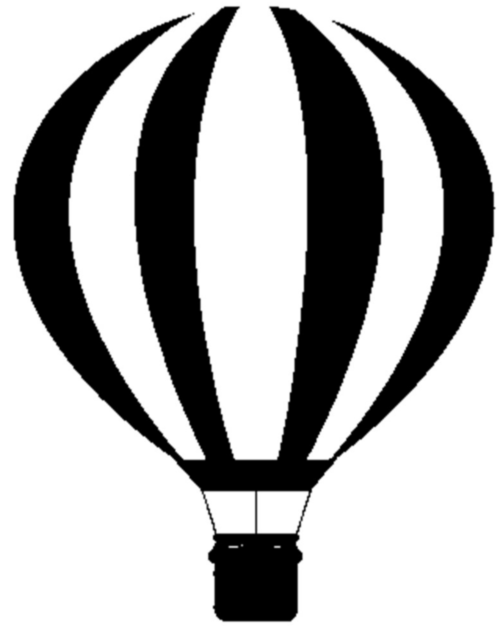
Unit 1: Phases of Matter



Regents Chemistry

Irondequoit High School

Mrs. Young

Essential Questions:

What are particles and how can we model their physical behavior?

How does the relative placement of particles affect a substance's properties?

How can we explain the nature of gases based on the kinetic molecular theory?

How do gases behave?

Why do bubbles behave in the way they do?

*Name*____

*Class Color/ Period*____________________

Learning Targets: By the end of this unit I Can…

1. List the three phases of matter, and use a simple particle model to differentiate among properties of solids, liquids, and gases.
2. State that intermolecular forces are created by the unequal distribution of charge result in varying degrees of attraction between molecules (more on this topic later).
3. State that physical properties (such as conductivity, malleability, solubility, hardness, melting point , and boiling point) of substances can be explained in terms of chemical bonds and intermolecular forces.
4. Use table H to describe intermolecular forces & how the atmosphere affects boiling point.
5. State the tenets of the Kinetic Molecular Theory (KMT) for ideal gases: (a)all gas particles move in random straight line motion (b)particles are separated by huge distances relative to their size so that the volume of gas particles is considered negligible (c)particles have no attractive forces between them (d)particles have collisions that may result in the transfer of energy between particles, but the total energy of the system remains constant (collisions are elastic)
6. Identify and explain the conditions when real gases are most like an ideal gas.
7. Use statements of the KMT as a model to predict behavior of gases
8. Explain the relationships of pressure, volume, temperature, velocity, frequency, and force of collisions among gas molecules.
9. State that equal volumes of gases at the same temperature and pressure contain an equal number of particles.
10. Convert temperatures in Celsius to Kelvin and vice versa
11. Solve problems using the combined gas law.

Vocabulary: (vocab without definition lines are considered review terms): states of matter

1. Intermolecular force:____

____

2. Kinetic molecular theory:______________________________________

____

3. Pressure:____

____

4. Temperature:____

____

5.Volume:____

____

6. Direct proportion: ____

____

7.Inverse proportion:____

____

8. STP:____

____

9. Elastic collision:____

____

10. Kinetic energy:____

11. Combined gas law:____

12. Ideal gas:____

13. Real gas:____

How do gas particles create pressure? Use this space to ask questions, generate models, predict what's going on during the phenomena presented this unit.

TOPIC 1.1

STATES (PHASES) OF MATTER

How do we use particle models to show differences in solids, liquids, and gases?

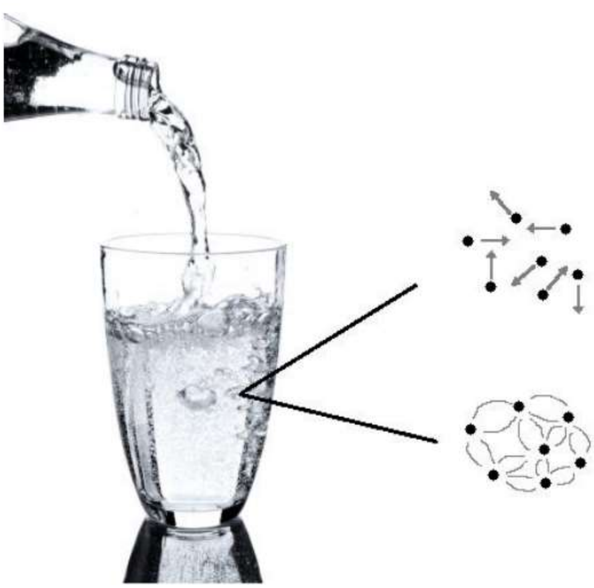
Physical properties such as _________________, __________, __________ __________, __________ __________ are caused by intermolecular forces (IMFs).

REFERENCE TABLES

Table A

STP = S________________________ T_________________________ and P______________________

Model 1: States of Matter and Intermolecular Forces



Kinetic Energy: Energy of motion.

- The kinetic energy allows the particles to move.
- Highest in gasses.

Intermolecular Forces: Forces of attraction.

- Attractive forces between atoms or molecules.
- These forces exist between atoms or molecules when they are very close to one another.
- Determine the phase of matter.

1. In your own words explain what intermolecular forces are.

____

____

____

2. Similar to magnets, it takes ____________________ energy to move atoms that have stronger attractive forces.

3. Intermolecular forces are (stronger/weaker) when particles are closer together.

4. Rank the states of matter (high, medium, low) for each of the two categories below. Include a brief explanation.

Table 3.	Solid	Liquid	Gas
Kinetic Energy of particles			
Intermolecular Forces			

CHECKPOINT

Take a look at the world around you, even just in this classroom. You will find that there are many substances in the room, but not all are in the same state of matter. **State (**aka **phase) of matter** is a **physical property** that can be used to describe any element, compound, or mixture *at a particular temperature and pressure.*

Property or Characteristic	**SOLID**	**LIQUID**	**GAS**
Represented by: (lowercase, always!)			
Particle Diagram			
Shape • definite/fixed/crystal • always takes shape of container			
Volume • definite/fixed • always fills volume of container			
Distance Between Particles • large • medium • small			
Particle Movement • free to move • limited motion • mostly fixed position			
Particle Attraction • strongest • weaker • weakest			

TOPIC 1.2

EXPLORING THE NATURE OF GASES

What is it about gases that allows them to be compressible and expandable?

You will be working on parts of this POGIL for a few periods with your pressure pals. Be sure to ask questions or ask for a mini-lesson if you're not "getting it". Visualization and connecting to real world examples will help you better understand these concepts.

Imagine This! Read and answer questions.

1. Describe the location of gas particles in relation to each other: ________________________________
2. Imagine our Gym as a closed container full of gas molecules (students!). Each student is a gas molecule found in a random position throughout the gym. Everyone is walking in a straight line. Since everyone started in a random position, no one is walking in exactly the same line and sometimes they bump into each other or into the wall. When they bump into each other, there is no attraction or repulsion, just a new direction they start walking in.
   a. Does everyone walk at the same pace? __________ Neither do gases! Different gases tend to move at different speeds.
   b. What would happen if the temp went up? ________________________________
   c. What would happen if the temp went down? ________________________________
   d. What would happen if half of the gym was closed off and all gases had to stay to just the open half of the gym? ____

KMT These ideas make up KMT, kinetic molecular theory, used to explain how **IDEAL** gas particles behave. **NOTE: You can look these up in your book or the internet.**

1. **Gas** consist of large numbers of tiny particles that are **far apart relative to their size** and therefore **take up no volume**. Gases have low density and are easily compressed. Draw a particle diagram of a gas:
2. There are **no forces of attraction or repulsion between gas particles**.
3. Gas particles **travel quickly and randomly in straight lines.**
4. **When particles collide** they bounce off walls or each other and **no energy is lost and this is called an elastic collision.**

Draw characteristic 2, 3 or 4 (or a combination) of gases inside the box:

CHECKPOINT

Assignment 1.1

___ 1. The kinetic molecular theory states that all particles of an ideal gas are

A) arranged in a regular geometric pattern
B) separated by small distances relative to their size
C) colliding without transferring energy
D) in random, constant, straight-line motion

___ 2. Which statement describes particles of an ideal gas, based on the kinetic molecular theory?

A) Gas particles do not transfer energy to each other when they collide.
B) Gas particles have no attractive forces between them.
C) Gas particles move in predictable, circular motion.
D) Gas particles are separated by distances smaller than the size of the gas particles.

___ 3. According to the kinetic molecular theory, which statement describes the particles of an ideal gas?

A) The force of attraction between the gas particles is strong.
B) The gas particles are hard spheres in continuous circular motion.
C) The collisions of the gas particles may result in the transfer of energy.
D) The gas particles are arranged in a regular pattern.

___ 4. According to the kinetic molecular theory, the particles of an ideal gas

A) have no potential energy
B) have strong intermolecular forces
C) are arranged in a regular, repeated geometric pattern
D) are separated by great distances, compared to their size

___ 5. In which 1.0-gram sample are the particles arranged in a crystal structure?

A) $CaI_2(aq)$ B) $C_2H_6(g)$
C) $CaCl_2(s)$ D) $CH_3OH(l)$

___ 6. Which statement describes a chemical property of silicon?

A) Silicon reacts with fluorine.
B) Silicon is a brittle solid at 20.°C.
C) Silicon melts at 1414°C.
D) Silicon has a blue-gray color.

___ 7. At STP, which 2.0-gram sample of matter uniformly fills a 340-milliliter closed container?

A) $KCl(aq)$ B) $Xe(g)$
C) $Br_2(\ell)$ D) $Fe(NO_3)_2(s)$

___ 8. Which statement best describes the shape and volume of an aluminum cylinder at STP?

A) It has no definite shape and no definite volume.
B) It has a definite shape and a definite volume.
C) It has no definite shape and a definite volume.
D) It has a definite shape and no definite volume.

TOPIC 1.4

THE MATH OF GASES: *What gas is filling the balloon? What formulas and unit conversions are you responsible for?*

(Topic 1.3 is separate POGIL packet on vapor pressure)

Volumes of Gas Samples at Different Temperatures

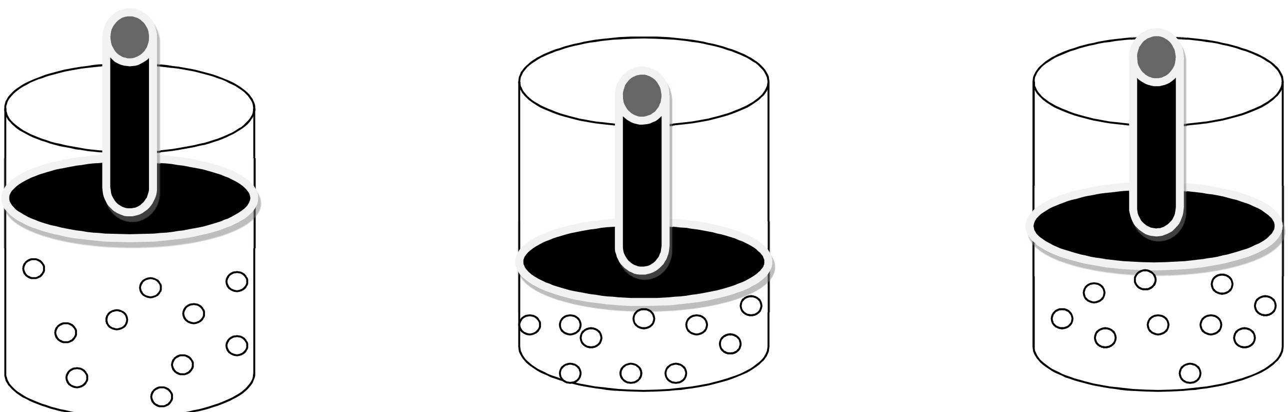
1. Imagine there is a balloon in the room and one hanging out the window. Next to each is a thermometer. If a piece of string is used to measure the distance around the center of the balloon, and the temperature, the following data would be found:

Circumference of balloon inside: ___30_________cm temp inside: ____20____ C

Circumference of balloon outside: _____20_________cm temp outside: ___0______ C

What does this tell you? ____

2. Here are 3 cylinders of gases. Each has a piston on the top, which can move up or down if the volume of the gas changes. As temp goes up, gases ________________________. As temp goes down, gases ______________________.



A B C

Which cylinder has the greatest volume? ______________ predict its temp: high med low

Which cylinder has the smallest volume? _______________ predict its temp: high med low

3. The ratio of volume and temperature is proportional. You can solve for either unknown, using the formula:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

1 refers to the initial,
2 refers to the final.

* For all calculations, temp must be in Kelvin!!!

Convert all temperatures to K before beginning any calculations!

The formula for this is on table _______ and is…

K= ______________________________

CHECKPOINT

Solve the following problems using this formula:

1) The temperature inside my refrigerator is about 4^0 C. If I place a balloon in my fridge that initially has a temperature of 22^0 C and a volume of 0.5 liters, what will be the volume of the balloon when it is fully cooled by my refrigerator?

2) A man heats a balloon in the oven. If the balloon initially has a volume of 0.4 liters and a temperature of 20 ^{0}C, what will the volume of the balloon be after he heats it to a temperature of 250 ^{0}C?

3) On hot days, you may have noticed that potato chip bags seem to "inflate", even though they have not been opened. If I have a 250 mL bag at a temperature of 19 ^{0}C, and I leave it in my car which has a temperature of 60^0 C, what will the new volume of the bag be?

4) A soda bottle is flexible enough that the volume of the bottle can change even without opening it. If you have an empty soda bottle (volume of 2 L) at room temperature (25 ^{0}C), what will the new volume be if you put it in your freezer (-4 ^{0}C)?

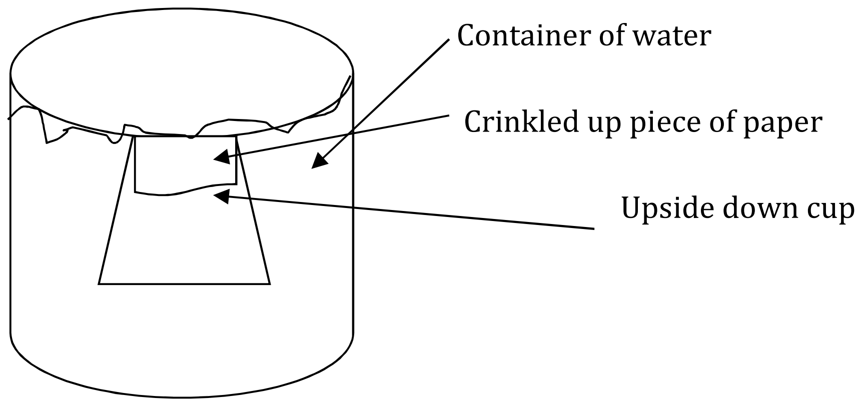
5) Some students believe that teachers are full of hot air. If I inhale 2.2 liters of gas at a temperature of 18^0 C and it heats to a temperature of 38^0 C in my lungs, what is the new volume of the gas?

TOPIC 1.5 → **How does pressure work? Is it related to volume?**

Air Pressure

Try This

1. Take a piece of paper and crinkle it up. Place it inside a clear plastic paper cup and be sure it is stuck in the bottom. Turn the cup upside down and submerge it in a large bin of water. Take it out vertically and take out the piece of paper. Is it wet? ____________ There is air trapped in the cup that pushes out in all directions. The air pushes on the water with enough pressure to keep the water out of the cup!



Create a model with your team of what you think is going on that allows this to occur. Use at least 3 labels, arrows and write an explanation of what's going on in the model.

Explanation of air pressure:

Collisions of gas molecules with surrounding objects are what we experience as air pressure. There are huge numbers of air molecules in a tire. The tiny push from each one adds up to a lot, enough to hold a car up! Although we barely notice it, the air around us exerts pressure on us all the time. Atmospheric pressure is air pressure that is always present on Earth as a result of air molecules colliding with objects on the planet. The greater the number of collisions, the greater the pressure. (from Living By Chemistry, Key Curriculum Press)

CHECKPOINT

Teacher Demo #1 (pop can): This will be done at a specific point for the whole class, so if you come to this point before I am ready, skip on to the next session!

Aluminum Can Demo

Supplies: List the supplies needed for this experiment

Before: What do you think will happen if the aluminum can with water in it is boiled and then flipped over into the cold water?

During: What do you notice about the can while it is being heated? Does this change what you think is going to happen?

After: What happened when the can was inverted (flipped over) into the cold water (use at least 3 of your senses)? Why do you think this happened?

The science behind the collapsing can:

When the can was heated, the water in the can boiled. The vapor from the boiling water pushed air out of the can. When the can was filled with water vapor, it was cooled suddenly by inverting it in water. Cooling the can caused the water vapor in the can to condense, creating a partial vacuum. The extremely low pressure of the partial vacuum inside the can made it possible for the pressure of the air outside the can to crush it.

A can may be crushed when the pressure outside is greater than the pressure inside, and the pressure difference is greater than the can is able to withstand. You can crush an aluminum can with your hand. When you squeeze on the can, the pressure outside becomes greater than the pressure inside. If you squeeze hard enough the can collapses. Usually, the air pressure outside the can is the same as the air pressure inside the can. However, in this experiment, the air was driven out of the can and replaced by water vapor. When the water vapor condensed, the pressure inside the can became much less that the air pressure outside. Then the air outside crushed the can.

When the water vapor condensed, the can was empty. You may have expected the water in the beaker to fill the can through the hold in the can. Some water from the beaker may do this. However, the water cannot flow into the can fast enough to fill the can before the air outside crushes it.

What is one question that you still have about this demo? (yes, you must have a question)

____

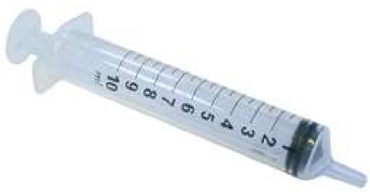
____

____

TOPIC 1.6 → **If temperature is constant, how are pressure and volume related?**

Pressure vs. Volume

Try It:



Take a syringe **with a marshmallow** and move the plunger so it is halfway full of air. Now get a cap so the gas cannot escape. Slowly push the plunger, forcing the air to occupy a smaller volume. What happens as you do this? **Let everyone in your team try!** ______________
____

What happens as you pull the syringe towards a higher volume? **Let everyone in your team try!** ____
____

As you pushed the plunger, causing the air molecules to take up a smaller space, the number of collisions between air molecules increased and this is exerted as pressure. As you pulled the plunger you had a greater space and the number of collisions decreased allowing the marshmallow to expand.

- Big Idea – As pressure on a gas increases, its volume ________________________

Real World Connection:

1. During take-off and landing on an airplane, or at other times when your altitude changes, you may feel the need to "pop" your ears. Your middle ear contains a pocket of air. The Eustachian tube that leads from the back of the nose to the ear supplies this air. When you swallow, air goes through the tube and into the pocket, so that the pressure inside your ear is the same as the air pressure. You experience the change in pressure for the gas inside your ear to match a change in air pressure as a "pop".

2. In industry gases are often stored in tanks at high pressure or even at low temperatures so that they are liquids. Otherwise, containers needed for them would be huge! These tanks are usually made of thick metal so they don't change volume.

CHECKPOINT

Where else have you experienced air pressure? ____
____

Graphing Task: Graph the following data, then make a best fit curve.

Gas in a Syringe

Total Pressure (psi)	Volume (mL)
75	20
50	30
38	40
25	60
19	80
15	100

Gas pressure and gas volume are INVERSELY PROPORTIONAL to each other. Think of it this way, when the volume of the gas in the syringe was very small, the gas pressure was very high. When the volume was large, you did not feel the pressure – it was low. As long as there are gas molecules in a container, neither the gas pressure nor the volume can ever reach zero.

STOP

Teacher Demo #2 (vacuum) This will be done at a specific point for the whole class, so if you come to this point before I am ready, skip on to the next session!

Question:

____

Draw Set Up:

Your Prediction of what will happen: ____
____
____

Observations: ________________________
____
____
____

Explanations of results: ____
____
____
____

Solving Problems involving Pressure and Volume

Use the following formula to solve the problems below.   (again, 1 is initial, 2 is final)

$$P_1 \ \text{x} \ V_1 \quad = \quad P_2 \ \text{X} \ V_2$$

1) 1.00 L of a gas at standard temperature and pressure is compressed to 473 mL. What is the new pressure of the gas?

2) In a thermonuclear device, the pressure of 0.050 liters of gas within the bomb casing reaches 4.0×10^6 atm. When the bomb casing is destroyed by the explosion, the gas is released into the atmosphere where it reaches a pressure of 1.00 atm. What is the volume of the gas after the explosion?

3) Synthetic diamonds can be manufactured at pressures of 6.00×10^4 atm. If we took 2.00 liters of gas at 1.00 atm and compressed it to a pressure of 6.00×10^4 atm, what would the volume of that gas be?

4) The highest pressure ever produced in a laboratory setting was about 2.0×10^6 atm. If we have a 1.0×10^{-5} liter sample of a gas at that pressure, then release the pressure until it is equal to 0.275 atm, what would the new volume of that gas be?

5) Atmospheric pressure on the peak of Mt. Everest can be as low as 150 mm Hg, which is why climbers need to bring oxygen tanks for the last part of the climb. If the climbers carry 10.0 liter tanks with an internal gas pressure of 3.04×10^4 mm Hg, what will be the volume of the gas when it is released from the tanks?

6) Part of the reason that conventional explosives cause so much damage is that their detonation produces a strong shock wave that can knock things down. While using explosives to knock down a building, the shock wave can be so strong that 12 liters of gas will reach a pressure of 3.8×10^4 mm Hg. When the shock wave passes and the gas returns to a pressure of 760 mm Hg, what will the volume of that gas be?

CHECKPOINT

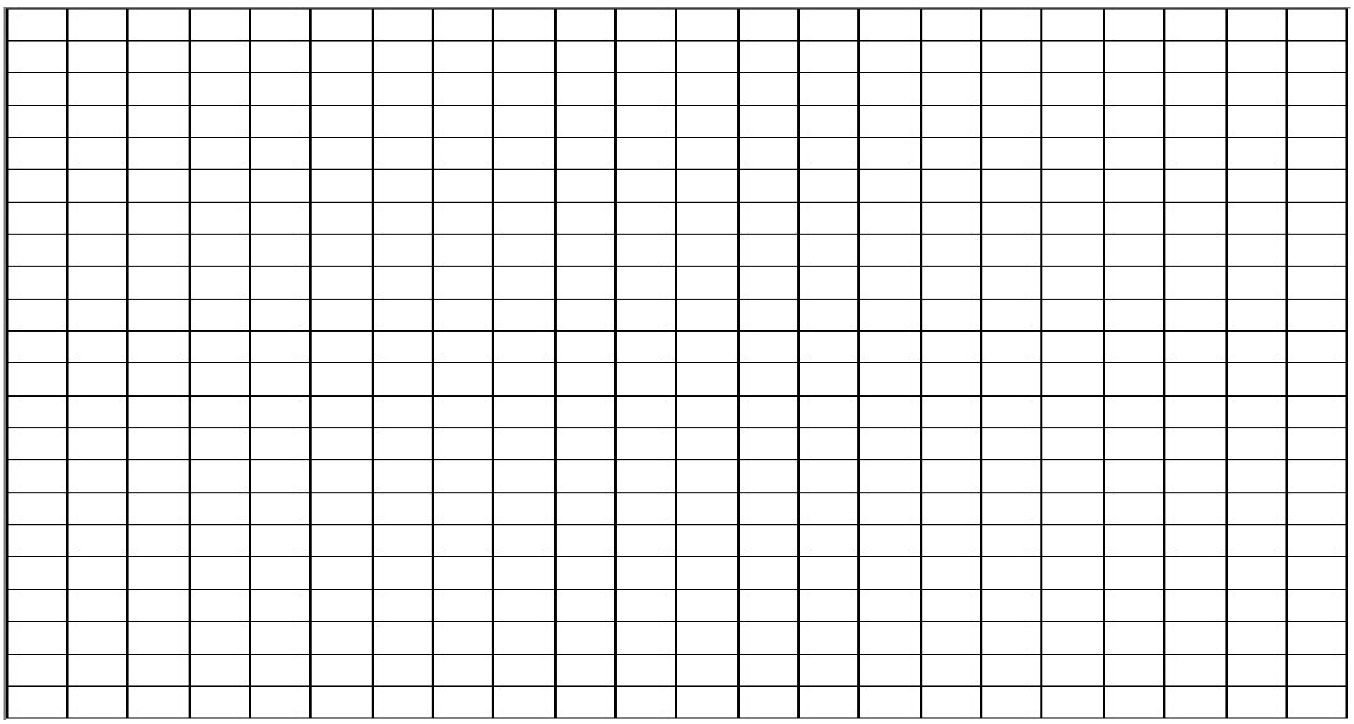
TOPIC 1.7 → **If volume is held constant, how are pressure and temp. related?**

Pressure and temperature

Graphing Task: Graph the following data, then make a best fit line (not curve!).

Helium Gas in a Tank

Total Pressure (atm)	Temperature (Kelvin)
130	293
138	313
125	283
106	240



- Big Idea – As temperature of a gas increases, the pressure on the gas _______________

Real World Question:

Why shouldn't you keep a aerosol can of hairspray in the car on a hot summer day?

Pressure and volume are DIRECTLY PROPORTIONAL. Therefore the following formula is true. Use it to solve the following problems.

$$\frac{P1}{T1} = \frac{P2}{T2}$$

Remember- all temperature values MUST be in ______________________________.

1. A 5.0 L propane tank is under a pressure of 2 atm when the temperature is 14 degrees C in the morning. During the day the tank warms up to 34 degrees C. What is the pressure of the propane gas inside the tank during the day?

2. Gas is trapped inside a container where the pressure is 3 atm and the temp is 75 degrees C. If the temp is lowered to 0 degrees C, what is the pressure inside the container?

3. A balloon at 50 psi and 83 degrees C is placed in a chamber with a pressure of 20 psi. If the volume stays the same, what happens to the temperature of the gas within the balloon?

CHECKPOINT

TOPIC 1.8

If NONE are constant, how are they related?

<u>Ready for all 3?</u> – The Relationship between Volume, Temperature and Pressure of Gases

P	T	V

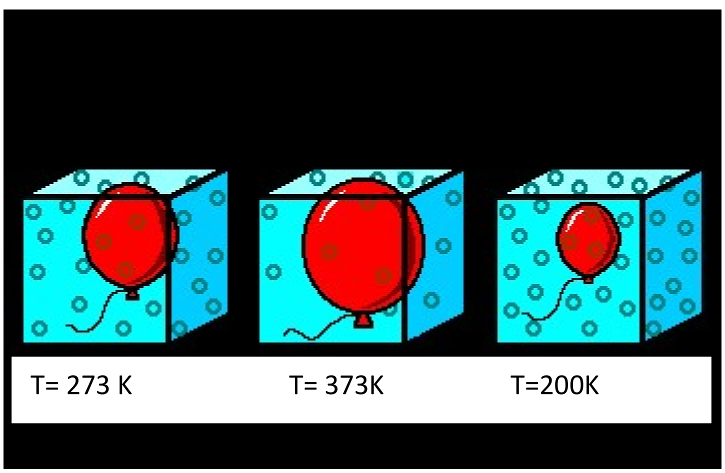
Temperature, pressure and volume are all interrelated when gases are concerned. There is a very easy way to understand this relationship. See the letters P, T and V written across this page? ***Pinch the variable that is constant with your index finger and thumb. Move the variable you want to change up or down, depending on how it changes. Watch to see what happens to the other variable. For example,,,,***

When temperature increases at constant pressure, what happens to volume? ______________________________

When pressure decreases at constant temperature, what happens to volume? ______________________________

When temperature increases at constant volume, what happens to pressure? ______________________________

Make conclusions about these 3 cubes. Compare the temp, pressure and volume of each.



Volume of balloon is greatest in: ____________

Pressure is greatest in: __________________

Temperature is greatest in: _______________

Which has low temp and high pressure: _________

Which has high temp and low pressure: _________

Which has medium temp and pressure: _________

C

<u>Teacher Story Time</u> – Frozen Diet Coke

What happened and why?

Combined Gas Law Equation

We have been looking at temperature, pressure and volume, 2 factors at a time, but it is more realistic to consider all 3. There is a formula we use from Table T to show all 3 factors. **You can use this formula for any problem and if one factor remains constant, cancel it out on BOTH sides of the equation. So there is NO need to remember all the different formulas you have used in this packet – they all came from this 1 formula!!!**

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

PRACTICE PROBLEMS: Remember Temperature MUST be in ______________________________.

1. The air inside a 180 mL glass bottle is at 1.0 atm and 25 degrees C when you close it. You carry the glass bottle with you up a mountain where the air pressure is 0.75 atm and the temp is 5 degrees C. What is the volume of air inside the glass bottle?

2. If I initially have a gas at a pressure of 12 atm, a volume of 23 liters, and a temperature of 200 K, and then I raise the pressure to 14 atm and increase the temperature to 300 K, what is the new volume of the gas?

3. A gas takes up a volume of 17 liters, has a pressure of 2.3 atm, and a temperature of 299 K. If I raise the temperature to 350 K and lower the pressure to 1.5 atm, what is the new volume of the gas?

4. A gas that has a volume of 28 liters, a temperature of 45 ^{0}C, and an unknown pressure has its volume increased to 34 liters and its temperature decreased to 35 ^{0}C. If I measure the pressure after the change to be 2.0 atm, what was the original pressure of the gas?

5. A gas has a temperature of 14 ^{0}C, and a volume of 4.5 liters. If the temperature is raised to 29 ^{0}C and the pressure is not changed, what is the new volume of the gas?

6. If I have 17 liters of gas at a temperature of 67 ^{0}C and a pressure of 88.89 atm, what will be the pressure of the gas if I raise the temperature to 94 ^{0}C and decrease the volume to 12 liters?

7. I have an unknown volume of gas at a pressure of 0.5 atm and a temperature of 325 K. If I raise the pressure to 1.2 atm, decrease the temperature to 320 K, and measure the final volume to be 48 liters, what was the initial volume of the gas?

8. If I have 21 liters of gas held at a pressure of 78 atm and a temperature of 900 K, what will be the volume of the gas if I decrease the pressure to 45 atm and decrease the temperature to 750 K?

9. If I have 2.9 L of gas at a pressure of 5 atm and a temperature of 50 ^{0}C, what will be the temperature of the gas if I decrease the volume of the gas to 2.4 L and decrease the pressure to 3 atm?

10. I have an unknown volume of gas held at a temperature of 115 K in a container with a pressure of 60 atm. If by increasing the temperature to 225 K and decreasing the pressure to 30 atm causes the volume of the gas to be 29 liters, how many liters of gas did I start with?

11. How hot will a 2.3 L balloon have to get to expand to a volume of 400 L? Assume that the initial temperature of the balloon is 25 ^{0}C.

12. I have made a thermometer which measures temperature by the compressing and expanding of gas in a piston. I have measured that at 100^0 C the volume of the piston is 20 L. What is the temperature outside if the piston has a volume of 15 L? What would be appropriate clothing for the weather?

13. Submarines need to be extremely strong to withstand the extremely high pressure of water pushing down on them. An experimental research submarine with a volume of 15,000 liters has an internal pressure of 1.2 atm. If the pressure of the ocean breaks the submarine forming a bubble with a pressure of 250 atm pushing on it, how big will that bubble be?

14. Divers get “the bends” if they come up too fast because gas in their blood expands, forming bubbles in their blood. If a diver has 0.05 L of gas in his blood under a pressure of 250 atm, then rises instantaneously to a depth where his blood has a pressure of 50.0 atm, what will the volume of gas in his blood be? Do you think this will harm the diver?

CHECKPOINT

TOPIC 1.9

What if T, P, & V are all the same??? AVOGADRO'S HYPOTHESIS

Under what conditions do gases behave most ideally (most like a gas)?

Avogadro's Law

1 mole of any gas at STP takes up 22.4 liters of space. **We can extend this reasoning to say that the volume of an ideally behaving gas is *directly proportional* to the number of particles present *if the temperature and pressure are held constant*. To help explain this, please look at the three containers of gas.**

CO_2	H_2	Ar
2 atm	2 atm	2 atm
5.0 liters	5.0 liters	5.0 liters
800 K	800 K	800 K

- Which one has more gas particles?
- Which one weighs the least?
- Which one has more atoms?

Practice question:

1. You are given two equal sized containers of He and H_2 that both behave as ideal gases and have equal pressures and temperatures.
   a. Does each container have the same number of particles? Explain
   b. Do they have the same number of atoms? Explain.
   c. Do they have the same mass? Explain.

TOPIC 1.10

When does water act most real??? AVOGADRO'S HYPOTHESIS & IDEAL GAS CONDITIONS *Under what conditions do gases behave most ideally (most like a gas)?*

Ideal Gas different from a real gas:

This will be done at a specific point for the whole class, so if you come to this point before I am ready, skip on to the next session!

An IDEAL gas is different from a real gas because:

1. Ideal gases have NO __________________ forces (no ________________ for one another), but real gases __________!!!
2. Ideal gas particles are considered to have essentially _________ volume, whereas real gas particles _____________ have volume.

Story Time:

Real gases act most like ideal gases when … (think about water!)

temperatures are _____ and the pressure is ______.

When the pressure is _______, particles are far apart and so they can't ___________ each other very strongly. When the temperatures are high, particles will be moving ______________ and so won't tend to __________ to each other as they go whirling by.

Some real gases ACT more real than others! The greater the intermolecular attractions between molecules, the more ___________ a gas is.

The _________ a gas molecule is, the greater the intermolecular forces between its molecules.

So, among the gases He, CO_2, SO_2 and SO_3, ________ would act the most real (because it has the ______ mass) and ______would be most ideal (because it has the _____________ mass).

Summary Sheet for POGIL - **Gas Laws**

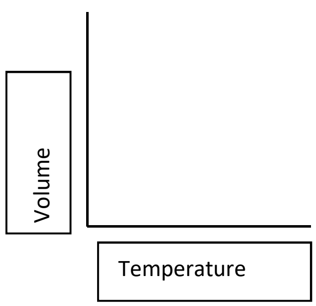
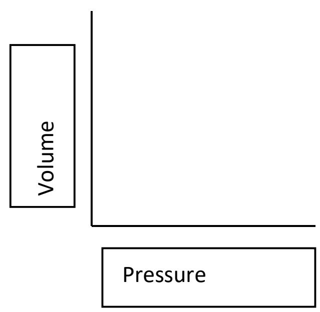
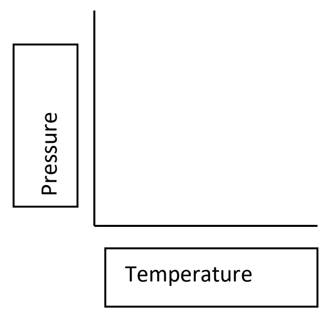
1. What did you learn from doing this POGIL? Please give details and tell which parts/activities were most helpful/least helpful.

2. Choose the ideal conditions for a gas and circle it:

   Temperature: Warm Cold

   Pressure: High Low

3. Organize your thoughts! Complete the following table to explain the behavior of gases.

	Temp and Volume	Pressure and Volume	Temp and Pressure
Relationship			
Graph			
Formula			