
KNOW (verb) – consciously aware; certain; knowledge;
LABEL (noun) – a characteristic, quality, or category written on an item
LABORATORY (noun) – a room for science, medicine, or equipment
LACTOSE (noun) – a sugar with a five-membered cyclic ring; milk sugar
LARGE (adjective) – a huge quantity; great; sizeable; massive
LATIN (noun) – a language stemmed from Rome; Italy, Spain, and England; A formal language by educated individuals for communication
LATTER (adjective) – the last thing, group, or previously mentioned
LAVENDER (noun) – a plant commonly used in soap, lotion, and salve
LAW (noun) – a rule enacted or legislated from government; authority
LEAD (noun, verb) – a controller, absent minded; cause, especially by bad events or influence; the first in a funny competition
LEAF (noun) – an appendage on a plant for photosynthesis; foliage
LEARN (verb) – study; remember; know; skill; practice
LEATHER (noun) – skin for furniture, clothes, equipment, or bedding
LEAVE (verb) – a short time away from a position or location
LEFT (adjective, adverb) – toward the western side; away;
LEGISLATE (verb) – documents about rule, law, decision by government
LENGTH (noun) – a measurement for sides, edges, or distance
LIGHT (noun) – a ray by the sun or fire; the event from a lamp or bulb
LIME (noun) – calcium oxide or calcium hydroxide; Also a fruit; citrus
LINEAR (adjective) – a line; sequential events; in mathematics, $y=mx+b$
LIQUID (noun) – a chemical phase; constant volume and variable shape
LIST (noun) – arrangement; record; set containing similar states, actions, events or timelines; a courtesy in context to whom
LITERATURE (noun) – history; culture; heritage; law; comedy
LITER (noun) – a unit; volume in the metric system; 1000 milliliters
LOAN (noun, verb) – agreement borrowing money or an object for extra
LOCAL (adjective) – nearby regions encompassing neighbors or streets
LOSS (noun) – amount gone; no longer in presence; a disadvantage
LOW (adjective, adverb, verb) – not important; less than usual; bottom
LUKEWARM (adjective) – slightly above ambient temperature
MACROSCOPIC (adjective) – visible to humans without a microscope
MAJOR (adjective) – most; most in a group; rank in the military
MALLEABLE (adjective) – ductile; a substance influenced by pressure
MARKER (noun) – utensils using ink for communication by paper
MASS (noun) – unit measured by a scale; pounds, grams, ounces
MATERIAL (noun) – pieces; particles; items necessary in manufacturing
MATH (noun) – language about abstract thought not typically physical
MAX (adjective) – apogee; climax; extreme; limit; capacity;
MEASURE (verb) – quantifying; clarifying; exactly knowing; exactly
MECHANICAL (adjective) – motion; translating, or rotating machine
MECHANISM (noun) – part; way; a piece in a system
MEDIUM (adjective) – substance or means; a method to expression
MELT (verb) – a phase transitioning from solid to liquid;
MEMBER (noun) – individual in a group; parts selected from a group
MEMBRANE (noun) – skin connecting animal tissue; soft layer
MENTHOL (noun) – chemical with formula $C_{10}H_{20}O$; an aromatic
MENTHONE (noun) – a chemical and essential oil with formula $C_{10}H_{18}O$
METAL (noun) – conductive element or mixture when solid
METALLURGY (noun) – a field purposing metal; raw materials
METHANE (noun) – the chemical CH_4 , a flammable gas at S.T.P.
METHOD (noun) – practice; systematic process from evaluation
MICROSCOPIC (adjective) – not visible unless by a microscope
MILLILITER (noun) – a unit; mL; thousandths of a liter; a volume
MILLIMETER (noun) – a unit; mm; a thousandths meter; a length
MINERAL (noun) – natural formation with crystal patterning
MINT (noun) – a plant; herb; Business uses mint in toothpaste

MIRROR (noun, verb) – an object reflecting; reflection; image
MIX (verb) – combine; dissolve into a solution; diverse
MODEL (noun, verb) – example; copy; function; identify
MODERN (adjective) – recently; presently; futuristic
MOL (noun) – a unit in chemistry; 6.022×10^{23} amounts per mol
MOLAL (adjective) – unit; kilograms per liter; colligative properties
MOLAR (adjective) – unit by chemists; 1 mol per liter in liquid or gas
MOLD (noun) – container with hollow shape duplicating the whole
MOLECULAR (adjective) – relationship to molecules or micro-organisms
MOLECULE (noun) – two or more atoms; a structure by elements
MONGOL (noun) – heritage from Mongolia and Gobi desert
MORDANT (noun, adjective) – substance affixes by inorganic oxide
MOTION (noun) – movement; category in Newtonian physics
MULTIPLE (adjective) – more than one; many; large numbers;
MULTITUDE (noun) – large; multiple; quantify; quality or state;
Na₂CO₃ (noun) – sodium carbonate; soda ash; buffer in chemistry
NaCH₃COO (noun) – sodium acetate; chemical in food, epoxy, and rubber without water; hygroscopic chemical formed from vinegar
NaCl (noun) – sodium chloride; ionic chemical in table salt and saltwater
NaHCO₃ (noun) – sodium bicarbonate; ionic molecule in baking soda
NaOH (noun) – sodium hydroxide; strong base; alkaline in water
NATIVE (adjective) – local; regional; from the area or a place
NATURE (noun) – innate; world; environment; universe
NEED (noun, verb) – requirement; right; necessary wish from children
NEGATIVE (adjective) – not positive; less than zero; bad without safety
NEOPRENE (noun) – chemical; polychloroprene; rubber in wetsuits
NEW (adjective) – recent; innovative; dissimilar than previous events
NEWFOUND (adjective) – discovery unlike recent history
NEWTON (noun) – unit for force; pressure-area; another English adroit;
NH₄ (noun) – ammonia; metabolite from decomposing protein;
NH₄Cl (noun) – ammonium chloride; acidic in water by Brønsted-Lowry
NITRATE (noun) – polyatomic anion, NO₃⁻; solute in fertilizer and waste
NITRIC (noun) – nitric acid; inorganic acid; highly corrodes metal
NITROGEN (noun) – element 7; diatomic molecule, N₂; inert;
nm (noun) – unit; nanometer; one billion per meter; viruses and hemoglobins size in “nano” lengths; visible and ultraviolet spectrum;
NO₂ (noun) – chemical; nitrogen dioxide; health hazard causing death
NOBEL (noun) – gold medal prized by committees from Sweden
NON-SPONTANEOUS (noun) – pathway not natural; Gibbs defined positive free energy (ΔG) as unlikely events without more heat or work
NONSYNTHETIC (adjective) – product from natural circumstances
NOTEBOOK (noun) – paper bound by metal spiral, coil or tape
NUCLEAR (adjective) – nucleus in chemistry; nucleolus by biologists
NUCLEIC (noun) – acid from organism genes; DNA; RNA; nucleotide
NULL (adjective) – absence; abstract placeholder; empty; no effect
NUMBER (noun, verb) – total; symbol; count; place value; proportion
NYLON (noun) – plastic; polymer in thread, fiber, cord, and mesh
O₂ (noun) – chemical; dioxygen; bacteria respire “oxygen”
OBJECT (noun) – physical item; a wishful reason; particular material
OBSERVE (verb) – monitor; watch; actively record; remark;
OFTEN (adverb) – more than once; plural; many times during occasion
OIL (noun) – hydrocarbon; grease; petroleum; fuel; fat; lubricant
ONE (noun) – first; only; single; cardinal; without companion; lonely
OPEN (verb, adjective) – not closed; clear; available; no secret
ORDAIN (verb) – sanction; agree; confirm; establish; authorize
ORDER (noun) – sequence; decision in must; chronology; taxonomy;
ORGANIC (noun, adjective) – chemistry with carbon; nature; from farm;
ORIGINAL (noun, adjective) – first copy, edition, version; from the root
OSMOSIS (noun) – chemical gradient transporting water and salt; total osmotic pressure across cell walls sums individual solute pressures
OTHER (determiner) – alternate; opposite; exception; complement

OUTCOME (noun) – final event, action, or state; result; effect;
OUTPUT (noun, verb) – an amount from production; produce;
OXIDE (noun) – substance reacted with oxygen; rust; corundum
OXYGEN (noun) – element 8; six protons and ten neutrons; dioxygen;
PACKAGE (noun) – a courier’s delivery; a thing wrapped or covered;
PAGE (noun) – article, sheet, paper, or leaf printed in composition
PAINT (noun) – role layering surfaces with dye and oil, water, or latex
PAIR (noun, verb) – two items, sets, or things; together; match
PAPER (noun) – fiber pressed into a sheet from wood
PARAGRAPH (noun) – sentences in a sequence summing an idea
PARAMETER (noun) – measurement from a system;
PARK (noun) – civic area with plants for recreation and public events
PART (noun, verb, adverb) – some; piece; component; separate; degree
PARTICLE (noun) – small fragment; simple and pure subatomic object
PEPPERMINT (noun) – plant; herb; commodity in candy making
PERCENT (adverb) – part in 100 amounts symbolized by %; per cent
PERFUME (noun) – smell sprayed or lathered onto skin from resin
PERIODIC (adjective) – regular interval; an event or action patterned
PERSONAL (adjective) – relationship to private beliefs; particular;
PERSPECTIVE (noun) – viewpoint from an individual or group
PERTURB (verb) – bother; affect; disrupt; force;
PHASE (noun) – state in chemistry, such as solid, liquid, gas, and plasma;
PHENOMENON (noun) – experience caused by nature and universe
PHILOSOPHY (noun) – genre about good and bad or right and wrong
PHOTO (noun) – image; visual recording from past timeline by light
PHYSICAL (noun, adjective) – substance; not abstract;
PHYSICS (noun) – category about natural law without intervention
PICTURE (noun, verb) – image; photograph; draw; paint
PIECE (noun) – part; element in a set; member in a whole;
PLANT (noun, verb) – (mostly) photosynthetic eukaryotes; (mostly) green colored; (mostly) multicellular organisms; commonly food
PLASTIC (noun) – product from polymer; material; plastikos; fit for mold
PLATE (noun) – flat substance from hard material; metal base
PLAYBILL (noun) – monthly magazine from theatergoers; Broadway
PLAYSCRIPT (noun) – script by theaters composing drama
PLEASE (verb) – provide; gift; satisfy; give; request;
POINT (noun) – a value, idea, or piece in a statement
POLICY (noun) – agreeable ideas by government and political leaders
POLYETHENE (noun) – chemical; thermoplastic based in ethylene
POLYMER (noun) – molecular structures with repetitive covalent bonds
POLYVINYL (noun) – chemical; ‘many’ vinyl; resin in records and platters
POPULAR (adjective) – famous to many; not ordinary;
PORTION (noun) – part in total; amount served to one and single person
POSITIVE (noun) – numbers greater than zero; naturally agreeable;
POSSIBLE (adjective) – capable; might; an option; slight certainty
POTENTIAL (noun) – energy from ability or relative configuration
POUR (verb) – transfer; flow; faster than drizzle, but slower than splash
PRACTICE (noun, verb) – ability; skill; action for additional ability or skill
PRECISE (adjective) – exact; careful; close to a representative group
PREDICT (verb) – forecast; foretell; future fact from past interactions
PREPARE (verb) – expect; adapt; suit; fit; train; condition; make; use;
PREVIOUS (adjective) – exist beforehand; in the past; prior exposure;
PRIMARY (adjective) – major; most; important; considerable; principle;
PRINCIPLE (noun) – natural relationship, belief, or behavior; essence
PRIOR (adjective) – before in time; not present or future; abstract
PRIZE (noun) – popular collection; valuable amount; critical to crowds
PROCEED (verb) – forth; continue; forward; advance;
PROCESS (noun) – an outcome achieved by a sequence or order
PRODUCE (verb) – manufacture; build; create; make; assemble; put
PROFESSOR (noun) – role in university based on a hierarchy or rank
PROGRAM (noun) – series; instructions; pattern by instructors

PROMOTE (verb) – brief; encourage; advertise; brought; develop
PROOF (noun) – evidence toward an argument; truth; fact
PROPEL (verb) – forward; move; displace; certain force;
PROPORTION (noun) – amounts comparable by reason
PROTECT (verb) – defend; guard; prevent; care; block
PROTEIN (noun) – substance composing amino acids; discovery about proteins are: primary (residues), secondary (shape and folds), tertiary (multiple shapes and folds), and quaternary structure (more than a single strand)
PROVE (verb) – justify; attest; verify; demonstrate; clearly show
PROVIDE (verb) – give; foster; supply; furnish; procure; yield
PUMP (noun, verb) – a mechanism moving liquids and gases; transport
PURE (adjective) – essential; principle; single type; not a mixture
PYROLYSIS (noun) – high temperature chemicals reacting by heat
QUANTITY (noun) – important amount measured for an objective
QUARK (noun) – a subatomic particle; fermions found by collisions between proton-proton, proton-nucleus, and cosmic rays.
RADIATION (noun) – energy by waves or particles; electromagnetism
RADIOACTIVE (adjective) – dangerous energy above threshold
RADIUS (noun) – center measured to edge in a conic section
RAIN (noun, verb) – water from cloud; precipitation; water drops;
RAISE (verb) – elevate; rise; upward; increase; hoist; lift;
RATE (noun, verb) – quantity per time; pace; judge; critique; criticize
RATIO (noun) – relative; relation; quotient; amount divided by another
RAW (adjective) – simple; no treatment; natural condition
REACT (verb) – interact; response; result; course; undergo
REACTANT (noun) – chemical input before output; before outcome
REASON (noun, verb) – explanation; basis; excuse; judgement
RECEIVE (verb) – not transmit; welcome; admit; accept
RECORD (noun, verb) – set; map; account not harmful; list; store; measure; inform
RED (noun, adjective) – color; red animals are cardinals and ants
REFER (verb) – direct; mention; assign; decide; advance
REFORM (noun, verb) – improvement through administration; change;
RELATE (verb) – connect; understand; establish; associate
RELEVANT (adjective) – applicable; affect
REMAIN (verb) – stay; exist; continue; endure;
RENDER (verb) – cause; generate; represent to people
RENEWABLE (adjective) – substance through easy and simple resources
RENNET (noun) – enzyme grown in mammal stomachs, solely ruminant
REPEAT (verb) – recur; recite; repetitive; reiterate; echo
REPEL (verb) – drive backward; reverse; challenge; block; avert
REPRESENT (verb) – speak and write as the individual or advise thereof
REQUIRE (verb) – need; order; demand; list; ask; desire; obligate;
RESEARCH (noun, verb) – examination; subject; recently inform
RESIDE (verb) – accompany; occupy; short living; vest alongside
RESIN (noun) – solid vulcanized into rubber or via viscous, liquid amber
RESOLUTION (noun) – official conclusion; verbal promise
RESOURCE (noun) – physical good; material able to support
RESULT (noun, verb) – outcome; end; data mark; answer;
REVERSE (verb) – change; opposite course; halt;
REVERSIBLE (noun) – system in equilibrium with surroundings
REVIEW (noun, verb) – commentary; decide; survey; judge
REVOLUTION (noun) – popular favor; significant changes throughout art, culture, and intellect; a segment in time not uniform
RIGHT (adjective) – just; valid; genuine; bona fide; authentic decision
ROCKET (noun, verb) – vessel forced into atmosphere; quick travel
ROLE (noun) – job; major; title; act; duty; daily activity post
ROMANCE (noun) – poetic gesture; marital conversation; movement
ROMAN (adjective) – stereotype from archeological evidence near Rome, Italy; tradition to Southern Europe, specially Roman Kingdom

ROOT (noun, verb) – base in plants transporting nutrients; stem
RUSSIA (noun) – significant region and state in northern hemisphere; cognate words are Sputnik 1, beluga, sable, and pogrom.
SAFETY (noun) – state with definite actions; a condition; not harmful
SALINE (noun) – liquid with high salt concentration; Doctors prescribe intravenous 0.9% sodium chloride in water for fluid and salt imbalance
SALT (noun) – ionic chemical; Commonly deposits from lake or ocean contain salt in vast amounts and large enough now to prospectors
SALTWATER (adjective) – liquid associated with the sea; pH is near 8.2
SALVE (noun) – cream for injured persons; ointment; healthy grease
SAMPLE (noun, verb) – representation about a group; represent
SAPON (noun) – soap with plant oil; rose, mandarin, sandalwood, vanilla; rare spice, flower, or seed for beauty, hygiene, and cleanliness
SAPONIFICATION (noun) – chemical action between base and fat or oil
SCALE (noun, verb) – analytical tool about mass; weigh; increase
SCATTER (verb) – spread; move away; flew apart; no specific position
SCIENCE (noun) – record about nature; methodology for phenomenon
SCIENTIST (noun) – role by an expert in the 21st century for the sciences
SEAWATER (noun) – water from ocean and tidal zones with salt inside
SEMIIMPERMEABLE (adjective) – a gradient; partial action; not 100%
SENTENCE (noun) – words collected into proper grammar and syntax
SEPARATE (adjective, verb) – independent pieces; distant; divide
SEQUEST (noun, verb) – bodies lowering financial expense; isolate; hide
SERIAL (adjective) – multiple; regular; serial misconduct in soccer
SET (noun, verb) – elements collected into a group; establish; position
SETTING (noun) – ambient environment in a place, business, or school
SHARE (verb) – provide; divide; part; involve; allot between people
SHEET (noun) – flat parchment; flat cloth on bed or furniture; children dress in a sheet during October on Halloween for costume about ghosts
SHIFT (verb) – move; translate; position; direct;
SHIP (noun) – waterborne vessel floating on a stream, river, lake, estuary, wetland, canal, reservoir, harbor, waterway, sea, and/or ocean
SIGN (noun, verb) – object depicting probable presence; write; instruct
SILK (noun) – cloth from silkworms, such as genus: Bombyx. After metamorphosis, empty cocoons soften in water for spinning into thread
SILVER (noun) – element no. 47. Chemical symbol Ag. A precious metal.
SIMILAR (adjective) – alike; almost the same; broadly uniform
SIMPLE (adjective) – basic; not complex; not difficult; without decor
SINGULAR (adjective) – only; alone; one thing; by itself; individual
SIR (noun) – formal title to men; Middle English sire; senior
SLOPE (noun) – surface incline; coordinate change; steep rise
SMALL (adjective) – little; not very big; amounts not large
SMELL (verb) – sensation from the nose; olfactory sense
SNAPSHOT (noun) – photograph; quick shot; an example
SOAP (noun) – household and personal care item; suds
SOCIAL (adjective) – activity between people; amenity; culture
SODA (noun) – bubbles containing carbon dioxide or minerals predominantly carbonate, including Trona, Nahcolite, and Limestone
SODIUM (noun) – element no. 11. Sodium discharges 589 nm light.
SOLID (noun, adjective) – chemical phase described by constant volume and stable shape; hard or firm material; rigid, brittle, and not plastic
SOLUTE (noun) – minor chemical dissolved into chemical in excess
SOLUTION (noun) – chemists in a union define solution as, “A liquid or solid phase containing more than one substance.”
SOLVENT (adjective) – majority chemical; polar and nonpolar molecules
SOURCE (noun, verb) – initial place; origin; a products starting point
SPACE (noun) – empty area; region above earth’s atmosphere
SPEAK (verb) – sound by human voice; conversation; language
SPEARMINT (noun) – essential oil from herbs; aromatic; carvone
SPECIAL (adjective) – not ordinary or usual; favorite
SPECIFIC (adjective) – particular thing; relationship narrowing

SPECIMEN (noun, adjective) – example; reference; certain identity
SPECTRUM (noun) – light; beams separated into a measurable range
SPECTROMETER (noun) – instrument for measuring light in radio, microwave, infrared, visible, ultraviolet, x-ray, and cosmic ray regions
SPHERE (noun) – 3-dimensional object, much like a baseball or bubble
SPONTANEITY (noun) – tendency; Gibbs free energy (ΔG) measure
SPONTANEOUS (adjective) – natural; free energy above zero
STANDARD (noun, adjective) – quality; moral; correct value; usual
START (verb) – begin; initial location; sudden cause
STATE (noun) – condition; current representation; static existence
STATUE (noun) – large metal sculpture, figure, model, or cast
STATUTE (noun) – law ordained by legislative body, rulers, or institution
STEAM (noun, verb) – hot gas from boiling liquid, hot gaseous water
STEAM-POWERED (adjective) – mechanical engine powered by steam
STEP (noun, verb) – interval; movement; height interval; leg movement
STICK (noun, verb) – long object, but also hard and thin; pole; put; point
STOICHIOMETRY (noun) – relationship between chemical reaction coefficients; topic in chemistry measuring input and output
STORAGE (noun) – location holding objects; place storing items
STORE (noun, verb) – place keeping things; put; hold
S.T.P. (noun) – standard temperature and pressure is 293.15 Kelvin and 1 atmosphere pressure
STRENGTH (noun) – ability exercising physical and mental labor
STRUCTURE (noun, verb) – body; arrangement; organization; part
STUDENT (noun) – person learning; people in a classroom or school
STUDY (verb) – learn; major; research; examine; discover
STYROFOAM (noun) – polystyrene; chemical branding by commercial enterprise; polymer from styrene monomers; foam
SUBATOMIC (adjective) – particles smaller than a nucleus or atom
SUBLIME (verb) – chemical change from solid to gas
SUBMISSION (noun) – authority granted over things, or documents; rights relinquished or passed; voluntary withdrawal from rights
SUBSTANCE (noun) – material with particular physical characteristics
SUBSTITUTE (noun, verb) – alternative; replace; spare
SUET (noun) – fat from tallow; hard animal fat; room temperature solid
SULFATE (noun) – anion (SO_4^{2-}), sulfur fully oxidized; ionic in many salts
SULFUR (noun) – element no 16 embodies yellow color and rotten smell
SULFURIC (noun) – strong acid; America spells as sulphuric
SUMMARY (noun) – description; blurb; whole; statement; discussion
SURROUND (verb, adjective) – everything else; around; adjacent
SWEET (adjective) – not salty, sour, bitter, or savory; sugary; candy
SYNTHETIC (adjective) – artificial; not natural; false; imitative
SYSTEM (noun) – connection between pieces; purpose; organization
TABLE (noun) – furniture with four legs and flat surface leveled
TABLET (noun) – medicine; pill; substance pressed into pellet
TALLOW (noun) – beef or sheep fat; lard rendered from suet; A versatile leftover from tissue in 18th-21st century having non-food benefits
TAPE (noun) – plastic with sticky; material affixing or fastening parcel
TASTE (noun) – sensation caused by tongue; sense from licking morsel
TEA (noun) – plant matter boiled, such as flowers, leaves, or herbs
TECHNIQUE (noun) – technical action; execution carrying finesse
TECHNOLOGY (noun) – an industry; discoveries categorized into ancient, classical, medieval, renaissance, industrial, modern, atomic, information, and future eras in electronic video games
TEFLON (noun) – trademark in fluoropolymer industry
TEMPERATURE (noun) – physical quantity measured by thermometer
TENSILE (adjective) – material property; forces by tension; stress
TERMINOLOGY (noun) – jargon or nomenclature; approvable definition
TEST (noun, verb) – examination with relevant examples; examine
TEXTILE (noun) – fabric; raw goods from cotton, wool, or synthetic fiber
TEXTURE (noun, verb) – representation; quality; rough; raise; smooth

THEORY (noun) – hypothesis; formal relationship reasoning facts
THEREOF (adverb) – prior; previous; aforementioned; from; by that
THERMODYNAMICS (noun) – major branch in physics applying temperature, pressure, moles, and volume to pure substances
THERMOMETER (noun) – thermoscope; numerical thermoscope; instrument graduating hot and cold environments
THOUGH (conjunction) – albeit, rather, but, nonetheless; secondly
THREAD (noun, verb) – thin fiber wound into yarn; wove; combine
THRESHOLD (noun) – imaginary level, point, or line drawn for reason
THROUGHOUT (adverb) – entirely; wholly; by every part; in the
TIME (noun, verb) – passage; abstract concept patterning states or cycles; interval; date; synchronize;
TOPIC (noun) – current discussion; major relation; theme
TOTAL (noun, verb) – each and every amount; whole; entire; sum; tally
TRAJECTORY (noun) – pathway; arc; similar curve; motions direction
TRANSITION (noun, verb) – process; between states; stage; passing
TRANSLATE (verb) – motion; different form changed along coordinates
TREE (noun) – tallest plants with trunk, branch, seed; spermatophyte
TRIAL (noun, verb) – effective period; examination; suitable time; test
TRIGONOMETRY (noun) – mathematics fielding angles, sides, and ratio
TRUE (adjective) – factual; correct; not false; actual; real; proven
TUBE (noun) – plastic, metal, rubber, or glass composed into a cylinder
TYPE (noun, verb) – group; category; class; characteristic set; key press
UBIQUITOUS (adjective) – common; all over; anyplace; too many
ULTIMATE (adjective) – pinnical; most; great importance;
UNCERTAINTY (noun) – situation without known certainty
UNIQUE (adjective) – uncommon; not regular; unusual; rare; each person had an unforgettable and incredible life
UNIT (noun) – standard measurement; single; basic representation
UNITE (verb) – join; combine; bring; group; groups existing
UNKNOWN (adjective) – obscure; not known; alien action or event
UPON (preposition) – above; on; along a timeline; within circumstance
USEFUL (adjective) – applicable; effective; achievable; constructive
USE (verb) – purpose; act; move; touch; fiddle; toy;
VACUUM (noun) – vacant space; absence; region lacking matter
VALID (adjective) – agreeable truth; reason; within conditions;
VALUE (noun, verb) – members agreeing on benefit; judgement
VAPOR (noun) – gas from liquid with high concentration and density
VARIABLE (adjective) – not constant; often; mutable
VAST (adjective) – extreme; wide; broad; expansive; enormous
VESSEL (noun) – vehicle making journeys across lake, river or sea
VIALE (adjective) – possible; doable; likely; achievable outcome
VIAL (noun) – glass receptacle, container, bottle, or ampoule
VINEGAR (noun) – chemical CH_3COOH ; acetic acid; weak acid
VOCABULARY (noun) – words and phrases in language; nomenclature
VOLATILE (adjective) – sudden event; explosive or violent effect
VOLT (noun) – standard unit defined by an International Electrical Congress in 1892 from electromagnetic forces in a Clark Cell, 1.4328 Volts at 288 K. Later, the standard came from a Weston cell, then recently a Josephson system by standard step per current between two superconductors; potential per charge
VOLTMETER (noun) – a tool for measuring electrical circuits
VOLUME (noun) – space in three dimensions; quantity inside shape
VERSUS (preposition) – abbreviated v.s.; compare; against
WAND (noun) – special stick biologists use; metal looped for inoculation
WANT (verb) – not a need; would; impulse; seek; hunger; desperate
WAR (noun, verb) – competition; measurable conflict; fight; challenge
WASH (verb) – clean by water; rinse with liquid; scrub
WATCH (noun, verb) – clock; focus; monitor; examine
WATER (noun) – chemical, H_2O ; liquid from earth's rain and oceans

WEAK (adjective) – not strong; chemists categorize acids and bases into strong versus weak categories by pK_a or pK_b , respectively

WEEK (noun) – seven days; 1/52 years; duration or period with Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday

WEIGH (verb) – measurement quantifying mass; action measuring influence by gravity

WET (adjective) – water on an object; moist surface; humid air

WIZARD (noun) – magical men helping or harming other humans

WOOL (noun) – hair from domesticated Artiodactyles for cloth

WORD (noun, verb) – concept from speaking, writing, or listening

WORK (noun, verb) – activity associated to physical and mental exertion

YEAR (noun) – total time around the sun; four seasons; fall, winter, spring, and summer combine into a year; 365.25 days

YIELD (verb) – gain; loss; amount; net; produce; supply;

ZINC (noun) – element no. 30; A trace mineral vital to human genetics

Zn (noun) – abbreviation to Zinc, see Zinc; smithsonite or hemimorphite

ZnSO₄ (noun) – zinc sulfate is commonly in Galvanic Cell experiments

β-AMYLASE (noun) – enzyme from sweet potato catalyzing carbohydrates; a glycoside hydrolase enzyme catalyzes complex sugars