NEW UNIT!

Chemical Interactions

Atomic Basics

#21

Vocabulary:

- **Matter:** **Anything that has mass and takes up space.**
- **Atom:** **the smallest particle of matter.**
- **Element:** **A pure substance made up of only one type of atom.**

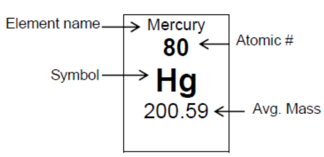
Vocabulary:

- **Subatomic Particle: Smaller particles that make up an atom.**
  - **Proton = positive (+) charge**
  - **Neutron = no charge**
  - **Electron = negative (-) charge**

Introduction:

Atomic Structure

- **Atomic # = # of Protons**
- **# of Protons = # Electrons**
- **Protons + Neutrons = Atomic Mass**
- **Neutrons = Atomic Mass - Protons**

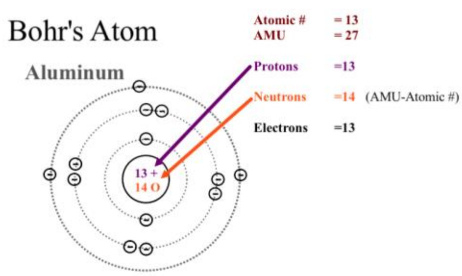


Atomic Model:

- **Protons and Neutrons are found at the center (nucleus) of the atom**
- **Electrons are found outside the nucleus in "shells"**
  - **1st shell holds up to 2 e-**
  - **2nd shell holds up to 8 e-**
  - **3rd shell holds up to 18 e-**

BOHR MODEL:

- **Protons and Neutrons are found at the center (nucleus) of the atom**
- **Electrons are found outside the nucleus in "shells"**
  - **1st shell holds up to 2 e-**
  - **2nd shell holds up to 8 e-**
  - **3rd shell holds up to 18 e-**



Understanding Chemical Reactions

#22

Vocabulary:

- **Compound:** a chemical made up of two or more elements.
- **Molecule:** the smallest piece of a compound.
- **Chemical Formula:** describes the chemical makeup of an element or compound
- **Reactants**: chemicals that react together.
- **Products:** substances that form from a chemical reaction.
- **Chemical Equation:** a written explanation for a chemical reaction.

Chemical Formulas:

H_2O

- How many atoms of Hydrogen?
- 2
- How many atoms of Oxygen?
- 1
- Water

Chemical Formulas:

CO_2

- How many atoms of Carbon?
- 1
- How many atoms of Oxygen?
- 2
- Carbon Dioxide

Chemical Formulas:

NaCl

- **How many atoms of Sodium?**
- **1**
- **How many atoms of Chlorine?**
- **1**
- **Sodium Chloride (table salt)**

Chemical Formulas:

$$H_2SO_4$$

- **Hydrogen = 2**
- **Sulfur = 1**
- **Oxygen = 4**

Sulfuric Acid (battery acid)

Chemical Formulas:

$$C_6H_{12}O_6$$

- **Carbon = 6**
- **Hydrogen = 12**
- **Oxygen = 6**

Glucose (Sugar)

Chemical Reactions:

- **During a chemical reaction, atoms cannot be created or destroyed.**
- **Atoms are rearranged during chemical reactions.**

DO NOW:

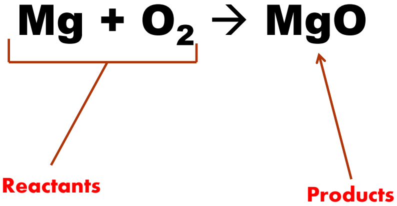
1. **What elements are in the following compound?**

$$C_8H_{10}N_4O_2$$

2. **How many total atoms are in the compound?**

Chemical Equations:

$$Mg + O_2 \rightarrow MgO$$



Chemical Equations:

$$Mg + O_2 \rightarrow MgO$$

- **Read: Magnesium plus oxygen react to form magnesium oxide.**
- **In order to "solve" a chemical equation, we must "balance" it.**
- **The correct chemicals are shown, but not in the correct proportion.**

Chemical Equations:

$$Mg + O_2 \rightarrow MgO$$

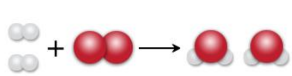
- **We balance the equation by adding "coefficients" in front of the formulas.**
- **The coefficient tells us how many molecules of each chemical are in the reaction.**

$$H_2 + O_2 \rightarrow H_2O$$

NOT BALANCED

BALANCED!

$$2H_2 + O_2 \longrightarrow 2H_2O$$



Chemical Equations:

$$Mg + O_2 \rightarrow MgO$$

- In order to "balance" the equation, we have to count the atoms on both sides of the equation.

Chemical Equations:

$$Mg + O_2 \rightarrow MgO$$

LEFT	Right
Mg = 1	Mg = 1
O = 2	O = 1

What atoms are out of balance?

Chemical Equations:

$$Mg + O_2 \rightarrow 2MgO$$

LEFT	Right
Mg = 1	Mg = + 2
O = 2	O = + 2

What atoms are out of balance?

Chemical Equations:

$2Mg + O_2 \rightarrow 2MgO$

LEFT	Right
Mg = + 2	Mg = + 2
O = 2	O = + 2

Chemical Equations:

$2Mg + O_2 \rightarrow 2MgO$

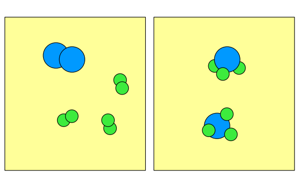
- **You can change the "coefficient", but you cannot change the subscript.**

Balancing Equations

- Balance the following equation by adjusting coefficients.

$N_2 + 3H_2 \rightarrow 2NH_3$

	reactants	products
N	2	2
H	6	6



PRACTICE

- Try it out!
- Balance the following equation.

$$\_\_H_2 + \_\_O_2 \rightarrow \_\_H_2O$$

Chemical Reactions:

Atoms are not CREATED or DESTROYED during a chemical reaction. Scientists know that there must be the SAME number of atoms on each SIDE of the EQUATION.

To balance the chemical equation, you must add COEFFICIENTS in front of the chemical formulas in the equation. You cannot ADD or CHANGE subscripts!

Building Molecules

#23

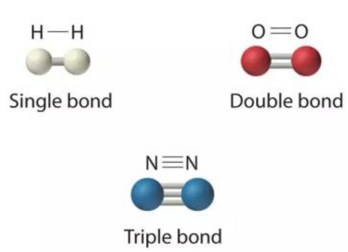
Chemical Formulas

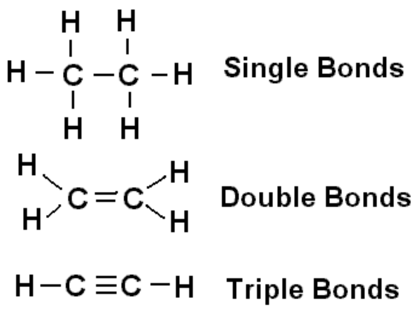
- **Carbon is written first if it is present in the molecule.**
- **Nitrogen is written before Hydrogen.**
- **Oxygen is written at the end of the formula.**
- **Hydrogen is written directly after Carbon and Nitrogen if both are present.**

Chemical Bonding

- **Hydrogen can make 1 bond (1 V.E.)**
- **Oxygen can make 2 bonds (6 V.E.)**
- **Nitrogen can make 3 bonds (5 V.E.)**
- **Carbon can make 4 bonds (4 V.E.)**

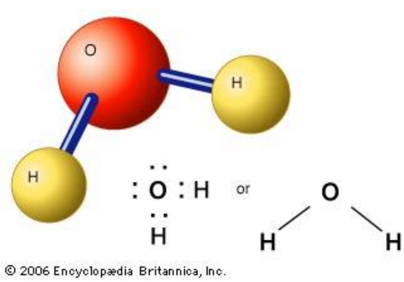
DRAWING THE BONDS





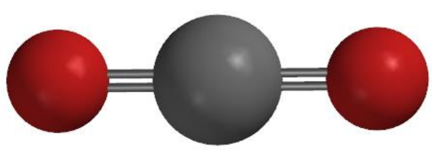
Building Models

H_2O



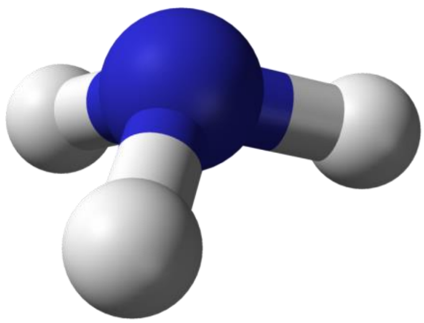
Building Models

CO_2



Building Models

NH_3



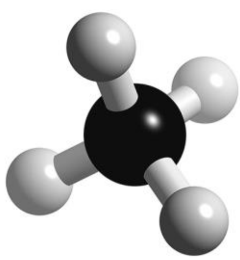
Building Models

C_2H_2

$H-C\equiv C-H$

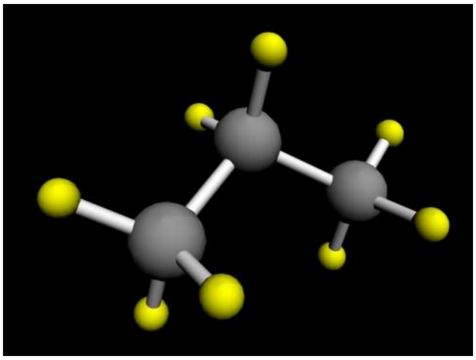
Building Models

CH_4



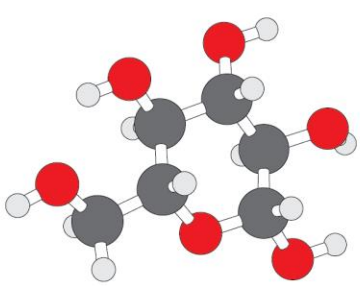
Building Models

C_3H_8



Building Models

$C_6H_{12}O_6$



Lab #21

STATES OF MATTER

Consider the following:

- What is matter?
- What is matter made up of?
- What are the three main states of matter?

VOCABULARY:

- **SOLID:** **Matter with a definite volume and shape.**
- **LIQUID:** **Matter with a definite volume, but no definite shape.**
- **GAS:** **Matter with no definite volume or shape.**

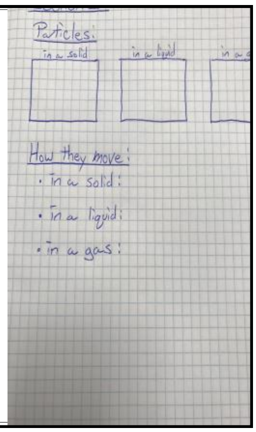
PRE-LAB Section 1:

- **Particles:** Draw particles in different states of matter.

Solid | Liquid | Gas

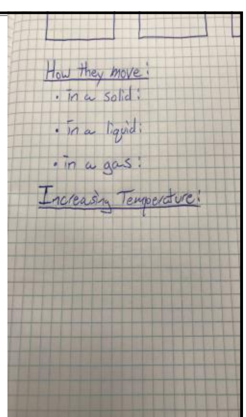
PRE-LAB Section 1:

- **How they move:**
  Describe how particles move:
  - In a solid:
  - In a liquid:
  - In a gas:



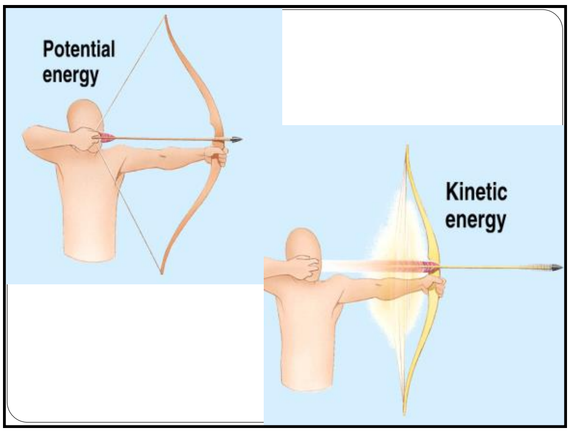
PRE-LAB Section 1:

- **Increasing temperature:**
- What happens to the particles when the temperature increases?



Vocabulary:

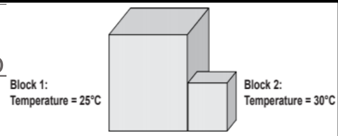
Temperature: a measure of the average kinetic energy (KE) of particles of matter
Thermal energy: the total amount, or sum, of kinetic energy in a substance; it depends on temp. and total # of particles



Vocabulary:

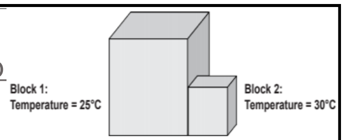
Heat: the thermal energy transferred from one object to another due to the temperature difference between the objects.

PRE-LAB Sectio



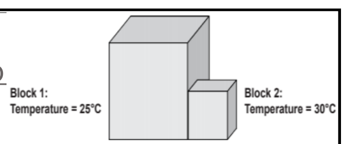
- **Temperature:**
- Which block has the higher temperature? Why do you think so?

PRE-LAB Sectio



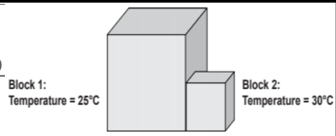
- **Thermal Energy:**
- Which block has more thermal energy? Why do you think so?

PRE-LAB Sectio



- **Heat Transfer:**
- Since the blocks are touching, there will be a transfer of thermal energy, or heat, from one to the other. Which direction will the heat transfer occur? Why do you think so?

PRE-LAB Sectio



- **Temperature:**
- Describe the heat transfer that would occur if you put Block 2 into a freezer, which has a temperature of 0℃. Why do you think so?

Hypothesis:

What do you think will happen to the water and food coloring inside the beaker when it is set on the hot plate?

Observations:

What happens to the water and food coloring? Describe and/or draw your observations.

Conclusion

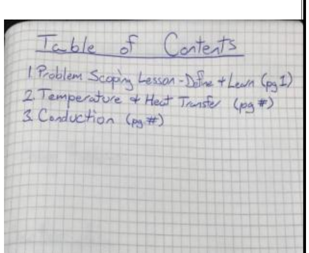
- **Explain:**
- Why did this happen?

LAB #22

CONDUCTION

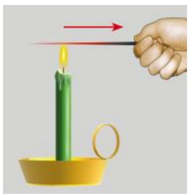
TABLE OF CONTENTS

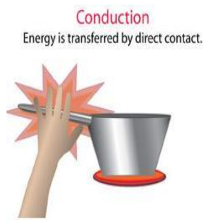
22. Conduction (pg #)



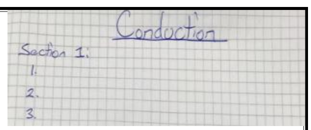
Vocabulary:

Conduction: The transfer of heat through solids by collisions of particles in contact with one another.





Section 1:



Feeling Temperature:

1. What two objects did you feel?
2. What did they feel like? (which one felt colder and which felt warmer?)
3. Why do metals feel colder than items such as plastic, wood, or paper?

Hypothesis:

- **What are the two materials your team received?**

PREDICT: Two ice cubes will be placed on top of the materials. Which ice cube will melt first?

Observations:

OBSERVE: Place one ice cube on top of each material. Record your observations.

Data:

COLLECT DATA: Fill out the data table with the whole class's data.

TEAM	Material which melted ice first
1	
2	
3	
4	
5	
6	
7	

Data:

Draw a diagram showing each material with an ice cube on top. On the diagram, indicate the direction of heat transfer using arrows. Also, note which material transferred heat more quickly.

Conclusion:

INTRODUCE: What was the purpose of this investigation?

ANALYZE DATA: What do you notice about the materials that melted ice more quickly?

EXPLAIN: Why did the ice melt faster on certain surfaces?

Vocabulary:

Conductor: **a material that transfers heat by the process of conduction easily and quickly.**

Vocabulary:

Insulator: **a material that slows down the transfer of heat by the process of conduction. Examples include plastics, paper, and wood.**

TABLE OF CONTENTS

Consider the following:

- **What is radiation?**
- **How is radiation different from conduction and convection?**
- **What are some sources of radiation?**

Vocabulary:

Radiation

The transfer of energy in the form of waves or particles (light) through space or through a material.

MYSTERY MIXTURE

#24

Focus Question:

- **How can we find out what two substances are in the mystery mixture?**

Hypothesis:

"Write your answer here"

Observations:

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				
Calcium Carbonate				
Calcium Chloride				
Citric Acid				
Magnesium Sulfate				
Sodium Bicarbonate				
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				
Calcium Chloride				
Citric Acid				
Magnesium Sulfate				
Sodium Bicarbonate				
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				
Citric Acid				
Magnesium Sulfate				
Sodium Bicarbonate				
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				**Used to melt ice and make pickles**
Citric Acid				
Magnesium Sulfate				
Sodium Bicarbonate				
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				**Used to melt ice and make pickles**
Citric Acid		"Sour Salt"		**Used to preserve food, make sour candy.**
Magnesium Sulfate				
Sodium Bicarbonate				
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				**Used to melt ice and make pickles**
Citric Acid		**"Sour Salt"**		**Used to preserve food, make sour candy.**
Magnesium Sulfate				**Used as a laxative, found in fertilizers/detergents**
Sodium Bicarbonate				
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				**Used to melt ice and make pickles**
Citric Acid		**"Sour Salt"**		**Used to preserve food, make sour candy.**
Magnesium Sulfate				**Used as a laxative, found in fertilizers/detergents**
Sodium Bicarbonate				**Used in baking, found in toothpaste**
Sodium Carbonate				
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				**Used to melt ice and make pickles**
Citric Acid		**"Sour Salt"**		**Used to preserve food, make sour candy.**
Magnesium Sulfate				**Used as a laxative, found in fertilizers/detergents**
Sodium Bicarbonate				**Used in baking, found in toothpaste**
Sodium Carbonate				**Used to make glass, soaps, and paper.**
Sodium Chloride				
Sucrose				

Chemical Name	Chemical Formula	Common Name	Observations	Uses
Ascorbic Acid				**Supplement for tissue growth and repair**
Calcium Carbonate				**Used as chalk, found in bones, shells**
Calcium Chloride				**Used to melt ice and make pickles**
Citric Acid		**"Sour Salt"**		**Used to preserve food, make sour candy.**
Magnesium Sulfate				**Used as a laxative, found in fertilizers/detergents**
Sodium Bicarbonate				**Used in baking, found in toothpaste**
Sodium Carbonate				**Used to make glass, soaps, and paper.**
Sodium Chloride				**Used as a food preservative**
Sucrose				**Sweetener, source of energy for humans**

Mystery Mixture:

OBSERVATION:

1. **Which two substances do you think are in the mystery mixture?**
2. **What could you do to get more information?**

Procedure:

- **Add 1 scoop of two different substances into the mixing tray.**
- **Add a few drops of water.**
- **Observe for a reaction.**
- **Record data for any mixture that produces "fizzing".**

Mystery Mixture Summary

Substance Combinations that Produced Fizzing
Mystery Mixture

Mystery Mixture Summary

Substance Combinations that Produced Fizzing
Mystery Mixture
Ascorbic Acid + Sodium Bicarbonate
Ascorbic Acid + Calcium Carbonate
Ascorbic Acid + Sodium Carbonate
Citric Acid + Sodium Bicarbonate
Citric Acid + Calcium Carbonate
Citric Acid + Sodium Carbonate
Calcium Chloride + Sodium Bicarbonate

Day 2 Testing:

Identify ALL combinations that produced bubbles:

Attach second data table for today's data.

Day 3 & 4 Testing

1) Place all dry chemicals in wells first.

2) React with 3 drops of water one after the other.

Well	Substances	Description of fizzing	Other observations	Large-scale reactions
1	Ascorbic acid + calcium carbonate $C_6H_8O_6 + CaCO_3$			
2	Ascorbic acid + sodium bicarbonate $C_6H_8O_6 + NaHCO_3$			
3	Ascorbic acid + sodium carbonate $C_6H_8O_6 + Na_2CO_3$			
4	Calcium chloride + sodium bicarbonate $CaCl_2 + NaHCO_3$			
5	Citric acid + calcium carbonate $C_6H_8O_7 + CaCO_3$			
6	Citric acid + sodium bicarbonate $C_6H_8O_7 + NaHCO_3$			
7	Citric acid + sodium carbonate $C_6H_8O_7 + Na_2CO_3$			
8	Mystery mixture			

Analysis:

1. **What happened when we added water to the mixture?**
2. **What causes the bubbling and fizzing?**
3. **Why does the mixture eventually stop fizzing?**

Results:

1. **Which two substances do you THINK make up the mystery mixture?**
2. **What evidence do you have to support your claim?**

Results:

3. **Why did we select these seven combinations to retest?**
4. **What was left in the well trays after the reaction?**
5. **What gas do you believe was produced by the mystery mixture?**

Air Is Matter

#25

Prelab Questions:

1. Make a list of the gasses you know about or have heard about.
2. Everything is made of elements. What elements could be in the gas that forms when baking soda and citric acid react?

Prelab Questions:

3. What is air?
4. What is matter?

Focus Question:

- **Is air matter? How do you know?**

Hypothesis:

"Write your answer here"

Vocabulary:

- **Air: a mixture of gasses. Air is 78% N_2, 21% O_2, and 1% trace gasses.**
- **Compress: to force air into a smaller space.**
- **Expand: to take up more space.**

Vocabulary:

- **Air Pressure: the force exerted on the walls of a container by a gas.**

Materials

1 syringe
1 tube
1 clamp
1 bubble wrap bubble

Observations:

Part 1: Individual

Part 2: Group

Analysis:

1. **What happens to the particles of air in the syringe when you push on the plunger?**
2. **What happens to the air particles in the bubble when you pull up on the plunger?**

Analysis:

3. **Are there more air particles in the bubble when it is compressed or expanded?**
4. **What happens to air particles when the air is expanded?**

Conclusion:

- **Explain what you did for this investigation**
- **How do you know that air takes up space? What is your evidence?**
- **Explain what you now understand about gas particles. (What happens to a gas when it is compressed? Expanded?)**

Capture the Gas

#26

Vocabulary:

- **Gas: a phase of matter that has no definite shape or volume. Particles of gas fly independently through space.**

Focus Question:

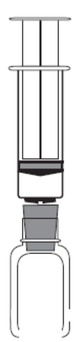
- **How can the gas produced in a chemical reaction be studied?**

Hypothesis:

"Write your answer here"

Procedure

a. Get a basin of *group materials* for your group.
b. Get a bottle-and-syringe system for each pair.
c. Put on protective eyewear.
d. Make a stock citric acid solution. Dissolve one level, 2-mL spoon of citric acid in 100 mL of water.
e. Put one level, 2-mL spoon of sodium bicarbonate into the bottle. Twist the stopper into the bottle.
f. Take up exactly 5 mL of citric acid solution in the syringe. Insert the tip of the syringe into the hole in the stopper.
g. Push the solution into the bottle. *Don't* remove the syringe. Observe and record.
h. Dump the used experiment and conduct three more trials. It is *not* necessary to wash out the bottle between trials.



DATA: Day 1

Volume of Gas Produced (mL)				
Trial 1	Trial 2	Trial 3	Trial 4	Average

CLASS AVERAGE:____________________

DATA: Day 2

Volume of Gas Produced (mL)				
Trial 1	Trial 2	Trial 3	Trial 4	Average

CLASS AVERAGE:____________________

FINAL AVERAGE:____________________

Analysis:

1. **What happened to the syringe plunger during the reaction between citric acid and sodium bicarbonate?**
2. **What caused that to happen?**

Analysis:

3. **Why is a syringe more useful than a balloon to conduct this experiment?**
4. **What errors might have occurred while gathering data?**

Analysis:

5. **What do you think might happen if you doubled the amount of either the citric acid solution or the sodium bicarbonate powder? Why do you think so?**

CONCLUSION:

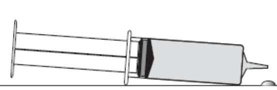
Revisit your focus question, "*How can the gas produced in a chemical reaction be studied?*

- **Explain what we did in this activity.**
- **Explain how you studied the gas produced.**
- **Explain what you learned by completing the activity.**

DO NOW

DO NOW:

RESPONSE SHEET—KINETIC ENERGY



Bess filled a syringe with water and left it by the sink in the sunshine. Ten minutes later she saw a little puddle of water under the syringe tip. Bess said:

This syringe must be broken. It's leaking!

But it wasn't broken.

What do you think caused the little puddle of water to appear under the syringe tip?

Kinetic Energy

#27

Vocabulary:

- **Contraction: the reduction of volume of a sample of matter as a result of cooling.**
- **Kinetic Energy: the energy of motion**

Focus Question:

- **What happens to particles in liquid when the liquid is heated and cooled?**

Hypothesis:

"Write your answer here"

Procedures:

- **Your task is to build and use a bottle system to explore what happens to water when it is heated and cooled.**

Analysis:

1. **How does a real liquid thermometer work?**

Conclusion:

- **Explain how you built the bottle system.**
- **Explain your results.** ***What happened when you placed the bottle in cold and warm water?***
- **Explain what you learned about the expansion and contraction of liquids.**

Calories

#28

PreLab:

- **100mL of water at 20°C is mixed with 100mL of water at 80°C.**
- **What is the final temperature of the water?**

ANSWER = 50°C

Thermal Equalibrium:

When two substances in physical contact with each other exchange no heat energy.
(temperature stabilizes)

Vocabulary:

- **Temperature:** **a measure of the average kinetic energy.**
- **Heat:** **the transfer of thermal energy.**
- **calorie:** **the unit of heat in the metric system.**

Equations:

- **One calorie is the amount of heat needed to raise the temperature of 1 g of water 1°C.**
- **It takes 1 calorie of heat to raise the temperature of 1 g of water from 25°C to 26°C**

Equations:

$$cal = m \times \Delta T$$

$$\Delta T = T_f - T_i$$

cal = **calories**

m = **mass of water in g.**

ΔT = **change of temperature.**
(will never be negative)

Equations:

$$T_f = \frac{T_1 + T_2}{2}$$

T_f = the final temperature after two equal volumes of water are mixed.

DATA:

	Mass (g)	Starting temp. (°C)	Final temp. (°C)	ΔT (°C)	Calories (cal)
Hot water	50				
Cold water	50				

ANALYSIS:

1. **Calculate the final temperature we would expect the water to be using the equation:**

$$T_f = \frac{T_1 + T_2}{2}$$

Does this temperature match your measured results?

ANALYSIS:

2. **Compare the heat transfer from the hot water and the heat transfer to the cold water. What do you notice?**

Conclusion:

- **What was the purpose of this lab?**
- **Explain how we prepared the lab to collect data.**
- **Explain your data.**
- **What did you learn from completing the activity?**

Phase Change

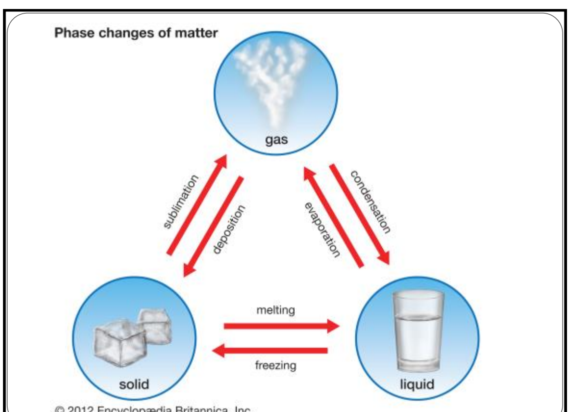
#29

Vocabulary:

- **Condensation:** to change from a gas to a liquid.
- **Deposition:** to change from a gas to a solid.
- **Evaporation:** to change from a liquid to a gas.
- **Freezing:** to change from a liquid to a solid.

Vocabulary:

- **Melting:** to change from a solid to a liquid.
- **Sublimation:** to change from a solid to a gas.



Focus Question:

- What is the melting point of water? Can you change it?

Hypothesis:

"Write your answer here"

Procedure:

1. Obtain you materials.
2. Place approximately 100g of ice in the plastic tub.
3. Record the mass and temperature of the ice.
4. Add 2 level scoops of your substance to the ice.
5. Stir and record the temperature of the ice after each 1 minute interval for 10 minutes

DATA:

Substance added: ________________

Mass of ice: ________________

Initial temp of ice: ________________

TIME (min)	TEMPERATURE (°C)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

DATA:

Substance	Lowest Temperature
Citric Acid	°C
Calcium Chloride	°C
Magnesium Sulfate	°C
Sodium Carbonate	°C
Sodium Chloride	°C
Sucrose	°C

DATA:

Substance	Lowest Temperature
Ascorbic Acid	°C
Calcium Carbonate	°C
Sodium Bicarbonate	°C
Sodium Tetraborate	°C

Analysis:

1. **Which substance reached the lowest temperature?**
2. **Why does ice melt when salt is added, even though the temperature falls below 0°C?**

Day 3: Prelab

1. **How do you change the phase of water from a gas to a liquid?**
2. **How do you change the phase of water from a liquid into a solid?**

Day 3: Data

Group	Observations
Control	
Experimental	

Day 3: Hypothesis

What will happen to the cups in each group?

Day 3: Analysis

1. **Why did water condense on the bottom of the cups?**
2. **What was different between the control and experimental group?**
3. **How were you able to freeze the condensation into ice?**
4. **Would the water on the outside of the cup freeze if we replaced the salt with calcium carbonate?** ***(look back over your data)***

Results

1. **What does salt do to the melting point of ice?**
2. **Why was salt necessary to freeze the water inside the vial and on the outside of the plastic cup?**
3. **In terms of heat transfer, explain how the water was able to freeze.**
4. **In terms of kinetic energy (heat), describe the difference between water vapor, liquid water, and ice.**

7-Habits

1. **Read pages 51 - 54 in the text. Stop at We Can Control Only One Thing.**
2. **Work on pages 52-53 in the Activity Guide.**
3. **Discuss pages 56-59 in the Ultimate Activity Guide**

Solutions

#30

Vocabulary:

- **Solution:** a mixture formed when one substance dissolves in another
- **Dissolve:** to incorporate one substance uniformly into another substance at the particle level

Vocabulary:

- **Solute:** a substance that dissolves in a solvent to form a solution.
- **Solvent:** a substance in which a solute dissolves to form a solution

Vocabulary:

- **Soluble:** capable of being dissolved
- **Insoluble:** not capable of being dissolved

Focus Question:

- **Do all substances form solutions in water?**

Hypothesis:

"Write your answer here"

PROCEDURE: Part 1

- Add 1 scoop of NaCl to a cup. Label the cup "NaCl"
- Add 1 scoop $CaCO_3$ to a cup. Label the cup "$CaCO_3$"
- Add 30mL of water to each cup. Stir the mixture

PROCEDURE: Part 2

- Label the other two cups "NaCl" and "$CaCO_3$".
- Run each mixture through the filter and record your observations of the filtrate.

PROCEDURE: Part 3

- Using a pipette, transfer a few drops of the NaCl filtrate into well #1 of the evaporating tray.
- Use a second pipette to transfer a few drops of the $CaCO_3$ filtrate into well #2 of the evaporating tray.
- Label your tray with tape and a sharpie for tomorrow's observations.

DATA: Part 1

MIXTURE	OBSERVATIONS
$CaCO_3$ + H_2O	Before adding water: After adding water:
NaCl + H_2O	Before adding water: After adding water:

ANALYSIS: Part 1

1. **Did the $CaCO_3$ + H_2O form a solution? What is your evidence?**
2. **Did the NaCl + H_2O form a solution? What is your evidence?**

DATA: Part 2

MIXTURE	FILTRATE OBSERVATIONS
NaCl + Water	
$CaCO_3$ + Water	

DATA: Part 3

MIXTURE	EVAPORITE OBSERVATIONS
NaCl + **Water**	
$CaCO_3$ + **Water**	

ANALYSIS: Part 2-3

1. **Were you able to separate any NaCl from the water using the filter? How do you know?**
2. **Were you able to separate any $CaCO_3$ from the water using the filter? How do you know?**

CONCLUSION:

- **What was the goal of this lab?**
- **Explain the procedures of this lab. What did you do? How did you filter the solutions?**
- **Explain your results. Were you able to filter out the $CaCO_3$ from water? Were you able to filter out NaCl from water?**
- **Which of the two chemicals formed a solution with water? What is your evidence?**

How Much Will Dissolve?

#31

Purpose:

- The goal of this activity is to determine the solubility of NaCl and $MgSO_4$ in water.

Equation:

$$Solubility = \frac{Mass\ of\ Solute}{Mass\ of\ Solvent}$$

Procedure: Part 1

- Add 100mL of water to cup using graduated cylinder.
- Take your cup to a scale.
- Using the pipette, get the mass of water to equal exactly 100.0g.
- Slowly add NaCl to the water and stir until you get it just to the point where no more will dissolve.
- Weigh the solution and record.

DATA: Part 1

Mass of H_2O (mL)	Mass of NaCl Solution (g)	Mass of Salt (g)	Solubility of NaCl (g/mL)
100.0 mL			

Analysis: Part 1

1. Subtract the mass of H_2O you started with from the mass of your NaCl solution. This is your mass of NaCl. Record in data table.
2. Find the solubility of NaCl in water by dividing the mass of NaCl by the mass of water. Your answer will be in g/mL.

$$Solubility = \frac{Mass\ of\ Solute}{Mass\ of\ Solvent}$$

Procedure: Part 2

- Add 100mL of water to cup using graduated cylinder.
- Take your cup to a scale.
- Using the pipette, get the mass of water to equal exactly 100.0g.
- Slowly add $MgSO_4$ to the water and stir until you get it just to the point where no more will dissolve.
- Weigh the solution and record.

DATA: Part 2

Mass of H_2O (mL)	Mass of $MgSO_4$ Solution (g)	Mass of $MgSO_4$ (g)	Solubility of $MgSO_4$ (g/mL)
100.0 mL			

Analysis: Part 2

1. **Subtract the mass of H2O you started with from the mass of your $MgSO_4$ solution. This is your mass of $MgSO_4$. Record in data table.**
2. **Find the solubility of $MgSO_4$ in water by dividing the mass of $MgSO_4$ by the mass of water. Your answer will be in g/mL.**

$$Solubility = \frac{Mass\ of\ Solute}{Mass\ of\ Solvent}$$

CONCLUSION:

- **What was the goal of this lab?**
- **Explain the procedures of this lab. What did you do?**
- **Explain how you determined the amount of solute that was able to dissolve in water.**
- **Which solute was more soluble in water? NaCl or $MgSO_4$? What is your evidence?**

Reactions

#32

Focus Question:

- **What happens at the particle level during a chemical reaction?**

Hypothesis:

"Write your answer here"

Chemical Reaction:

Evidence for a chemical reaction:

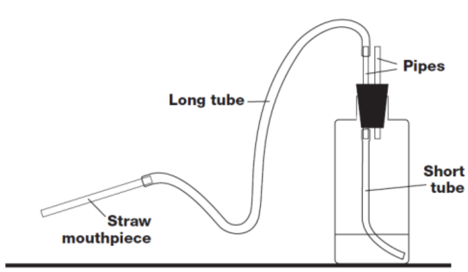
- **Odor**
- **Color Change**
- **Gas Bubbles**
- **Smoke/Fire**
- **Precipitate Formation**
- **Temperature Change**

Prelab

1. **What will happen if I add a spoonful of sucrose to a cup of water? Is it still sucrose?**
2. **What if I melt the sucrose. Is it still sucrose?**
3. **When sucrose burns, is it still sucrose?**

SAFETY

1. **Use your own mouthpiece**
2. **Only exhale through the straw!**
3. **Wear eye protection**
4. **Wash hands when finished**



OBSERVATIONS: Limewater

Describe the changes to the limewater you observed in the bottle:

OBSERVATIONS: Bromthymol Blue

Describe the changes to the bromthymol blue you observed in the bottle:

Analysis

1. **Starting substances change into new substances during chemical reactions. Did a chemical reaction occur in this investigation? How do you know?**
2. **What happened when your exhaled breath was blown through limewater?**

Analysis

3. **What happened when your exhaled breath was blown through bromthymol blue?**
4. **What in your exhaled breath reacted with the limewater and the bromthymol blue?**

Conclusion

- **What was the purpose of this investigation?**
- **Explain the setup of this lab, and the steps you took to collect your data.**
- **What does your data show?**
- **What did you learn by completing this lab?**